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Transformation from medical learner to a professional engager - Discussion about first year undergraduate two-week internship

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Abstract- This paper shows a two-week internship report of medical learner in first year undergraduate course. It introduces what medical learner participated the medical professional engagement; how they observed daily clinical working environment in hospital. Also, the transformation of medical learner has been shaping base on these comprehensive experience, not only professional behaviors, but also psychological maturity. The discussion about how a short period time of internship would be able to create a life-long impact to the first-year medical undergraduate.

Index Terms- Internship, medical learner, professional engager, learning perspective, professionalism

I. Introduction

Universities' internship is very important educational intervention for undergraduates. In UK, most universities have an optional year for undergraduates to do the internship before final year. In US, all top universities encouraged their student to do the intern-ship during summer vacation. In Chinese high education system, there is a whole year internship for final year universities' student before they graduate.

This internship has done at first-year first semester. It is the part of the course introduction clinical medicine. The following shows base information about internship:

1. Organization: The First School of Clinical Sciences/The First Affiliated Hospital of Guangxi Medical University
2. Department: Cardiothoracic Surgery
3. Duration: 14 days
4. Cases involve: (more than 100) lung cancer, pneumopathy, adenocarcinoma of the lung, esophagectomy, palmar hyperhidrosis etc.

The following demonstrate three different parts, watching, thinking and handling. It is the description of the entire internship process. As well as processing, a discussion about the transformation of medical learner to professional engager.

II. Watching

According to the students' future professional purpose individually, the organization send them to different department to learn. My future medical studies goal, is to become a surgery of combined cardiopulmonary transplantation.

2.1 Electronic patient's record management system

After I am finishing registration with departmental secretary, I start to use doctor's PC. I learned how to review the patient's record base on the leading of demonstrator. This is the intranet of hospital database, all patients record and related data are store on-line, such as basic information, inspection, preliminary diagnosis. A couple of findings were being found:

- Lung cancer patient middle late stage most, 50 – 70 years old most
- Lung cancer patient has young people, 30 to 45 years old, all late stage
- Lung cancer patient all smoking more than ten years
- Lung cancer patient come to hospital after clear symptom most, such long-term cough, expectoration, chest pain; only a few patients knew they had pulmonary nodule before
- Lung cancer patient had medical insurance, who corporates treatment with doctor; self-funding patient did not corporate and quit.

Doctor would be able to grasp state of an illness in every patient anytime anywhere base on electronic patient's record. It is a replacement of traditional paper work and out of date working procedure. This new digital medical information management system is more speedily, precisely and comprehensively tracking the treatment, up-to-date diagnosis, pre-post operation summary etc. As well as this professional coverage, it is used easily by anyone who in different age, background, professional stage and perspective.

2.2 Outpatient

After familiarize the electronic patient's record management system, I was following the teacher to outpatient department to receive patients. It is the busiest place in the hospital, especially, The First Affiliated Hospital of Guangxi Medical University, which is the best hospital in Guangxi Province. All patients must make appointment through phone, WeChat APP and other internet device. Some of them were transferred from countryside or any other smaller hospitals. As well as the patients who would like to do operations, wait and line up during the whole procedure, apart of some emergency cases. There is no time for break when

receiving patient in outpatient department, because so many people intend to register appointments, some of the patients run out of their patient and need to communicated by nurse.

2.3 Morning meeting of handover physicians and nurses

Handover both physicians and nurses occur every morning eight o'clock. All physicians and nurses are listening to duty physician and nurse report, and patients' conditions in each ward, as well as their treatments. Senior physicians also discussed outstanding cases. The communicational problem between physicians and patient are raised during morning handover, both physicians and nurse would be able to carry on the communications. Head of the department and some senior physicians concluded meeting, gave suggestions in order to solve the difficulties.

2.4 Senior consultant doctor group check patient in ward

After morning handover, department head and all physician would do a ward check: consultant every resident patient; managing physician treatment processing; consequence treatment in order to diagnose further and better actions; understanding problems and difficulties within early treatment. Patients' families would answer questions about diet during ward checking.

III. Thinking

Work of physicians are repeated but changeable. The duplicates are working procedures, the changes are situation of patients. The repeatable working procedures responses changeable situation of patients, which requested physician competence of compression resistance, consistently and substantially.

3.1 Tuesday seminar

Tuesday morning is the group studying time, starting from 7:30 am every Tuesday, before 9:00 the end. Presenters are the senior mid-age experts, head of the whole surgery department also attended. The contents of meeting are all relative technologies and equipment updated, as well as internal administrative business. It is very popular of this Tuesday morning seminar. Everyone is listening to the speaker seriously, even the night shift physicians.

3.2 Changing and replace the medicine

Patients are remedied by surgical treatment in thoracic surgery department mainly. The vulnus and dress change and medicines are very important. The process of dress change and medicines for vulnus implement by physicians, and update e-record of patient before and after in order to tracking the treatment from any other physicians. We should be aware the intention of replacing medicine, as well as the indication and regulations.

Each patient needs a closed thoracic drainage tube after operation, so that the thoracic gases and hydrops eliminates to water-sealed bottle. Therefore, the lung tissue reopens and recoveries function. Physicians should be tracking closed thoracic drainage tube and water-sealed bottle in order to give compatible treatment.

3.3 Pre-operation studies

My third day in the department is departmental surgical day. I have been given introduction of working procedure and operation arrangement. I was studying every forcoming operation details for half day seriously and understanding the procedure and regulations in operation room.

IV. Handling

Surgeon is more like warrior in battlefield with real gun and bullets, meanwhile, operation room is the key place examines medical students' knowledge and skills. Operation room is a special place, it requires germ-free totally, everything was placed at specific allocation, as well as limitation of motion for all people. The operation functional staff members are: head of surgical operation, first assistant, second assistant, anesthesiologist, first surgical nurse, second surgical nurse, six in total.

4.1 Changing in operation room

We must change sterile clothing, gauze mask, hat, shoes for germ-free, as well as deeply clean hands.

Surgical hand eliminated is very strict and need specific liquid and procedures.

4.2 Changing in operation room

Patient is the 74 years old lung cancer; he needs to implement a pneumonectomy. We need to clean 12 groups lymphedemas, then remove part of the lung. According to data of videos, the lymphedemas cleaning must implement by main surgery as soon as possible, then find the target cancerous parts and removed. The attending physician used to study at West China Center of Medical Sciences, Sichuan University. He introduced me different kinds of the pulmonary surgery and relative knowledges, as well as his experiences.

4.3 Embarrassing in operation room

There are ten operations I have been studying, two of them are acrohyperhidrosis, 21 and 22 years old respectively, male and female one each. The length of operation both are not very long, within an hour would be able to finish. They both occurred the accidents. The girl was crying before anesthesia because she never experiences the operations. Physician and nurse talk to her and stabilize her emotion first. The boy was postoperative mania. He was staying an hour after operation because he wants to move aimlessly. We must press down and not let go of him in case his wound reopens.

4.4 The danger of medical worker in operation room

Guangxi province is located tropical district, morbidity of infectious diseases is very high. According to my studies of 10 operations, there is an HBV patient, DNA positive, infective period. All physicians and nurses would be informed before, protections are essential in case accidents. However, accidents occurred, the assistant is a year one postgraduate student, cooperation with attending surgery is not very familiarized. He pricked attending surgery when passing suture needle, fortunately, the suture needle did not be used. And nurse treat wound. All physician and nurse were injected HBV vaccine.

4.5 Heartquake in operation room

My internship completed in the Chinese New Year. There are so many party and functions for most of people. We have an

emergence, fish bone stacked esophagus. A few days already, the esophagus suppurated and unabating high fever.
Three of fourth fish bone inside the esophagus, and the special sharp, it is not easy to take out.
Senior surgery did this operation, we have been learned how experience and skillful physician dealing this emergence case.
4.6 Time for me to move

According to this two day of learning in operation room, I was getting busy to help and move under senior physician super-vised. Help physician and nurse lay out the correct operational positions, wear aseptic clothes, grasped the machine and equipment in right order, check the working situation of the electronics device. Every time I move out the patient from operation room, their families was waiting and crying. The experience physician would settle their emotion and introduced operation outcome.
Every time we saw the patient's families was waiting outside the operation room cry with joy, our hard work is worth.

Two weeks internship was very busy and joyful. However, it certain my determination and faith to be a doctor at future base on the difficulties and hardships. I am one of the students at china medical university, it is one of best medical university in china. I am very proud of it!

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Exploring the Feasibility of Public Private Partnerships in the Healthcare Sector in Zimbabwe

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Abstract

Governments today face a broad range of complex healthcare challenges prompted by changing demographics, a growing burden of chronic diseases, escalating healthcare costs and rapidly changing healthcare technologies. Due to these challenges healthcare delivery systems are increasingly strained and are struggling to expand access and deliver high-quality healthcare services in line the implementation of Universal Health Coverage (UHC) and the overarching objective of achieving Sustainable Development Goal 3, which seeks to ensure healthy lives and promote wellbeing for all at all ages by 2030. Additional investment in health is, thus, needed in many countries, particularly in developing countries where healthcare infrastructure remains inadequate, and facilities lack the necessary management skills and patient care personnel to address the growing demands of caring for their populations. Faced with such a situation, and the imperative to stretch their healthcare funding and produce better results, many countries are increasingly turning to PPPs (World Bank, 2013). Zimbabwe, a developing country, situated in Southern Africa is faced with the same situation. A protracted debilitating economic crises has severely undermined the capacity to healthcare delivery to the populace. Against this backdrop, there is an increasing realisation within the country that provision of health services through several Public-Private Partnership initiatives could be of help to alleviate the challenges.

Key Words: public-private-partnerships; healthcare, universal health coverage, sustainable development goals, Zimbabwe

I. INTRODUCTION

As Asogwa and Odoziobodo (2016) point out, governments and the private sector have historically worked together on a broad range of issues, including setting regulatory frameworks, implementing development programmes, and other public policy decisions that affect the economy and society. Governments all over the world are, thus, turning to public-private partnerships (PPPs) as means of improving the delivery of public services and meeting the investment challenges that they face. In the health sector PPPs have particularly gained importance due to fiscal limitations. Zimbabwe has scope for PPPs in health care financing as it is a country faced numerous challenges including limited fiscal space, inadequate infrastructure, lack of technical capacity and skills flight.

II. GLOBAL CHALLENGES WITHIN THE CONTEXT OF UNIVERSAL HEALTH CARE COVERAGE

Governments today face a broad range of complex healthcare challenges prompted by changing demographics, a growing burden of chronic diseases, escalating healthcare costs and rapidly changing healthcare technologies (Abuzaineh, Brashers, Foong, Feachem, Da Rita (2018). Owing to these challenges healthcare systems are increasingly strained and are struggling to expand access and deliver high-quality healthcare services in line the implementation of Universal Health Coverage (UHC) and the overarching objective of achieving Sustainable Development Goal 3, which seeks to ensure healthy lives and promote wellbeing for all at all ages by 2030. As noted by Abuzaineh et al. (2018), additional investment in health is, thus, needed in many countries, particularly in developing countries where healthcare infrastructure remains inadequate, and facilities lack the necessary management skills and patient care personnel to address the growing demands of caring for their populations. Faced with such a situation, and the imperative to stretch their healthcare funding and produce better results, many countries are increasingly turning to PPPs (World Bank, 2013). USAID and Pakistan Initiative for Mothers and Newborns (2006) maintains that the underlying logic for partnerships is that both the public sector and the private sector have unique characteristics that provide them with advantages in specific aspects of service or project delivery. Furthermore, they submit that the most successful partnerships draw on the strengths of both the public and private sectors for complementarity, although roles and responsibilities of the partners may vary from project to project. In a similar vein, Jomo, Chowdhury, Sharma, Platz (2016) posit that from a public policy perspective, the prime objective of a PPP is improvement in the quality and efficiency of a given service to the citizen. They further argue that at the same time, PPPs have the benefit of attracting private resources into public services, thereby allowing public money to be diverted into other critical areas and alleviating long-term fiscal pressures.

The World Bank (2013) identifies four key factors driving governments worldwide to the PPP model for health sector improvements, namely, the desire to improve the operation of public health services and facilities and expand access to high quality services, the opportunity to leverage private investment or the benefit of public services, the desire to formalise

arrangements with non-profit partners, who deliver an important share of public services and more potential partners for governments as the private health care sector matures. While acknowledging the potential benefits of public funding and private delivery of health facilities and services, the World Bank (2013), however, notes that the path from publicly-run hospitals to privately-provided hospital services is not so well-known and can be challenging.

Relatedly, USAID and Pakistan Initiative for Mothers and Newborns (2006) notes that although a public-private partnership is one of a number of ways of delivering public infrastructure, including health services, it is not in any way a substitute for strong and effective governance and decision making by government. In the final analysis, government remains responsible and accountable for delivering public services, like health services and projects in a way that protects and advances the public interest.

The World Health Organization and World Bank (2017) asserts that the goal of universal health coverage (UHC) is ensuring that every community and individual accesses healthcare services. In the past few years, calls for the stepping up of efforts to attain UHC have grown considerably. Ghebreyesus (2017) puts it aptly by stating that all roads lead to universal health coverage (UHC). This underlines the centrality of global efforts to attain universal health coverage. According to Collaborative Africa Budget Reform Initiative (2015) UHC has been defined by the World Health Organisation (WHO) as ensuring that all people obtain the health services they need without suffering financial hardship when paying for them. For Ghebreyesus (2017), the key question of universal health coverage is an ethical one since it is a human right. He points out that at least 400 million people have no access to essential health services, and 40% of the world's population lack social security. Progress towards UHC means that more people, especially the poor, who are presently at greatest risk of not receiving needed services, receive the services they need. In addition, progress towards UHC implies lowering of barriers to seeking and receiving required medical care such as out-of-pocket payments, distance, poorly trained health workers and poorly equipped facilities (World Health Organization and World Bank, 2017). Importantly, UHC also entails that getting needed healthcare services is associated less and less with financial hardship and that people receiving health care services are still able to afford food and other necessities, and do not put their families at risk of poverty by accessing the care they need. World Health Organization and World Bank (2017) notes that in several less developed countries, lack of physical access to even basic services remains a colossal problem. Against this backdrop, health systems have a fundamental role to play in making strides towards UHC. Health systems strengthening through the enhancement financing, strengthening of governance of the system, improving health-care workforce, improving service delivery, improving health information systems and improving the provision of medicines and other health products is critical to progressing towards UHC. In this regard PPPs in the health care sector could also make a significant contribution as they allow the tapping of financial resources and expertise from the private sector.

III. THE SUSTAINABLE DEVELOPMENT GOALS FRAMEWORK

According to World Health Organisation (WHO) and the World Bank (2017) a number of the 17 Sustainable Development Goals (SDGs) adopted by the United Nations General Assembly in 2015 have targets related to health, with one goal SDG 3 focusing specifically on ensuring healthy lives and promoting well-being for all at all ages. Sustainable Development Goal 3.8 sets the following target to be attained by 2030:

> Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality, and affordable essential medicines and vaccines for all (Ghebreyesus, 2017).

Bhuwanee (2017) submits that there are compelling arguments that investments in health need to focus, not only on direct service delivery, but also on overall health-systems strengthening, as strong health systems will be pivotal to the achievement of SDG 3. Furthermore, he points out that many countries need substantial additional investments in health to achieve SDG 3. Evidently, the noble goal of achieving universal health coverage requires considerable fiscal space. Relatedly, Asogwa and Odoziobodo (2016) posit that there are challenges pertaining to finding mechanisms to harness the resources of the private sector to support public sector effort to promote national health. Against this backdrop, PPPs could be an alternative for bridging this gap. Relatedly, Shah and Thakur (2018), researching in India, assert that achieving Universal Health Coverage is not just the responsibility of the government, but cooperation from the private sector is imperative. Additionally, they note that the Indian private healthcare sector has grown rapidly in recent years and continues to contribute significantly to the provision of health services. They also submit that governments can improve private sector participation in health by improving transparency, reducing bureaucracy and allowing flexibility in post-contract negotiations. Some examples of successful healthcare PPPs that have contributed to improving the coverage and access to health services were also noted as well as the need to increase the level of private sector involvement in healthcare (Shah and Thakur, 2018).

IV. THE ZIMBABWEAN CONTEXT

According to the *National Health Strategy for Zimbabwe 2016-2020*, there are prospects that the economy will remain sluggish in the short to medium term, and total tax revenues will generally remain at about 27% of GDP. These fiscal trends and projections indicate that the government's capacity to allocate financial resources to the health sector is limited. This macro-economic environment calls for innovation and effective partnerships between government and other stakeholders in both funding and provision of health services to the population.

Zimbabwe is among those countries that are faced with limited fiscal space and consequently deteriorating public utilities and service provisions (Mutandwa and Zinyama, 2015). The Zimbabwean government is struggling to keep the

Healthcare sector afloat due to the ever-increasing costs and demand for healthcare as the population grows. The nation of Zimbabwe, among many other African countries is currently faced with severe staff shortages, low work motivation, high rates of absenteeism and a general inefficiency of the health sector.

Despite having embarked on economic reforms such as the Economic Structural Adjustment Programme (ESAP) in 1990, which were meant to improve the serious economic crisis that Zimbabwe was in, the situation in the health delivery system has drastically deteriorated (Mutizwa, 1998).The economic hardships in the country have further aggravated the situation due to budgetary constraints to meet the requirements of the public health institutions. Corruption and malpractice has also been cited at the public institutions and this worsens the situation.

Focus has been gradually shifting towards the role of Public-Private Partnerships (PPPs) to alleviate the situation. Public Private Partnerships are increasingly being adopted internationally and public-private collaboration has been used to deliver health services in systems performing excellently around the globe World Bank, 2013). PPPs have been proven for their ability to harness the efficiencies and expertise of the private sector to service delivery (Abuzaineh et al., 2018). This leads to the improvement of public health services and facilities to increase the access to services of higher quality (Sarmah, 2009; Abuzaineh et al., 2018). The private sector also brings in the benefits of more capital investment and sharing of risk (USAID and Pakistan Initiative for Mothers and Newborns, 2006; Kosycarz, Nowakowska and Mikołajczyk, 2018). In direct contrast to privatization, the public accountability is maintained with PPPs.

According to the Ministry of Health and Child Care E-Health document, (2012-2017) there is an increase in government efforts to increase the collaboration as well as provision of health services through several Public-Private Partnership initiatives. These initiatives are meant to strengthen health systems by covering the gaps identified in the six pillars for efficient delivery of health services, which were identified by the National Health Strategy of 2009-2013. The gaps included the presence of obsolete and non-functional medical equipment, reduced access to essential drugs and supplies, weakening of the health management and high human resource health vacancy level. The health sector is unacceptably underfunded with a budget allocation of US$7 per capita against the recommended US$34 per capita per annum. The result of these gaps is loss of life and untold suffering of the poor who are not able to access the services of the private sector.

V. PPPS- DEFINITIONS

The World Bank (2013) defines PPPs as initiatives that establish a contract between a public agency and a private entity for the provision of services, facilities or equipment. It further points out that a PPP exists when members of the public sector partner with private sector players in pursuit of a common vision and goals. Elaborating further, the World Bank posits that in a situation of equal partnership, all the partners bring resources together, contribute to the development and implementation of the project, and benefit from its results.

For the World Bank (2017), a PPP denotes a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance.

Likewise, the USAID and Pakistan Initiative for Mothers and Newborns (2006) posit that public-private partnerships (PPPs) denote arrangements between government and private sector entities for the purpose of providing public infrastructure, community facilities and health services. It adds that such partnerships are typified by the sharing of investment, responsibility, risk, responsibility and reward between or among the partners. They also point out that the reasons for establishing such partnerships vary but generally involve the financing, design, construction, operation and maintenance of public infrastructure and services.

Kosycarz, Nowakowska and Mikołajczyk (2018) a PPP is can agreement between one or more public and private entities, typically of a long-term nature, reflecting mutual responsibilities in the furtherance of shared interests. Importantly, this definition implies that PPPs work only when both parties benefit from the relationship, and the expected benefits are clarified in advance.

For Hellowell (2019), PPPs denote long-term contracts between a public and a private entity in which the latter is responsible for delivering new healthcare facilities and services. He further elucidates that in PPPs of this kind, the private entity earns an income stream from a performance-adjusted unitary fee, paid by the public entity, together with user fees.

As Mutandwa and Zinyama (2015) note, a commonality in the definitions of PPPs is that the concept is largely discussed as a gap-filler towards infrastructural development by government. They hasten to stress that the impact of PPPs mainly depends on the extent to which the government effectively controls the private partners, sufficiently providing for the operational autonomy for private partners.

VI. HISTORY OF PPPS

Jomo et al (2016) submit that public-private partnerships are not new, asserting that concessions, the most common form of PPPs, where the private sector players exclusively operates, maintains and carries out the development of infrastructure or provide services of general economic interest , date back thousands of years. They point out that during the time of the Roman Empire, concessions served as legal instruments for road construction, public baths and the operation of markets. The authors cite an example of medieval Europe, where as early as 1438, a French nobleman named Luis de Bernam was granted a river concession to charge the fees for goods transported on the Rhine. They however, point out that, while the practice has been around for millennia, the term “Private-Public Partnership” or PPP was coined and popularized in the 1970s, when neo-liberalism began questioning the hitherto dominant Keynesian paradigm and the

role of the state in the context of poor economic performance. This view is corroborated by Mutandwa and Zinyama (2015) who posit that the evolution of PPPs can be traced back to the 1970s during which a macro-economic dislocation ensued. They further point out that the trajectory of PPPs is found in the New Public Administration (NPM) body of reforms in which there was a retreat of government frontiers in the provision of public goods and services, noting that in that context, PPPs were seen as the gap-filler of the recurrent government failure.

Similarly, Abuzaineh et al. (2018) notes that historically, governments have engaged the private sector to deliver services through healthcare PPPs to achieve one or more of the following six functions: financing, design, building, maintenance, operation and delivery of services.

In Zimbabwe, as Dube and Chigumira (2011) asserts, the idea of PPPs was mooted in 1998 and significant attempts to craft a PPP framework were made in 2004. Nonetheless, to date the legal and regulatory frameworks for PPPs are yet to be established although some PPP projects have been implemented in the country, such as the Beitbridge-Bulawayo Railway (BBR), the New Limpopo Bridge (NLB) and the Newlands Bypass (Dube and Chigumira, 2010).

VII. PPPs MODELS

There are several of models which can be adopted depending on the requirements of the Healthcare system. These include Build and transfer scheme (BT), Build and operate and transfer Scheme (BOT), Build own operate and transfer scheme (BOOT), Build lease and transfer (BLT), Build transfer and operate (BTO), Rehabilitate operate and transfer (ROT) and the Lease develop and operate scheme (LDO) (Savas 2000). Private Perspective

According to Dube and Chigumira (2010) under the Build-and-Transfer scheme (BT), the private sector player sources the requisite finance and constructs the facility. After completion, the company hands over the infrastructure to government, which then takes over all the roles. The government pays the firm an agreed amount of money, along with negotiated reasonable returns.

Confederation of Indian Industries and HOSMAC (2016) asserts that under the Build – Operate – Transfer (BOT) arrangement, the private sector builds an infrastructure project, operates it, and eventually transfers ownership of the project, or a major part of it, to the government. Usually in that arrangement the government becomes the company's only customer and promises to purchase at a predetermined amount of the project's output. This is meant to ensure that the private player recovers its initial investment in a reasonable duration. At the end of the contract, the public sector assumes ownership but can elect to assume operating responsibility, contract the operation responsibility to the developer, or award a new contract to a new partner (Confederation of Indian Industries and HOSMAC, 2016).

Build–Transfer–Operate (BTO) is a variation of Build – Operate – Transfer (BOT). Under this arrangement public sector contracts with the private player to design, construct and operate a facility (Confederation of Indian Industries and HOSMAC, 2016; Mutandwa and Zinyama, 2015). After completion, the private player transfers ownership of the facility back to the public sector. The public sector then leases the facility back to the private partner under a long term contract.

The Confederation of Indian Industries and HOSMAC (2016) asserts that the other model is the Build–Own–Operate (BOOT) model. In this kind of arrangement the public sector either transfers ownership and responsibility for an existing facility or contracts with a private firm to build, own and operate a new facility permanently. The private partner usually provides the financing. The facility is then handed to the government or government department after the agreed term (Mutandwa and Zinyama, 2015).

The Design–Build–Operate (DBO) model is another common PPP model. Under this model the public sector contracts with a private player to design, construct and operate a facility, but ownership of the facility remains with the public sector (Dube and Chigumira, 2010; Mutandwa and Zinyama, 2015; Confederation of Indian Industries and HOSMAC, 2016).

Another common PPP model is the Design–Build–Finance–Operate (DBFO) arrangement. In this model the private player is responsible for designing, building, financing and operating the facility. The arrangements vary significantly in terms of the degree of financial responsibility that is transferred to the private player.

The Private Finance Initiative (PFI) is another PPP model. It entails an arrangement where a private sector consortium finances, builds and maintains a project in return for an annual fee from the government for a period of 25-30 years, throughout the life span of the project (Dube and Chigumira, 2010; Confederation of Indian Industries and HOSMAC, 2016).

According to Dube and Chigumira (2010) the Rehabilitate-operate and transfer (ROT) models involves a system where the infrastructure that is in existence but in a bad state is handed over to a private sector partner for refurbishment, reconditioning and maintenance. The private player is allowed to operate the infrastructure for a period, recover investment costs and get a reasonable return, after which the facility is handed back to the government.

Under the Build-lease-and-transfer (BLT) the private sector constructs infrastructure and once complete, it hands the operation issue to the government on a lease basis, where the government pays for the lease (Dube and Chigumira, 2010; Mutandwa and Zinyama, 2015. The lease payments give the firm an opportunity to recover its costs, and after an agreed term, the government stops paying the lease and assumes ownership and control over of facility.

On the other hand the Lease, develop and operate (LDO) arrangement is whereby a private sector actor leases an existing facility from the public sector, renovates, modernises or expands it before assuming operation rights for a fixed term. That way, the company gets an opportunity to recover costs, with the public sector benefiting from the lease payments (Dube and Chigumira, 2010; Mutandwa and Zinyama, 2015).

For Abuzaineh et al., (2018), in health care there are three basic PPPs models, namely, the infrastructure-based model, for to build or refurbish public healthcare infrastructure, the discrete clinical services model , for adding or expanding service delivery capacity, and the integrated PPP model, for providing a comprehensive package of infrastructure and service delivery.

VIII. PPPS IN ZIMBABWE

The Zimbabwean government introduced the Public-Private Partnerships as early as 1998 whereby the private sector could partner with the government to improve service delivery. The government took this policy position due to the underperformance of the State-Owned Enterprises. These entities were making losses and becoming a liability to the nation's finances. PPPs were then proposed as a solution to improve the public infrastructure and other service delivery. This was done to complement the Public-Sector Reforms (PSR) under the Economic Structural Adjustment Programme (ESAP) where commercialisation and privatisation strategies where employed to improve the delivery of services and were quite successful in some sectors (Massimo, 2014).

The proposed PPP strategy in 1998, however, failed to take off since there was no framework to support the policy implementation. It was only in 2004 that the government was able to craft a framework on PPP investment. The 2004 Public-Private Partnership in Zimbabwe Policy and Guidelines were put in place to provide the parameters for developing an appropriate legal and regulatory framework which should protect the investors and consumer interests. However, the guidelines were not further developed into a legal and regulatory framework though some PPP projects have been implemented successfully in the nation (Dube and Chigumira, 2010). These projects include the Beitbridge-Bulawayo Railway (BBR), the New Limpopo Bridge (NLB) and the Newlands By-Pass (NBP) Zimbabwe National Chamber of Commerce (ZNCC, 2009).

The BBR was executed under the Build-Operate-and-Transfer scheme (BOT) by the Beitbridge Bulawayo Railway (Pvt) Limited, a subsidiary of NLPI Ltd which was established to implement the project (Dube and Chigumira, 2010). The construction phase was executed in a record eighteen month. The BBR is a 350km railway line from Beitbridge to Bulawayo which is an essential link for the fuel transportation to the southern parts of Zimbabwe.

The New Limpopo Bridge (NLB) was the first BOT of that nature in Africa whereby a private company, New Limpopo Bridge (Pvt) Ltd also a subsidiary of NLPI Ltd was awarded to finance and build a toll bridge over the Limpopo River in 1993 by the governments of Zimbabwe and South Africa. The bridge was completed in a record time of thirteen months and the company is still operating the bridge. The company has also been able to upgrade its systems to ease border crossing procedures and promote trade.

The NBP was completed in 2007 having been implemented under the Build and Transfer scheme (BT) and the constructor handed to the government at completion. The NBP is a four-lane highway bypassing the Newlands shopping centre in Harare.

The Zimbabwe Investment Authority (ZIA) has also adopted some BOT PPP model and investors are getting some incentives because of getting into the PPP scheme which include five-year tax holiday and reduced rate of tax for five years after. This arrangement is regularised and made legal by the Income Tax Act. However, regardless of some success stories the uptake of PPPs has been depressingly low (Zinyama and Nhema, 2015). Dube and Chigumira (2010) cited the uncertain political environment and the absence of a sound legal framework for guiding the PPP project implementation as the main factors affecting the PPP uptake in Zimbabwe.

There has been an increase in cooperation between the public and private sectors in recent years for development and delivery of infrastructure. These PPP arrangements were because of the need for investment cover as well as to improve the quality of the public service in general.

In 2009, the Short-Term Emergency Recovery Programme document (STERP) invited private sector players in areas such as air and rail services, power generation, dam construction and national highways. There was a follow up document the Three Year Macroeconomic Policy and budget Framework (STERP II) which further confirmed the government position on the need to make use of PPPs. In 2009 and 2010 several documents were drafted after a series of workshops on PPPs to form the basis of PPP structuring, but they are yet to be adopted by the government.

The Draft PPP Policy Document the government had identified the transport sector, education sector, health facilities and power infrastructure as the primary candidates for early PPP (Dube and Chigumira, 2010). However, up to now Zimbabwe still has unclear legislative and regulative framework for PPPs.

A study conducted by Mugwagwa, Chinyadza and Banda (2017) revealed the need for collaboration between government and private sector in health delivery in view of the shrinking resource base for health delivery which has weakened an already strained health system faced with manifold economic, social and political difficulties. The study acknowledges that the government has established the National Health Strategy and several programmes for the direction and institutionalisation stakeholder participation in health care delivery, the maintenance of the momentum of public-private cooperation and creation an enabling environment. Mugwagwa et al. (2017) also note that the monitoring of alignment of the motivations, procedures and impacts of private sector participation in health delivery is impeded by the added constraints of human resources, funding and time. They concluded that while broadened participation by the private sector results in some favourable intermediate outcomes in terms of access and equity, there is need for systematic documentation and standardisation of the various approaches and procedures employed by the different actors, in order for their motivations to be aligned with the government's health care delivery goals and for more predictable, scalable, measurable and sustainable impact from these interventions to be realised. This, they contend, will not only help to avoid possible deleterious links like wastage of much needed resources through overlaps and duplications between private sector participation and health system performance in the country, but will also ensure timely decision-making, curation and deployment of required institutionalisms and identification

of synergies that are appropriate for government, health facilities and patients.

IX. RATIONALE FOR PPPS IN HEALTH SECTOR

Kosycarz, Nowakowska and Mikołajczyk (2018) submit that all governments globally struggle with rising health care expenditures and public budget constraints. This factor has led governments to look for various approaches to limit their costs and increase investment in the health sector through PPPs. PPPs are increasingly seen as improving the performance of healthcare systems worldwide, by bringing and mixing the best characteristics of the public and private sectors to improve efficiency, innovation and quality. In the same vein, Hellowell (2019) posits that the economic case for using the PPP model over a conventional public system resides in its ability to transfer the risks of infrastructure and service delivery to the private sector, give rise to in a lower risk-adjusted cost to the state, that is, better value for money. He further asserts that theoretically, this transfer is achieved in three ways. First, the payment to the private sector is made as, when and to the extent that facilities and services are availed to users and failure to achieve these outcomes results in reduced payments to the private sector. Second, the private sector's profits are determined by its ability to minimise costs, for instance, by exploiting economies of scope across the range of activities under its control (Hellowell, 2019). Hellowell (2019) further elaborates that governments often prefer the use of PPPs over public procurement because they provide access to private capital, thereby allowing the impact on public budgets of any related up-front expenditures to be deferred. He, however, hastens to point out that, ironically, the result is a long-term financial commitment to repay the private capital with interest, and pay service costs and the expected profits of the private firms involved. This seems to suggest that PPPs may not always be cost-effective to the public sector so caution should be exercised in adopting them.

Hellowell (2019) notes that around the world, hospitals are in disrepair, and facilities and services are managed poorly, as most governments lack the capital budgets to finance new constructions on a large scale, and are constrained by national policies and hiring norms that inhibit their ability to implement reforms. Through partnering with the private sector players by means of PPP arrangements, governments access more flexible and innovative practices—such as the introduction of comprehensive computer systems and performance-based human resource management practices, thereby expanding capacity and improving service delivery (Hellowell, 2019). In addition, governments gain access to new sources of financing and are able to share risks with the private sector. The private sector also reaps benefits from PPPs, including an opportunity to access new markets at a lower risk profile, while contributing to a public good (Hellowell,2019).

Sarmah (2009) suggests that apart from general considerations of quality, cost and efficiency, PPPs have been viewed as a vehicle of attaining equity in public health. Equity is crucial as it one of the guiding tenets of UHC and SDG 3.

In a similar vein, USAID and Pakistan Initiative for Mothers and Newborns (2006) points out that although PPPs are not necessarily the solution for the delivery of all services, they can yield benefits such as cost saving, risk sharing, improved level of services, enhancement of services, and increased economic growth. It however, points out that PPPs have potential risks such as loss of control by government, increased costs, political risks , unreliable services, in ability to benefits from competition, reduced quality of service, bias in the selection process and labour issues.

Whyle (2015) asserts that PPP initiatives have made a significant impact in the fight against diseases that disproportionately affect the poor, noting that non-state actors, including for-profit and not-for-profit organisations, as well as individuals are usually the principal providers of primary health services in the majority of low and middle income countries. Whyle (2015) submits that private sector involvement in health is given, but there is debate as regards how public-private cooperation can enhance the efficacy and efficiency of health systems. In particular, there are legitimate concerns vis-à-vis the difficulties of imposing consistent regulation and quality control on a sector as diverse and fragmented as the private health sector. In the context of sub-Saharan Africa, the difficulties of regulation lead to inconsistent quality and allow an unscrupulous minority of service providers to prevail (Whyle, 2015). However, Whyle (2015) concludes that while these concerns are legitimate, it is crucial to note that PPPs, when correctly implemented, present an opportunity to control the actions of the private sector in the best public interest. There is, therefore, need for an improved understanding of PPPs as mechanisms for ensuring that the private health care sector acts in accordance with national priorities, and the effective implementation of PPPs.

Taylor, Nalamada and Perez (2017) submit that the underlying causes of morbidity and mortality must be addressed to achieve long-term improvements in health. Furthermore, they contend that these underlying causes, or determinants of health, cut across all areas of development, such as education, gender equality and employment and, as such, effectively addressing them requires multi-sectoral collaboration, hence the need for PPPs. In a similar vein, Whyle and Olivier (2016) asserts that while the delivery and financing of healthcare is commonly considered to be the sole responsibility of the state, despite the fact that in low- and middle-income countries a lack of resources hampers governments' capacity to fulfil this role, the health systems of many low and middle income countries are mixed health systems in which public health systems operate alongside a non-state health sector, with market systems often playing a dominant role. They argue that in such arrangements, inadequate government funding and under-regulation of the private sector combine to undermine the efficiency and equity of the system as a whole. They further note that in most Southern African countries, insufficient public health infrastructure, shortages of medical drugs, and inadequate financial and human resources undermine the state's capacity to meet population health needs, and low quality of care characterises public sector provision. Although historically the state was seen as the appropriate sole provider of health care, and interaction and collaborations between the public and private sectors was limited, structural adjustment programmes driven by the World Bank and International Monetary Fund in the 1980s and 1990s, together with international concern

about the government's capacity to deliver adequate health services, and economic theory regarding the increased efficiency of the private sector, saw reductions in public spending which undermined public sector health care provision, resulting in an increased role for the private sector in health care (Whyle and Olivier, 2016).

Likewise, Languillle (2017) posits that in middle and low income countries, the involvement of private actors in the provision of health is not a recent phenomenon, pointing out that literature on PPPs in both sectors acknowledges the historical role of private actors in this field. She argues that what is new in the rise of PPPs, both as policy and practical provision arrangements, is the scale of the phenomenon, and its significance for the on-going reconfiguration of the relation between the public and private sectors. For Languille (2017), there are general factors that explain the expansion of PPPs in both sectors. These factors include neoliberal globalisation and the attendant ideological shift. During the first phase of the neoliberal era, in the 1980s, the dominant discourse advocated a retreat of the state and its drastic downsizing by means of outright privatisation. Languille (2017) contends that emergence of PPPs particularly coincided with the next stage of neoliberalism, beginning in the late 1990s, when the role of the state was rehabilitated to correcting market failures and enabling the private sector to thrive. The second factor which has contributed to the emergence of PPPs as an acceptable policy model for health provision was power shift among international organisations (Languille, 2017).

Confederation of Indian Industries and HOSMAC (2016) points out that PPPs provide a vehicle for coordinating with private actors to undertake integrated and comprehensive efforts to meet community needs. They seek to take advantage of the expertise of each partner, to ensure that resources, risks and rewards can be allocated in a way that best meets defined public needs. In the healthcare sector, PPPs are an approach for addressing public health problems through the combined efforts of public, private, and development organizations. Each partner makes a contribution in its area of special competence, bringing in expertise that is usually not available in development projects. The partners in a PPP rally around a common cause, while at the same time pursuing some of their own organizational objectives. Through the correct use of PPP mechanisms, public sector organizations such as the ministries of health may achieve their objectives faster, and with smaller investments. Through PPPs, private sector entities are able to expand their markets, develop new marketing techniques, and contribute to the communities in which they operate. Development organizations achieve their strategic objectives in collaboration with others, leverage new resources for public health, and gain experience with a highly feasible and sustainable approach to public health promotion.

According to Abuzaineh et al (2018) PPPs in healthcare provide opportunities for governments to leverage private sector resources and expertise, to enable investment in large-scale projects that advance national and local public health goals, such as improving quality of service delivery, and expanding access to care.

Kosycarz, Nowakowska and Mikołajczyk (2018) observe that two of the most crucial benefits of PPPs are reducing the financial burden on the public sector for infrastructure development, and risk sharing between partners. The authors contend that PPPs are considered more as an instrument to improve value for money than an additional source of financing and they have been used in several countries to reform the healthcare sector constructively. They posit that in undeveloped and developing countries public–private partnerships have been commonly used to drive and facilitate innovations in healthcare activities, with the most common activities relating to research , vaccines and discovery of drugs for the treatment of communicable diseases, development of personalized medicines,management and infrastructure growth.

For Jomo, Chowdhury, Sharma, Platz (2016), the principal objective of a PPP is improvement in the quality and efficiency of a given service to the citizens, while at the same time having the benefit of attracting private resources into public services, thereby allowing public money to be directed into other critical areas, thus alleviating long-term pressures on public finances. They maintain that the gains of PPPs have in many cases not been realized and the performance and viability of PPPs varies significantly across activities and sectors, asserting that for PPPs to be an effective instrument of delivery of important services, such as infrastructure, countries should have the institutional capacity to create, manage and evaluate PPPs, in relation to other alternative sources of funding. Jomo et al. (2016) argue that in order for PPP to be justifiable, it must provide what they term value for money. By this they mean the cost of a PPP, as well as the quality of service, would need to compare favourably with how public sector provision would have performed on these criteria. They contend that the cost of a PPP project would need to be assessed over its lifetime, taking into consideration the entire range of expenses linked to financing, construction and transactions related to tendering, negotiations and monitoring projects. They further posit that in this respect, the evidence provided by several researchers and international organisations indicates that PPPs have frequently tended to be more expensive than the alternative of public projects, citing the example of Lesotho where a hospital constructed through a PPP arrangement turned out to be very expensive.

Jomo et al. (2016) contend that the much-discussed case of recently built hospital in Lesotho provides an illustrative example of how a seemingly successful PPP may have negative impacts on the country's fiscal liabilities, and hence on overall social development. They point out that a recent quantitative study of the project using measures that reflected capacity utilization, clinical quality and patient outcomes describes the project as successful project and generally concludes that health care PPPs may improve hospital performance in less developed countries and that changes in leadership and management might account for differences in clinical outcomes.

Jomo et al. (2016), however, note that referring to the same project, an Oxfam study (2014) asserts that the hospital threatens to bankrupt the impoverished African country's national health budget, since more than half the country's health budget (51%) is being spent on payments to the private

consortium that built and administers the hospital. They further point out that PPPs cost US$67 million per year, at least three times what the public hospital would have cost today, and it consumed more than half of the total government health budget. The Lesotho hospital case highlights the complexity of the costs of PPPs and the consequent need to improve their impact assessment on long term sustainable development. It also highlights the need for caution when replicating apparently successful PPPs in other contexts. Overall, the research evidence indicated that PPPs have tended to be more expensive than the alternative public projects. In several instances they have failed to deliver the envisaged gains in quality of service delivery, including efficiency, coverage and development impact, with their impact varying across sectors.

Hellowell (2019) observes that the Lesotho public–private partnership (PPP) is an ambitious attempt to outsource new healthcare facilities and a broad range of clinical services. He, however, notes that quality of services delivered is relatively high, but the cost to government has been greater than had been projected.

As Mutandwa and Zinyama (2015) note, the constant failure of African governments to provide adequate services to their people is well documented and can only be remedied through PPPs. Zimbabwe is one of the countries that have resorted to PPPs due to lack of resources to provide basic services to the citizenry.

According to the Zimbabwe's E-Health Strategy document, the country is making efforts to increase collaboration and health service provision through numerous PPP initiatives. This has been necessitated by the gaps identified by the National Health Strategy (2009-2013). These gaps were identified in the six pillars of health systems for efficient delivery of health services. These included the Public Sector Human Resource Health vacancy which lies at an unacceptable levels, weakened health management, great reduction in access to essential drugs and supplies, obsolete medical equipment and shortage of infrastructure. Above all, the health system is grossly underfunded and the budgetary allocation was then standing at US$7 per capita per annum compared with the WHO recommendation of at least US$34 and this has long since gone even further down.

The Public Health System has virtually broken-down thus causing the private health sector to expand and dominate. This has caused untold suffering as the poor patients are forced to seek services from the expensive service providers in the private sector. This has led to the thought that there is need for collaboration of the private and the public sector since neither of the two can stand alone in providing the best interests of the health system (Venkat Raman & Bjorkman, 2009).

Dube and Chigumira (2010) note that in Zimbabwe, the public healthcare system has been traditionally the largest provider of health-care services, with Mission hospitals and non-governmental organisations (NGOs) playing a complementary role. The infrastructure in the public health institution was also well managed and maintained. However, years of economic decline, have almost resulted in a reversal of this pattern, with the public sector failing to perform its leading role. The health infrastructure in Zimbabwe is in a sorry state as a result of underfunding and a lack of maintenance. As result, the period 2008-2009 saw public hospitals more or less closing doors to patients as lack of supplies took its toll, with those who could not afford private medical facilities being left vulnerable. Lack of supplies for health facilities also extended to laboratory equipment and laboratory reagents. In the meantime, the privately run health institutions managed to persevere, and they more or less managed to carry the burden placed upon them by the public sector failure, but only for patients who could afford their comparatively high service charges. This shows the critical role that a combination of the public and private sector can play in bringing back normalcy in the sector, which is where PPPs become relevant.

Mutandwa and Zinyama (2015) submit that Zimbabwe harbours high hopes of turning around poorly performing public utilities by bringing the new expertise, financial resources and a more commercial orientation through PPPs. They further point out that the Zimbabwe Agenda for Socio-Economic Transformation, the country's economic blueprint for the period 2013 to 2018, also gives an impetus to the use of PPPs in water infrastructural development and service provision.

Zinyama and Nhema (2015) also point out that during the Government of National Unity in Zimbabwe, under the Short-Term Emergency Recovery Programme document (STERP), PPPs were provided for under private sector invitation in areas such as air and rail services, power generation, dam construction and national highways. This was also reconfirmed under the Three Year Macroeconomic Policy and budget Framework (STERP II) which also envisaged the use of PPP in infrastructure development.

X. CONDITIONS FOR THE SUCCESSFUL IMPLEMENTATION OF PPPS

For PPPs to be an effective instrument through improvements in service delivery, efficiency and development impact, it is important that the public sector is able to correctly identify and select projects where PPPs would be viable, structure contracts to ensure an appropriate pricing and transfer of risks to private partners, establish a comprehensive and transparent fiscal accounting and reporting standard for PPPs, and establish legal, regulatory and monitoring frameworks that ensure appropriate pricing and quality of service. In sum, it is necessary that countries have in place the institutional capacity to create, manage, evaluate and monitor PPPs.

Taken together, an institutional framework that provides countries with the above four interrelated capacities would have the benefit of ensuring that PPPs are established for the right reason, that is ensuring an improvement in the quality and cost efficiency of a given service to the citizen and not as a vehicle for undertaking off budget activities. They are also essential for making sure that efficiency improvements are measurable and monitored and facilitating good governance in the administration of the PPP.

A study by Mutandwa and Zinyama (2015) indicated that although Zimbabwe has already engaged PPPs it is generally failing to achieve the desired results due to lack of a legal framework and an institutional framework. The two authors also argued that corruption continues to hinder PPP uptake

through underhand deals and inflation of prices in the absence of proper legal framework.

Mutandwa and Zinyama (2015) also cited lack of political will, especially to involve the Western countries of which the political leadership declared western countries enemies, as one of the hindrances to the uptake of PPPs in Zimbabwe.

Zinyama and Nhema (2015) maintain that despite some successful PPPs cases in Zimbabwe, the uptake of PPPs has been depressingly low, due to an uncertain political environment and the absence of legal framework to guide the implementation of PPP projects. The two authors summarized the reasons for the low uptake of PPPs in Zimbabwe as investor perceptions of high political risk, lack of political commitment, lack of clear legal and policy frameworks, lack of financial resources with the government, currency risks, lack of expertise and capacity within the government and lack of policy consistency.

Zinyama and Nhema (2015) conclude that case studies evidence demonstrates that regulatory, legal and institutional frameworks are critical for PPPs to be successful in Zimbabwe, submitting that Zimbabwe should move with haste to finalise the PPP policy development. Furthermore, they recommended the establishment of a standalone PPP unit as is the case in Australia, United Kingdom, several European countries and in South Africa. They also suggested that Zimbabwe should simplify regulations, procedures and rules to remove bottle-necks for smooth functioning of the government, noting that this is only attainable through policy predictability and consistency to enhance confidence in investors. In the same vein, Mutandwa and Zinyama (2015) assert that requisites for the successful adoption of PPPs the world over successful PPPs largely depends on conditions which serve as benchmarks for proper implementation, without which implementation of PPPs becomes problematic. They point out that pre-conditions for PPPs are relatively similar in context but vary from one country to another. In some countries such as those in the European Union preconditions are well-articulated. They further submit that chief among the preconditions for successful implementation of PPPs are legal and institutional framework, political will, government commitment, economic stability, financial support, technical expertise, public acceptance, and respect of property rights. Relatedly, Zinyama and Nhema (2015) assert that in planning the execution of PPP projects there are a number of issues that need to be addressed. These include international best practices, legal and institutional policy in place.

Apparently, Legal, regulatory and policy frameworks particularly play an enabling role for establishing PPPs. Such a framework helps in establishing the legal reforms needed to reduce impediments to improved or expanded service such as assignments of responsibility for development, control lines, financing, regulating and managing infrastructure and services. It is also important to note that legal reforms are required to overcome potential constraints to PPPs including hindering asset management or ownership, repatriation of resources and impediments to cost recovery.

Dube and Chigumira (2010) maintain that PPPs involve complex technical issues and their success is dependent on the friendly interaction of multiple stakeholders. A study by Mutandwa and Zinyama (2015) indicated that corruption continues to hinder PPP uptake through underhand deals and inflation of prices in the absence of proper legal framework for PPPs. The study also indicated that there were no clear rules and regulations in place and there was also lack of political will to involve the Western countries, having declared them enemies. It was also revealed that the problem was exacerbated by the fact that Zimbabwe is under sanctions from the western powers, hence private players from those countries are forbidden through instruments such as Zimbabwe Economic Recovery Act (ZIDERA). The study also revealed that there was no legislation, policy or institutional framework that pertains to PPPs specifically in Zimbabwe. In addition, the study indicated that the concept of PPP legislation is shrouded in confusion. The study, thus, concluded that Zimbabwe was not ready for PPPs in the infrastructure development sector because it lacked political commitment, legal framework, finance, and monitoring and evaluation.

Sajani and Aktaruzzaman (2014) argue solid commitment at all levels of government, smooth flow of resources, active involvement of local government, raining, strong supervision and monitoring by all the partners, communication among the partners are critical to the success of PPPs as they engender a strong sense of ownership, mutual trust and respect are significant concerns for the success of partnership.

Relatedly, Torchia, Calabrò and Morner (2013) submit that while PPPs can provide mechanisms for achieving the comparative advantages of public and private sectors in mutually supportive ways, numerous issues are essential so they need to be carefully considered when implementing PPPs. Importantly, these authors note that despite the involvement of the private sector in PPP projects, the government needs to play the role of regulator, especially in sectors like health care where accountability is critical and the public interest is crucial. Particularly, they argue, the public sector should set standards and monitor product safety, efficacy, and quality, and ensure that citizenry has sufficient access to the products and services they require. Torchia et al. (2013) strongly contend that PPPs do not imply less government but a different governmental role. Through a review of PPPs in the health care sector, the authors further suggest that partnerships between the public and the private sector contribute to the improvement of the health of the poor by combining the different skills and resources of various entities, public and private, in innovative ways. Furthermore, they contend that in order for PPPs to be beneficial, the public sector should fund fundamental research; set standards for product safety, efficacy, and quality; establish a system whereby the citizenry has sufficient access to health product and services; use public resources efficiently; and create an atmosphere in which business enterprises are properly motivated to meet the needs of the whole population.

Studying results based financing (RBF) of health care in Zimbabwe, Mutupo (2017), concluded that as regards equity and inclusiveness there is a trade-off between achieving allocative efficiency and equity, especially when scaling up health programmes, and that under RBF, private partners assumed an active role in health finance outside government with a view to improving equity, sustainability, transparency,

governance, effectiveness and allocative efficiency in financing health care. She recommended that the government upholds the spirit of partnership under the PPPs initiative. Such PPP arrangements, she contended, ensures mutual accountability, donor coordination, harmonisation of efforts to ensure positive health outcomes and ownership of the initiative through the active involvement of the state and communities. The study also concluded that PPPs ease the allocation of resources, enhance equity in health care provision and are a good governance mechanism that ensures that the health delivery system is operating well in line with the dictates of the RBF philosophy. This conclusion seems to suggest that PPPs are appropriate for the resource–constrained health care system in Zimbabwe, although further research would be required to determine the nitty-gritties of their implementation.

Languille (2017) identifies three factors that make a literature review on health PPPs a challenging exercise, namely, the absence of a consensual definition of PPPs within and across sectors, the extreme heterogeneity of the category and the underlying ideological confrontation between proponents of the public sector and advocates of the private system. She further points out that the design and management of practical PPPs are source of high transaction costs, which require important contractual and administrative capacities in sector ministries. She also expressed scepticism as regards the impact of PPPs, arguing that the key predictions of the PPP doctrine, that is, cost-efficiency and improved service delivery to the poor, are barely fulfilled in practice. Furthermore, she contends that PPPs, both as policy model and practical arrangements, are underpropped by a narrow conception of health, which denies its fundamental embeddedness within the society and the economy. In addition, she argues that in both PPPs schemes are in practice onerous for the public purse and generates an administrative burden for highly strained health systems. However, she acknowledges that in view of the worldwide currency of the partnerships mantra and the private sector's quest for new sources of profit, PPPs are likely to gain prominence as ingredients of social policies in developing and emerging countries.

Looking at the case of Lesotho, Byiers, Große-Puppendahl, Huyse, Rosengren and Vaes (2016), observed that a key factor in determining the course of a PPP is the capacity of the public partner to sufficiently negotiate, manage and monitor the deal throughout its entire contract term. Further, they noted that Lesotho was lacking in this particular regard. The Lesotho case, they contended, suggested that a manifest lack of capacity of a public actor involved in a PPP arrangement may result in a power imbalance that is detrimental to the public interest purportedly served by the PPP. Thus, this risk should be considered when weighing the pros and cons of a PPP and in comparison to other options.

Researching in the Nigerian context, Asogwa and Odoziobodon (2016) posits that public-private partnership as financing model for physical and socio-economic development has been in vogue for more than two decades in developed countries and in South Africa. They note that PPPs have been used by developed countries as a financing strategy or option for public sector projects since the 1990s, but it was only in the last few years that Nigeria started creating an enabling atmosphere for PPPs as part of its socio-economic and political reform programmes. Furthermore, they point out that there are challenges relating to finding mechanisms of harnessing the resources of the private sector to support public sector effort towards the promotion of the national health objective, especially, the health-related targets of SDGs. They, however, suggest that accelerated progress should be contingent on partnerships that are established on mutual trust, joint planning, policy formulation, sharing of information, implementation and evaluation, as well as joint financing of activities and programmes. In addition, they submit that there is also need for collaboration to improve quality by supporting innovation, improving information for quality monitoring, enhancing clinical and administrative management capacities, and reviewing national programmes and project support on SDGs as well as to enact appropriate consumer protection laws aimed at protecting consumers from monopolistic and unfair business practices that are consequences of market deregulation or privatization. Łakomy-Zinowik and Horváthová (2016) conclude that PPPs were created as a remedy for inadequate funds that were intended for providing public services by the public sector and as a form of increasing the efficiency in the delivery of public services. Citing the example of the United Kingdom, the authors maintain that PPPs have contributed to the development and modernisation of medical infrastructure as well as to the inclusion of private actors in the provision of medical services, thus significantly contributing to the increase in the availability of medical clinics. They also submitted that resulted in shortening the time that patients spent waiting for medical examination.

With regard to Poland, Łakomy-Zinowik and Horváthová (2016) conclude that in spite of the fact that implementation of PPP in Poland is comparatively recent, Polish local authorities are slowly swaying in favour of transferring part of their rights to private subject, underscoring that lack of trust in PPPs can be engendered by failure to adjust the laws to possibilities offered by public private partnerships.

XI. CONCLUSION

Owing to increasingly shrinking fiscal space most countries are turning to PPPs in various sectors as well as the health care sector. PPPs in the health sector are quite common virtually across the globe, notably in Poland, Pakistan, Nigeria, South Africa and Lesotho. PPPs enable the harnessing of private sector resources, thereby helping to address fiscal challenges and the cost of health care provision. They can also drive innovation and improve service quality.

However, ironically PPPs can be costly to the government as it may be required to repay private sector partners for protracted periods of time. As such, individual PPPs ventures need to be carefully analysed and considered before they are adopted.

It increasingly came to the fore in the foregoing discussion that the conduciveness of the broader operating environment is critical for the success of PPPs. In particular, the legal and regulatory environment should be sufficient and appropriate for the establishment of PPPs. It also came out clearly that political will as well as a conducive political environment is a crucial success factor for PPPs. It is evident that currently Zimbabwe does not have an adequate legal and legislative framework for PPPs. This implies that for the effective implementation of PPPs to be effected, the country should develop an appropriate legislative and regulatory framework. The reviewed literature did not shed enough light as regards

the political environment and political will relative to PPPs in the Zimbabwean context. However, it is common knowledge that there is political polarisation in the country and private players who venture in projects that are meant for the common good, like healthcare programmes, are usually regarded with suspicion and have their political motives questioned by the government. As such, this is an area which needs to be critically considered before large scale PPPs can be ventured into.

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Effect of Small Scale Rice Farming On the Internally Generated Revenue in Argungu Local Government Areas of Kebbi State, Nigeria

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Abstract- Despite small-scale rice farming been seen as an integral part of Kebbi Economy, however, the extent to which small-scale rice farming affect the internally generated revenue in Argungu LGA of Kebbi State, is yet to be empirically examined. Low internally generated revenue as resulted to array of economic problems such as low level of employment generation, low per capital income, poverty and underdevelopment of the rural area etc., Thus, this study examines the effect of small scale rice farming on the internally generated revenue in Argungu LGA of Kebbi State. Econometric technique of logist regression analysis was employed to analyze the primary data sourced from field survey on this subject matter. The result shown that estimated coefficients of small-scale rice farming is 0.319 which implies that if the SSRF goes up by an infinitesimal amount, the probability for the variable IGR taking the value one rises by 0.319 is approximately 39 %. Thus, it can be concluded that small scale rice farming has positive and significant effects on the internally generated revenue. Also, the findings revealed that small-scale farmers' income, rice production output, and rice value chain have significant relationship with internally generated revenue in Argungu LGA of Kebbi State. Thus, this study recommended as follows, that Local and State government, as well as stakeholders in rice industry should encourage small scale rice farming to continue thrive through provisions of rice farming inputs such as, quality seedling, fertilizer, and microcredit to small-scale farmers who may be willing to engage in small-scale rice farming.

Index Terms- Small-Scale Rice Farming, Farmers' Income, Rice Production Output, Rice Value Chain and Internally Generated Revenue

I. Introduction

The importance of rice industry in the Nigerian economy cannot be overemphasized. It has traditionally been an important basic food commodity for certain populations in Sub-Saharan Africa, and West Africa in particular. Hence, the needs for increase cultivation of rice farming especially at small scale level. The demand for rice in Nigeria has been soaring; rising demand was partly as a result of population growth, increased income levels, rapid urbanization, and change in family taste, preference and associated changes in family occupational structures (Adesina, 2013; Central Bank of Nigeria, 2017)

However, federal government policy on rice production which includes; fertilizer subsidies, seedling, and various intervention programmes such as, FADAMA and Anchor Borrower Programme, seem to have encouraged domestic rice production. More so, government policy discouraging rice importation through the high tariff and outright ban on rice importation through the land border have led to increase in demand for home grown rice, and this has encouraged increase in rice farming across states in Nigeria (Asiru, Iye & Olaoluwa, 2018). According to the President, Rice Farmers Association of Nigeria, Aminu Goronyo, sannual rice production in Nigeria has increased from 5.5 million tonnes in 2015 to 5.8 million tonnes in 2017; and in 2015, Nigerians spent about N1bn on rice consumption. While spending on rice purchase had drastically reduced, however consumption had increased because of the increased local production of the commodity. The consumption rate currently stands at 7.9 million tonnes and the production rate has increased to 5.8 tonnes per annum. This increase was as a result of the CBN's Anchor Borrowers Programme with a total of 12 million rice producers and four million hectares of FADAMA rice land. ABP since inception had created economic linkage between Small Holder Farmers and reputable large-scale processors, thereby increasing agricultural outputs and significantly improving capacity utilization of processors. While it appears that government expenditure has resulted to increase in local rice production it is also reasonable to assume that this increase in local rice production has a multiplier effect on the revenue accrued to Nigerian government who have been able to reduce millions of naira spent on importation of rice and consequently increase foreign reserve base.

However, in Kebbi State, like other states in Nigeria rice farming by the small-scale farmer has been seen as an integral part of Kebbi economy (Ohen & Ajah, 2015). These small-scale farmers are the major actors in rice production in Kebbi State contributing their own quota to the Kebbi economy through employment generation, food security, and rice export to other states in Nigeria and abroad among other. At the local government level, the activities of small scale rice farming from the onset of rice cultivation, processing, storage, distribution, and marketing is expected to contribute to internally generated revenue directly or indirectly.

Nevertheless, despite small-scale rice farming has been seen as an integral part of Kebbi economy the extent to which small-scale rice farming, through small-scale farmers' income,

rice production output, and rice value chain affect the internally generated revenue in Argungu LGA of Kebbi State, is yet to be empirically examined. There is no empirical evidence to show that small scale farming in the area has contributed significantly to internally generated revenue.

In the meantime, according to Adi, Yakubu, Ibrahim and Eche, (2015), internally generated revenue has over the year remained the main focus of all the local government in Nigeria indeed the entire administration of local government is informed by the important role played by internal revenue generation in their locality. This is due to the issue of low finance that has been the major problem, which local governments in Nigeria are grappling with in recent times. More so, inability of local government to generate sufficient internal revenue to support the growth of local government area has leads to arrays of problems such as, unemployment rate, low per capital income, underdevelopment as well as increase in poverty especially in the rural area which is within the local government administration.

Therefore, there is need to examine the effect of small-scale rice farming on the internally generated revenue in Argungu LGA of Kebbi State. Meanwhile, previous studies related to small-scale rice farming in Nigeria and elsewhere so far reviewed, have given much weight to the technical efficiency in rice production, socio-economic determinants of small-scale rice farming as it affects rice output, challenges of small-scale rice farming in Nigeria which bothered on the constraints of rice farmers in achieving greater output and impacts of rice importation on Nigeria's economy. without considering the effect of small-scale rice farming on the internally generation revenue in Argungu LGA of Kebbi State (see, Agbamu & Fabusoro, 2015; Asiru, Iye & Olaoluwa, 2018; Igboji, Anozie & Nneji, 2015; Nwele, 2016; Unggul, Rudi, Tri, & Primanthi, 2015; Sokvibol-Li, & Pich, 2016) thereby created gap in the contextual literature.

While, some empirical findings like; Mbaye, Bèye, Guèye, Lokonon, and Ndione, (2018); Ohen and Ajah, (2015) concluded that small-scale rice farming has a positive and significant impact on the economy of Nigeria. Others like; Ajah and Ajah, (2014); Igboji, Anozie, and Nneji (2015) posited that small-scale rice farming contribution to the Nigeria economy is statistically insignificant due to technical inefficiency resulting to low rice output and subsequently low small-scale rice farmer income. The mixed results and inconclusive debate on the effect of small-scale rice farming on the Nigerian economy necessitate this empirical research.

More so, unfortunately, little or no studies have examined the effects of small-scale rice farming on the internally generated revenue in Argungu LGA of Kebbi State. Therefore, the objective of this study is to examine the effect small-scale rice farming has on the internally generated revenue in Argungu LGA of Kebbi State. Also, to establish the nexus between small-scale farmers' income, rice production output, rice value chain and internal generation revenue in Argungu LGA of Kebbi State. Thus, this study proposes the following research hypotheses.

i. Small-scale rice farming does not have any effect on internally generated revenue in Argungu LGA of Kebbi State
ii. Small-scale farmers' income, rice production output, and rice value chain does not have any relationship with internally generated revenue in Argungu LGA of Kebbi State.

The rest of this study is organized as follows; the second section deals with relevant theoretical, conceptual issues and empirical literature, particularly as they relate to the variables understudy. Section three states the methodology of the study, while section four covers the result and discussion of the data analysis. Five sections present conclusion and recommendation

II. Literature Review

Small-scale rice farming is the set of small-scale farmers engaging in rice farming in a piece of land or marginal land (Lashiola, 2012). On the other hand, Akpan (2013) defined internally generated revenue as those revenues that are derived within the state from various sources such as taxes (pay as you earn, direct assessment, capital gain taxes, etc), and motor vehicle license, among others. According to the Business dictionary, (2018) internally generated revenue are the monies collected by a government through the imposition of levies and taxes on facilities, incomes, sale of goods and services, transfers of properties, and other domestic transactions, as opposed to monies collected from duties imposed on imports and other international transactions. The internally generated revenue as the name implies is the revenue that the local government generates internally within the area of its jurisdiction (Olusola, & Siyanbola, 2014). According to Adi, Yakubu, and Eche, (2015).internally generated revenue (which is the revenue generated within the local government area of administration and it entails local tax or community tax, poll tax, or tenement rates, user fees and loans)

This study, anchored on the classic Johnston and Mellor (1961) micro impact of agricultural growth which concludes that economic policy ought to favor agriculture as a vehicle for starting growth in poor economies such as those of sub-Saharan Africa, Nigeria inclusive. Meanwhile, farmers, processors, input suppliers, and a range of other private actors will respond to public policies such as the policy of revenue generation. Johnston and Mellor (1961) provided a neat framework for thinking about consumption and production linkages from agriculture. The basic idea of the theory was that agricultural productivity growth would, in a closed economy, simultaneously lead to (a) higher rural incomes; (b) lower food prices in urban areas; (c) increased savings in rural areas, allowing for mobilization of capital for domestic industry; (d) expanded domestic markets for non-agricultural goods. An additional benefit was seen for the case of an open economy: by reducing food prices in urban areas, agricultural productivity gains would allow for nominal wages in manufacturing to remain low, making non-agricultural exports more competitive. The Johnston-Mellor model provided a strong narrative and conceptual argument for agriculture's role in growth. However, this study considered this theory relevant because any public policy targeting agricultural growth consequently is likely to have a multiplier effect on internally generated revenue. But the extent to which this theory is applicable in Nigeria context is subject to debate.

Empirically, Okodua, (2019) assesses the potential impact of the rice policy reforms on income mobility of households in Nigeria. The study probes into the potential of the new policy on rice production to produce considerable employment gains for

rural households in Nigeria given that local rice production will displace imported rice. The study employed a static Computable General Equilibrium (CGE) framework to investigate the potential additional income benefits or losses for Nigerian households stemming from the government's current initiative of increased domestic rice production. The findings reveal that the implementation of the new policy on domestic rice production will produce considerable employment gains for all households and for most sectors of the economy. The study only focuses on policy reform on overall income gain for both rural and urban households without examining the effect of small-scale rice farming on internally generation revenue.

Mbaye, Bèye, Guèye, Lokonon, and Ndione, (2018) uses a case study approach to investigate the patterns of employment and income generation in cotton and rice value chains in Senegal and Benin. The study combined quantitative and qualitative data to identify direct and indirect value chains' effects on employment and income, paying special attention to vulnerable groups such as youth, women, and informal employees. Surveys data, as well as Social Accounting Matrix, was used to assess the effects of these value chains on employment and income. The findings of the study revealed strong and positive relationships between rice value chains and jobs creation as well as income patterns. However, the scope of the study did not examine the effect of small-scale rice farmer income, rice farming production output, and rice value chain on internally generation revenue.

Samuel (2016) examines policies on the technical and cost efficiency levels of paddy rice farm households in Nigeria. Data were collected from a cross-section of 300 paddy rice farmers drawn from 3 states in Nigeria. The study used 2 estimation techniques: parametric technique (SF) and the non-parametric technique (DEA). The results showed that paddy rice production in Nigeria was still profitable but low and the estimated average technical and cost efficiency levels from the DEA approach were 0.721 and 0.295, respectively. Nevertheless, the study did not consider the effect of small-scale rice farmer income, rice farming production output, and rice value chain on internally generation revenue

Ohen and Ajah (2015) examine the cost and return analysis in small-scale rice production in Cross River State. Data collected were analyzed using descriptive and inferential statistics. The findings of the study reveal that small-scale rice production in the area was profitable; Age of the farmer, farm size, education and cost of seed were the significant factors that affected rice production in the study area. However, the extent to which small-scale rice farming affect the internal generation revenue was not mentioned.

Igboji, Anozie, and Nneji (2015) investigate socio-economic factors and profitability of rice production among small-scale farmers in Ebonyi state. The study adopted a descriptive technique and multiple regression analysis and factor analysis. The findings revealed that socio-economic factors have a significant impact on the profitability of rice production among small-scale farmers in Ebonyi state, Nigeria. Meanwhile, the study failed to examine the effect of small scale rice farming on, small-scale rice farmer income, rice farming production output, and rice value chain on internally generation revenue.

III. Methodology

The study adopts a survey research design. The study collected cross-sectional data from Argungu LGA of Kebbi State in order to describe and interprets what exists at present. Primary data was sourced via questionnaire instrument, semi-structured interview and focus group discussion on the effect of small-scale rice farming on the internally generated revenue in Argungu local government area of Kebbi State, Nigeria, while secondary information was sourced from relevant published and unpublished literature, textbook, newspapers among other. Thereafter, both quantitative and qualitative data are triangulated for better research results. The primary data collected was measured on various scale ranges from nominal, ordinal and interval scale. The test employed in this study is logist it regressions. However, the target population of this study comprises the entire categories of classified small scale rice farming operating in the area (that is small scale farmer with less than ten household workers or whose investment in machinery and equipment does not exceed six hundred thousand naira) However, due to the unknown population figure of these sets of people which population may not be correctly defined in order to do thorough and realistic study Godden (2004) suggested that probability sampling size determination is appropriately, it argued that such unknown population could be regard as infinite. Thus, following Godden (2004), this sample size was determined by using a formula for an infinite population as suggested by Godden (2004) as:

$$S = \frac{Z^2 p(1-p)}{C^2}$$

Where: S= the sample size, P = Percentage of success, C =Confidence interval and Z = Confidence level. With 95% level of confidence (corresponding value of 1.96) and a confidence interval of 0.05(5%) and Percentage of success is 50%, the sample size is calculated thus:

$$S = \frac{(1.96)^2 \ x \ 0.5 \ x \ 0.5}{(0.05)^2}$$

= 384.16 ≈ Three hundred and eight four (384) targeted population.

Subsequently, 384 questionnaires were proportionate apportioned in various farm settlement based on the concentration of small scale rice farmers in the area. In carrying out this survey research, the multi-stage sampling technique was adopted, in the first stage, all the rice farm settlement were identified and listed thereafter; following the sampling size determined above the entire rice farm settlement were group into 8 areas at least each of area of rice farm settlement have not less than 48 questionnaires.

In the second stage, convenient sampling technique was employed to select the respondents who could provide information on the impact of small scale rice farming on internally generated revenue accrued for the Argungu LGA of Kebbi State, Nigeria. This suitable sampling method was achieved through the help of the head of the household family in the study areas that graciously voluntarily provide information on the payment of the levy to LGA. The mass qualitative primary data collected were subjected to a series of treatment; coded, translated, analyzed and tested using logit regression. They are presented, for simplicity, using appropriate tables, charts, graphs as well as texts with the aid of

Eview version 10. Logit model measures the relationship between the strength of a stimulus and the proportion of cases exhibiting a certain response to the stimulus.

It is useful for situations where you have a dichotomous output that is thought to be influenced or caused by levels of some independent variable(s) and is particularly well suited to experimental survey data.

The variable of interest Y (IGR) is binary. The two possible outcomes are labeled as 0 and 1. Where Y = set of "Yes" = (1) responses that agreed that the internally generated revenue is a function of small scale rice farming or Y = set of "No" = (0) responses that disagreed that internally generated revenue is not a function of small scale rice farming. The study model Y as a function of explanatory i.e., X = (X1,....., Xp).

Where, X1, = SSRF stand for small scale rice farming which is measured by the size of a hectare of farmland and monetary values of other factors input.

X2, = RFY represent small scale rice farmer income which is measured by total monetary sale value of the quantity of bags of rice produced and sold within a period of one year

X3, = RPO symbolize small scale rice farming production output which is measured by the total quantity of bags of rice produced within a period of one year

X4, = RVC represent small scale rice value chain which is measured by the average value of the quantity of bags of rice produced but not sold directly to market but passes through intermediary within a period of one year

The Binary regression models are specified in line with Spector and Mazzeo, (1980) as follows;

$P(Y = 1/X) = F(\beta_0 + \beta 1X_i + \ldots + \beta pXp)$

With

(a) $F(u) = \frac{1}{1+\exp(-(u)}$ *or* $L_i = In(\frac{Pi}{(1-Pi)}) = \beta_i + \beta 2X_i + u_i$ *Logit*

(b) $0 < F(u) < 1$ and F increasing

Interpretation of parameters

$$\frac{dP(Y = 1/X)}{dX_1} = \beta_1 f(\beta_0 + \beta_1 X_i + \ldots + \beta pXp)$$

With f = F' always positive.

i. Marginal effects are non constant, different for each value of X.
ii. Sign of β_1 = Sign of marginal effect
iii. Marginal effects can be summarized by evaluating at the average value $X = X$.

At *Logit model*: interpretation in terms of Odds-Ratio

$$\log OR = \log \left(\frac{P(Y = 1/X)}{P(Y = 0/X)}\right) = \beta_0 + \beta_1 X_i + \ldots + \beta pXp$$

Prediction

For an observation $x_i = (x_{i1},\ldots,x_{ip})$ we predict the probability of success as

$P(Y = 1/X = x_i) = F(\beta_0 + \beta_1 x_{i1} + \ldots + \beta p x_{1p})$.

Set $y_i = 1$ if $P(Y = 1 \backslash X = \widehat{x_i}) > 0.5$ and zero otherwise.
(Other cut-off values than 0.5=50% are sometimes taken)

In explicit mathematical functional equation terms

IGR = f (SSRF)……. (1)

Where;

IGR; symbolize change in internally generated revenue as a result of marginal effect of small scale rice farming. This is measured qualitatively through dichotomous responses on whether small scale rice farming influences changes in IGR in terms of increase in rice farmer income (RFY), rice production output (RPO), and rice value chain (RVC) the study areas

Thus, SSRF determine the farmer income (RFY), rice production output (RPO), and rice value chain (RVC) i.e.,

SSRF = RFY + RPO + RVC

Whereas,

SSRF, RFY, RPO and RVC earlier defined

IGR = f (RFY, RPO, RVC) …….……. (2)

$$\frac{dP(IGR = 1/X)}{dX_{1\ldots j}} = \beta_1 f(\beta_0 + \beta_1 RFY + \beta_2 RPO + \beta_3 RVC)\ldots\ldots$$

α = intercept β_1, β_2, and β_3 are the parameters estimate ε = Measurement error.

A prior expectation, β_1, β_2, and $\beta_3 > 0$

IV. Data Analysis and Results Presentation

This section discussed the data analysis and result presentation at request the set of coded data used for the study is available. The data analysis and result is presented in the following tables as follows,

Table 1
Descriptive Statistic

	IGR	SSRF	RFY	RPO	RVC
Mean	0.974286	21.81429	18.57143	18.25714	20.92857
Median	1.000000	20.00000	20.00000	20.00000	20.00000
Maximum	1.000000	25.00000	25.00000	25.00000	25.00000
Minimum	0.000000	10.00000	10.00000	10.00000	10.00000
Std. Dev.	0.158508	2.967314	4.310883	4.107041	4.014021
Skewness	-5.992936	-0.734813	-0.409528	-0.118761	-1.145544
Kurtosis	36.91528	4.714601	2.590107	2.481879	4.368569
Jarque-Bera	18869.48	74.36997	12.23342	4.737624	103.8634
Probability	0.000000	0.000000	0.002206	0.093592	0.000000
Sum	341.0000	7635.000	6500.000	6390.000	7325.000
Sum Sq. Dev.	8.768571	3072.929	6485.714	5886.857	5623.214
Observations	350	350	350	350	350

Source: Researchers computation, using E-view 10 software

Table 1 described the basic features of the data used in the study. The study observation is 350. The minimum of 0 and maximum of 1 are the option available for the respondents' on the effect of small scale rice farming on the internally generated revenue while a minimum of 10 and maximum of 25 are the score allotted for responses on the effect of the explanatory variables on the dependent variable as stated in the model. SSRF has the highest mean value of 21.81 with the lowest standard deviation of 2.9.

The skewness which measures the degree of asymmetric of the series shows that both the dependent variable (IGR) and all the explanatory variables mirror negative that is long-left tail as well as normal skewness and platykurtosis because all the values of explanatory variables were within the range of 2 to 4 exception of SSRF. The Jarque- Bera is the test statistic which measure the difference of the skewness and kurtosis of the series with those from the normal distribution while, probability is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis- a small probability value leads to the rejection of the null hypothesis of a normal distribution.

Logit Regression Result

Table 2
Impact of small-scale rice farming on Internal Generated Revenue in Argungu LGA
Dependent Variable: IGR

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-2.819578	1.602994	-1.758944	0.0786
SSRF	0.319117	0.084125	3.793372	0.0001

McFadden R-squared	0.153906	Mean dependent var	0.974286
S.D. dependent var	0.158508	S.E. of regression	0.142752
Akaike info criterion	0.213667	Sum squared resid	7.091570
Schwarz criterion	0.235713	Log likelihood	-35.39181
Hannan-Quinn criter.	0.222442	Deviance	70.78361
Restr. Deviance	83.65932	Restr. log likelihood	-41.82966
LR statistic	12.87570	Avg. log likelihood	-0.101119
Prob(LR statistic)	0.000333		
Obs with Dep=0	9	Total obs	350
Obs with Dep=1	341		

Source: Researchers computation, using E-view 10 software

Table 2 present the logit regression. Parameters were obtained by maximization of the log-likelihood function. Convergence achieved after 8 iterations to find the maximum of the log-likelihood function -35.39. The estimated coefficients parameter of the latent model is 0.319 which implies that if the SSRF goes up by an infinitesimal amount, the probability for the variable IGR taking the value one rises by 0.319 is approximately

39 %. The overall model is significant given LR stat = 12.87570 with Prob(LR statistic) = 0.000333, P<0.001). The McFadden R-squared is pretty low (R^2 = 0.15).

In addition, Goodness-of-Fit Evaluation for Binary Specification using Andrews and Hosmer-Lemeshow Tests the H-L and Andrews Statistic values is 78.8423 and 283.6791 respectively with the Probability Chi-Square value of 0.0000 which is less than 0.05% level of significant suggest that the overall model is significant refers to Appendix for the detailed outcome. More so, for predictive accuracy the expectation-prediction table result shows that 98% is correctly classified, with a sensitivity of only 33.3% and a specificity of 100%. The gain is only 0.86 percentage points w.r.t. a majority forecast (i.e. `all applications are accepted'). The test of hypothesis is based on the p-value of Likelihood Ratio (LR) statistic and the p-value of coefficient parameter; reject H0 for a large value of LR; if p-value < 0.05 otherwise accept. The LR statistic is 12.88 while, Prob(LR statistic) is 0.00. Also, the p-value of SSRF is 0.00 < 0.05 level of significant. Therefore, the null hypothesis one which stated that small scale rice farming does not have any effect on the internally generated revenue in Argungu LGA of Kebbi State, Nigeria is rejected and the alternative hypothesis is accepted; the study concluded that small scale rice farming has a significant effect on the internally generated revenue.

Table 3

Nexus between Farmer Income, Output, Value Chain and Internal Generated Revenue

Dependent Variable: IGR
Method: ML - Binary Logit (Quadratic hill climbing)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-3.998319	2.505965	-1.595521	0.1106
RFY	0.125643	0.081392	1.543684	0.1227
RPO	0.094103	0.094405	0.996803	0.3189
RVC	0.200795	0.069222	2.900747	0.0037

McFadden R-squared	0.139790	Mean dependent var	0.974286
S.D. dependent var	0.158508	S.E. of regression	0.156283
Akaike info criterion	0.228470	Sum squared resid	8.450800
Schwarz criterion	0.272561	Log likelihood	-35.98231
Hannan-Quinn criter.	0.246020	Deviance	71.96461
Restr. Deviance	83.65932	Restr. log likelihood	-41.82966
LR statistic	11.69470	Avg. log likelihood	-0.102807
Prob(LR statistic)	0.008506		

Obs with Dep=0	9	Total obs	350
Obs with Dep=1	341		

Source: Researchers computation, using E-view 10 software

Table 3 presents the relationship between farmer incomes', (RFY), rice output (RPO), rice value chain (RVC) and as well as internal generated revenue (IGR). The constant (C) also known as the intercept is the value of IGR when other independent variables have a value of zero. The result as revealed that the constant (C) is -3.998319 and it is insignificant at 5% level of significance (i.e. 0.1106 > 0.05). This implies that IGR will decrease by approximately -3.99% when other independent variables in the model are zero. Furthermore, the results show that coefficient of RFY, RPO and RVC are 0.125, 0.094 and 0.200 with positive sign; this result suggests that both the dependent and independent variables are moving in the same direction. However, RFY and RPO relationship with IGR are statistically insignificant at 5% level of significance because the associated p-values = 0.122 and 0.318 > 0.05) while that of RVC is statistically significant with the p-value = 0.003 < 0.05 level of significance. The test of hypothesis is based on the p-value of Likelihood Ratio (LR) statistic; reject H0 for a large value of LR; if p-value < 0.05 otherwise accept H0. The LR statistic is 11.69470 while, Prob(LR statistic) is 0.00 < 0.05 level of significance Therefore, the null hypothesis two which that stated that Small-scale farmers' income, rice production output, and rice value chain does not have any relationship with internally generated revenue in Argungu LGA of Kebbi State is rejected and the alternative hypothesis is accepted; the study concluded that Small-scale farmers' income, rice production output, and rice value chain have significant relationship with internally generated revenue in Argungu LGA of Kebbi State. The finding of this study is in agreement with studied carried out by Mbaye, Bèye, Guèye, Lokonon, and Ndione, (2018); Ogbalubi and Wokocha (2013) which found a positive relationship between rice value chain and Nigerian economy.

V. Conclusion and Recommendations

This study examines the effect of small scale rice farming on the internally generated revenue in Argungu LGA of Kebbi

State. In-depth understanding of the effect of small scale rice farming on the internally generated revenue in relation to small scale rice farmer income, rice production output, and rice value chain will enable local and State government, as well as stakeholders in agricultural sector such as; Small scale rice farmers, Rice processor and Market men/women to be well informed on the significant effect of small scale rice farming on the internally generated revenue particularly in Argungu LGA of Kebbi State, Nigeria where the study is been carried out.

However, econometric approach of logist regression analysis was employed to analyzed primary data sourced from field survey. The result analysis has shown that small scale rice farming has positive and significant effects on the internally generated revenue. Also, the findings revealed that small-scale farmers' income, rice production output, and rice value chain have significant relationship with internally generated revenue in Argungu LGA of Kebbi State. Consequently, since small-scale farmers' income, rice production output, and rice value chain are germane to internal generated revenue; thus, this study recommended as follows, that Local and State government, as well as stakeholders in rice industry should encourage small scale rice farming to continue thrive through provisions of rice farming inputs such as, quality seedling, fertilizer, and microcredit to small-scale farmers who may be willing to engage in small-scale rice farming.

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Consolidation of Banks, Before and Beyond –

(A study of fifty years of nationalisation of Scheduled Commercial Banks in India and case study on Concentration risk in Banks)

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Abstract- To meet the emerging credit needs of the self-employed production spectrum[i] (with institutional credit as agent of change) and to create a socially responsible Commercial Banking system, the Government of India had acquired 14 large Scheduled Commercial Banks from the then Private Sector Banks in July 1969 and 6 more in April 1980 (nationalisation). These banks are known as Nationalised Banks.

On the eve of completion of fifty years of their creation and their proposed consolidation in to eleven banks, this paper made an attempt to comprehensively review the performance of these banks (vis-à-vis their objectives) with a view to suggest the road ahead, beyond amalgamation. It was found that these banks have contributed substantially to economic development and achieved most of their mission goals, by improving the share of credit flow to rural areas and priority sector development between 1969 and 1991. They adapted well to the norms prescribed by financial and banking sector reforms between 1991 and 2003.

But, on account of their shift in prioritisation of credit flow towards big borrowers, industrial sector, urban and personal segments in the last twenty years, they were found lagging behind in 2018 in the areas of - asset quality and profitability, meeting the credit needs of small clients and addressing regional imbalances. During the financial year 2017-18, 17 out of the 19 Nationalised Banks reported net losses, on account of inadequate interest income and increased provisioning requirements. 11 out of the 19 banks were placed under regulatory watch by the Reserve Bank of India (RBI) under prompt corrective action framework.

This paper analysed the data and information on the performance of Nationalised Banks for nearly 50 years from 1969 to 2018 under nine broad heads and concluded that the Nationalised Banks are still relevant for the economic growth of India. The paper suggested suitable steps for accomplishment of partly accomplished goals, attainment of current and sustainable viability, improving asset quality of loans and advances, ways to meet the credit needs of small borrowers and increasing the share of rural and semi-urban credit flow to diminish the share of rural money lender in Institutional arrangements for rural credit. The paper also discussed the issue whether consolidation is the need of the hour.

One of the important outcomes of this paper is the importance of diligent credit appraisal and monitoring for superior asset quality. To make the paper user friendly, this paper is attempted as a mixture of descriptive and intervention/evaluation study. Though it was not the original purpose of this research, this paper came out cogently as a case study for understanding the concentration risk in Banks.

Index Terms: **Shifts in Credit flow, Non Performing Assets (NPA), Profitability, Concentration risk.**

I. INTRODUCTION

1.1. India is a developing mixed economy, the fifth largest economy in terms of nominal GDP ($2.97 trillion in 2019) and third largest economy as per purchasing power parity ($11.47 trillion (estimate) in 2019). Young population, English knowledge, healthy ratios of savings and investment are among the positive factors that are contributing to its current economic development. On account of growing software industry and robust banking system, India has one of the fastest growing tertiary sectors (9% since 2001) in the world.

1.2. India's Banking sector, dominated by state owned banks contributed 19% of this GDP ($407 billion) and employed 1.30 million persons in 2016. The Scheduled Commercial Banks (SCBs) represents most of the organised banking system of the nation, whose

deposits stood at 80% of the net national income in 2015. The state owned public sector banks[ii] contributed more than 70% of the total assets of the Indian Banking system in 2018 and employed 0.84 million persons; though they were only 21 out of 149 Scheduled Commercial banks[iii] as on 31 March 2018. At the same time, the SCBs in general and the public sector banks (PSBs) in particular were facing serious concerns of asset quality and profitability.

1.3. As on 31 March 2018, the balance sheet size of SCBs was Rs.152.5[iv] trillion; with a deposits of Rs.117.9 trillion, outstanding credit of Rs.87.4 trillion and Investments of Rs.41.3 trillion. These indicators for PSBs were Rs.100.3 trillion (66%), Rs.82.6 trillion (70%), Rs.57 trillion (65%) and Rs.27.9 trillion (68%); and those for Nationalised Banks (NBs) were Rs.62.3 trillion (41%), Rs.53.1 trillion (45%), Rs.35.9 trillion (41%) and Rs.16.4 trillion (40%) respectively. A tabulation of select ratios is presented hereunder.

Year/Group of Banks/ Particulars	Credit Deposit ratio	CASA/ Total deposits	Priority Sector adv/Total advances	Secured adv/ Total adv	Term loans/ total adv	Operational profit / Total assets	Return on Assets	Return on Equity
2017-18								
Scheduled Commercial Banks	**74.16**	**40.00**	**30.55**	**80.64**	**57.00**	**1.99**	**-0.15**	**-2.81**
Public Sector Banks	**68.36**	**38.73**	**32.64**	**84.95**	**53.50**	**1.57**	**-0.84**	**-14.62**
2016-17								
Scheduled Commercial Banks	**73.04**	**38.68**	**31.16**	**82.92**	**56.24**	**2.11**	**0.36**	**4.16**
Public Sector Banks	**68.81**	**37.36**	**32.15**	**86.51**	**52.64**	**1.68**	**-0.10**	**-2.05**
Nationalised Banks	**67.17**	**34.39**	**35.66**	**88.00**	**50.87**	**1.58**	**-0.14**	**-2.81**

1.4. Only 2 out of 21 public sector banks (both are Nationalised Banks) had net profits in the financial year 2017-18 and the situation is still grim in 2018-19. 11 out of the 19 NBs were under the prompt corrective action framework of RBI, which came down to 8 by January 2019. Between 2015 and 2019, the Government of India (GoI) has pumped in Rs.2.46 trillion as capital infusion in PSBs, besides Rs.0.66 trillion mobilised by these banks from the capital market.

1.5. The PSBs , as on 31 March 2018, had a market share of only 68% of business; but had a share of 93% of the Gross NPAs in the system; while, the NBs had a market share of 43%; but had 64% of NPAs[v]. The stressed assets have been increasing and many PSBs/NBs were declaring losses quarter after quarter during the financial year 2018-19.

1.6. The GoI, together with RBI was scouting for ways to arrest the unending stream of problem loans and the ways to turnaround the PSBs (including NBs) at the earliest. Consolidation of Banks through strategic merger of two or more nationalised banks is being pursued as the prime option to prepare the banking system to face emerging challenges of the growing and ambitious economy. While the RBI was motivating the banks to reduce the NPAs, the GOI was pumping in more and more capital to meet the increased provisioning and leverage needs of the Public Sector Banks.

1.7. The Union Finance minister of India, while answering a question on the subject in Parliament in July 2019, stated that – 1) aggressive lending practices, 2) economic slowdown, 3) willful defaults/frauds/corruption and 4) the process of Asset quality reviews of Banks by RBI (a balance sheet cleansing process) as the major reasons for increasing NPA in Banks.

1.8. With a view to replicate positive outcomes of the consolidated Bank of Baroda[vi], the GoI announced on 29th August 2019, further consolidation of ten more nationalised Banks in to four Banks[vii], bringing down the Nationalised Banks to eleven. It was informed that during 2018-19, the NPA of PSBs came down by Rs.1.06 trillion to Rs.7.90 trillion and 5 out of the 18 PSBs have made profits (as against 2 out of 21 in the previous year). Further, it was also informed that 14 out of the 20 PSBs are in profit as on 30 June 2019.

1.9. The role of Banks as providers of critical resources for meeting the capital needs of economy is well accepted. Further, India is envisioning of becoming a $5 trillion economy at the earliest. The IMF is also optimistic of India's growth projections (7.26%-7.74% in 2019-24). The SCBs, whose deposits form a substantial part of the national income, have a significant role to play in this economic development process. With a business share of around 43% of SCBs, the 11 nationalised Banks have an equally important responsibility to achieve this national goal.

2. Research elaborations:

Research problem, methodology and limitations:

2.1. The Consolidation of banks improves the economies of scale, optimises branch network, releases surplus staff for field work and ensures ease of management to the owners. For PSBs and NBs, though impaired assets and adverse profitability are visible indicators of the problem, the roots lie deep inside. The eleven nationalised banks (Bank of Baroda, 4 proposed consolidated banks made up of 10 erstwhile banks, 6 banks which are not considered at present) and SBI are still struggling with the problems of asset quality. Some of the NBs have experienced shrinkage of business in 2018-19 and were forced to practice narrow banking.

Yet, the PSBs have an important role to play in economic development of the nation to reach the goal of "Banks with scale" for building a $5 trillion economy.

2.2. From this situation, arose our research problem –

- Are the nationalised banks efficient enough to deliver sustainable banking services to their designated clientele?
  - ✓ If yes, how far they have fulfilled the objectives of their creation?
  - ✓ What are the gaps in their accomplishment?
  - ✓ Are the gaps important and attainable?
  - ✓ If yes, what are the reasons for the current level of high NPA? and
  - ✓ How to address the current issue of worsening asset quality to attain current/sustainable viability at the earliest?
  - ✓ What should be the future course of action?

This research paper is an effort to address the above questions in an objective way, based on the information available/inferred on their progress since creation.

Methodology and sources of study:

2.3. This research paper is based on – analysis of the **secondary data** compiled annually by the **Reserve Bank of India** (RBI) from the banks under various publications.

2.4. The prime among them was the publication under the title Basic Statistical Returns of Scheduled Commercial Banks (BSR)[viii] in India (1972-2018). The second compilation is with the title "Statistical Tables relating to Banks in India (STRBI) (1996-2018)[ix]. Two annual publications of RBI namely the Annual Report (AR) (2000-2019) and Report on the Trend and Progress of Banking in India (RTPBI) (1998-2018) are also used extensively as source documents. The financial stability report brought out by RBI, half yearly, from December 2014 till June 2019 are used as source documents too.

2.5. One another important source was the speeches made by the Governor, Deputy Governors and Executive Directors of RBI in various fora on the topics relevant to the Research question, directly or indirectly. Some important articles published in Journals like EPW were also referred to validate the thoughts generated by the analysis. The information appearing on the topic in the print media was used sparingly.

2.6. Though the information available in the annual report and Balance sheets of individual Nationalised Banks was studied for the decade, the data and information is culled mainly from BSR or STRBI. This is to maintain consistency and accuracy, as it is felt that the information submitted by a bank to its regulator is transparent and accurate.

Limitations:

3.1. This paper is also subject to all limitations that a research paper is based on secondary data. The limitations include errors in data entry, inconsistencies in provision of information by the banks, data inaccuracies on account of non-submission or delayed submission of returns by the units, assumptions made by the analysts while compiling the data/information, availability of publication, etc. This paper made efforts to overcome this limitation by taking information from the published data base of the Reserve Bank of India (RBI).

3.2. As the financials of Scheduled Commercial Banks for the financial year 2018-19 are yet not published by RBI, the analysis of information is limited up to the financial year 2017-18 only.

3.3. Similarly, base year data for the year 1969 is taken as provided in BSR of 1973 (volume 2) of RBI. If details of any parameter for 1969 was not available, either it is deduced from the given data; or left blank, if such deduction is inconsistent with the base data of 1969.

3.4. It is observed that information furnished directly by the banks for publication of Banks at a glance by RBI, is in variance with the information compiled from the returns, could be due to information availability.

3.5. In the year 1993, one of the Nationalised Banks (NBs), New Bank of India was amalgamated in Punjab National Bank, bringing down the number of Nationalised Banks to 19. The IDBI Bank was added to this group in 2010. Bank of Baroda became a bigger bank with the merger of Dena Bank and Vijaya Bank with effect from 1st April 2018. However, for the purpose of our review, the nationalised banks were limited to current day 17 banks representing the earlier 20 banks; excluding IDBI Bank from the review. The nationalised banks will be coming down to eleven[x] (excluding IDBI Bank) after consolidation, as per the GOI announcement on 29th August 2019.

3.6. The availability and presentation of information was modified in BSR from time to time by the RBI. On account of this, the presentation of information on pre-determined parameters for 50 years was attempted within this limitation. However, every effort is made to present uniform information for maximum number of years possible.

3.7. Within these limitations, a sincere effort is made to conduct a scientific study with a view to come out with pragmatic recommendations.

Organisation of this paper:

4.1. The nationalised banks were profit making private sector banks as on the date of their nationalisation, with most of them having their origins in times prior to India's Independence in 1947. The concept of state controlled and socially responsible banking system has its origins in the two rural credit survey committee observations. Before Nationalisation of Banks in 1969, the SBI (1955) and its Associate Banks (1959-60) came under the state control. The event of Nationalisation itself was a sudden act.

4.2. The backdrop and the event provide a brief detail about this, including the objectives of nationalisation of banks in the first part. The second part deals with the analysis of progress made by these banks in their journey from 1969 to 2018/19. The third part deals with the discussion of the results and findings of the study. The fourth part deals with the action plan for future of these banks and areas for further research, ending with acknowledgements.

5. The Backdrop, event and the objectives of creation:

The Backdrop:

5.1. The history and progress of modern banking in India, its link with the rural credit needs of the country and the landmark steps the Government of India took in this direction are presented as Annexure 1 in this paper. Two decades after nationalisation of banks, India went through financial sector reforms in two stages, based on the recommendation of the Committee on Financial System (August 1991) and the Committee on Banking Sector reforms (December 1997) both Chaired M. Narasimham, former Governor, Reserve Bank of India (please see Annexure-2 for summary). India has been continuously pursuing the path of financial sector reforms thereafter.

The Nationalisation of Banks:

5.2. The Government of India, recognising the catalytic role that the banks could play in facilitating the development of economy through credit; at the stroke of midnight on 19th July 1969, nationalised 14 large Indian Banks[xi] with deposits of Rs.500 million and above (as on the recent reporting Friday) through an ordinance entitled the Banking Companies (acquisition and transfer of undertakings) ordinance, 1969; representing 85% of the then banking assets of the nation. The ordinance became an act on 9th August 1969 (22 of 1969); with the stated objective of serving better the needs of development of the economy in conformity with national policy and objectives and matters incidental thereto.

Objectives:

5.3. Though not explicitly spelt out in the act, the objectives of nationalization of banks were broadly – 1. Social welfare through credit control, 2. Controlling monopoly of the banks by the private business houses and diversification of credit portfolio in favour of weaker sections of the society, 3. Expansion of banking network to under-banked and unbanked areas, 4. Reducing regional imbalances, 5. Directing the credit flow to the sectors that contribute significantly to the national income, referred to as priority sectors, 6. Promoting banking habit and provision of banking services to the poor and excluded sections of the economy (financial inclusion), 7. Monetisation of rural economy and 8. Shift in orientation from profit maximisation to contribution to economic development through sustainably viable institutions. 9. Provision of credit to agricultural labour/tenant cultivators against their personal guarantee. A table depicting the objectives, verifiable parameters and key performance indicators is presented as Annexure 3.

5.4. The second round of nationalization of private scheduled commercial banks took place on 15th April 1980 by nationalisation of six more banks which had a deposit of Rs.2 billion and more[xii]. Of these six, the New Bank of India was merged with Punjab National Bank in 1993. The last two decades witnessed the addition of one more bank to nationalised banks and two mergers among public sector banks. The IDBI Bank was added to public sector banks after IDBI became a universal bank; wherein GOI held majority stake either directly or through financial institutions.

5.5. All the seven associate banks of SBI were merged with the parent; along with Bharatiya Mahila Bank on 1st April 2017. Vijaya Bank and Dena Bank got amalgamated in to Bank of Baroda on 1st April 2018. Thus, as on 30th June 2019, instead of 28 public sector banks, there were only 19 Public sector banks in operation. After the third round of consolidation by amalgamation of 10 nationalised banks to form 4 big nationalised banks, the Public Sector Banks will come down to 12, including SBI and eleven Nationalised Banks, excluding IDBI Bank.

3. Analysis and Findings:

6. **The Study and presentation:**

6.1. The performance of any organization is a result of its strategic endeavor to be in tune with the changing forces and factors in the internal and external environments. For Banks, changes in the economic policy and regulatory environment are important external factors; with organisational capacity[xiii] and soundness[xiv] are the important internal factors.

6.2. In the years between 1969 and 1980, the banks were operating in directed credit policy environment for promotion of a welfare state. Between 1980 and 1991, they were operating in an environment which envisioned growth with stability and self-reliance. Between 1991 and 2003, they were making efforts to adapt to the changes ushered by the financial sector reforms (1991) and the Banking sector reforms (1997). Between 2003 and 2019, the banks are operating in a challenging environment, making efforts to increase the outreach and assets, together with asset quality and profitability; along with efforts to comply with Basel III norms by March 2019[xv].

6.3. During this period (2003-19), the banks also faced directed credit fiats in the form of doubling of credit, annual credit targets, annual operational targets linked through MoUs by GoI, debt waivers and debt reliefs announced by various governments, economic cycles, adverse asset quality status etc., The Insolvency and Bankruptcy code (2016) came in as a timely legal intervention/option to resolve the stagnant and litigant impaired assets.

6.4. Based on the above, the journey of the Nationalised Banks could be divided in to four distinct phases; namely - The small steps (1969-80); the consolidation (1980-91), the change management (1991-2003) and the performance (2003-2018). To capture both brevity and detail, duly representing the study period; after going through nearly 47 years of data and information, the representative information is captured in the years – 1969 (the year of nationalisation) 1975 (the year of RRB formation), 1980 (year of Second tranche of Nationalisation of banks), 1991 (year of financial sector reforms), 1998 (year of Banking sector reforms), 2003 (beginning of the decade of economic progress), 2010 (the year which indicated the signs of slow down (decline in profitability with increase in NPA) despite being the peak year of economic growth +10.4%), 2013 (the year of lowest economic growth in the decade +3.2%), 2015 (the year of banking reforms through Indradhanush[xvi]) and 2018 (the latest year for which total audited information is available). For these years, data and information was captured and presented on nine important parameters for analysis to facilitate a discussion on the issues raised in the problem statement.

7. Presentation of information and analysis:

1. General Banking Indicators (bank network, branch network, deposits and advances):

7.1. As could be seen from Appendix Table 1, the state owned public sector banks including SBI, Nationalised Banks and their sponsored Regional Rural Banks (RRBs), formed nearly half of SCBs in these fifty years. More than the number of banks, the contribution is significant in expansion of rural and semi-urban branch network which grew from 1443 and 3337 in 1969 to 49384 and 38481 branches in 2018[xvii] bringing down the population per branch from 64000 to 10000 between 1969 and 2018, despite substantial growth in population. The rural branch expansion was noticeable in two phases, the first between 1975 and 1991 (mission mode) and the second after 2010 (inclusion efforts). In the second phase, in the non-branch mode, while the business correspondents and facilitators, the ATMs provided the physical link; the basic savings bank deposit accounts with ICT facilities, kisan credit cards and General Credit cards provided the requisite banking services (please see Appendix Table 2).

7.2. The outstanding deposits of the banks grew from Rs.46.65 billion in 1969 to Rs.114.34 trillion in 2018 with nationalised banks contributing approximately 50%, coming down from 61% in 1991. While the rural deposit share grew from 3% to around 10% of the outstanding, the semi-urban deposit share came down from around 22% to 16%. The overall share of rural/semi-urban segment in the total deposits of SCBs moved up from 25% in 1969 to 36% in 1991 and then came down to 21% in 2018. The demand deposits (consisting of current and savings accounts – CASA) came down from 45% in 1969 to around 40% in 2018, indicating the shift in preference to term deposits over low cost CASA. The slide of CASA share from 46% in 1975 to 31% in 2015 in Nationalised Banks is indicative of the scope for optimization of deposits cost in future. The rise in share of deposits of SCBs to National Income from 15.6% in 1969 to 80+% in 2018 is one of the major achievements of Nationalisation of Banks, as a resource provider to the economy.

7.3. The outstanding loans and advances grew from Rs.36 billion in 1969 to Rs.87.67 trillion in 2018 with a share of 50% to Nationalised Banks, which came down from 57% in 1991. While the share of rural advances grew from 3.5% in 1969 to 8.2% in 2018, while the semi-urban advances were near stagnant (11.27% to 12.3%) during the review period. The overall share of rural/semi-urban segment (catering to the rural clientele) moved up from 13% to 31% in 1991 and came down to 21% in 2018. The decline in the share of rural/semi-urban business (both deposits and advances) from 34% to 24% between 1991 and 2018, despite substantial increase in the branch network and additional inclusive efforts opens a new issue to probe – **"whether the SCBs have moved away from rural/semi-urban business in the reform and post reform era (1991-2018)"?** However, the share of priority sector advances to total advances made a substantial progress from 15% in 1969 to 40% in 2018.

7.4. The CD ratio of SCBs came down from 77% in 1969 to 74% in 2018; oscillating in between at 62% in 1991, 55% in 1998, 59% in 2003, before reaching 73% in 2010 and 79% in 2013. While these banks served as prime resource provider to the Government (major subscriber to Government securities) in the pre-reform era (1969-91), they were attracted by investment opportunities

(perceived less risky?) between 1991 and 2003. Even in 2018, the investment ratios of banks at 35% in investments and 6%[xviii] in cash (as percentage to demand and time liabilities (DTL)) indicates the current risk perceptions of the SCBs.

2. Regional distribution of network and business:

7.5. The Appendix Table 3 presented the regional distribution of network and business of SCBs along with the share of Nationalised Banks (NBs) from 1969 to 2018. In 1969, while the southern India had 35% of branch network, the western India had 35% share in business. While the northern India came third in branch network, the eastern India came third in business. The central and north eastern regions of India were the backward regions at the time of first tranche of nationalisation of banks.

7.6. Between 1969 and 1991, the nationalised banks took branch expansion and business development seriously and contributed nearly 50% of branch network and 60% of business of SCBs. These efforts resulted in greater share of branches in Central, Eastern and Northern India, with western India pushed down the order. But, western India continued to occupy the prime spot in business development, with Southern and Northern regions occupying the next two places; with eastern and central regions following them in business. The north eastern region has improved its branch network share from 1% to 3% and business share from 0.8% to 1.6%. Here again, the share of NBs was around 50% of the performance of SCBs.

7.7. Between 1991 and 2010, banks efforts have resulted in increased share of branch network in central India (2nd place with 19.9% branches). The top three business development positions remained unchanged. The status continued till 2018. Till 2013, the year up to which RBI presented information about Nationalised Banks (later presented information about Public Sector Banks including SBI and associates); the share of nationalised banks in the overall performance of SCBs remained around 50% both in branch network and business. **The stagnation or decline in the share of north eastern region both in branch network and business between 1991 and 2018** (3% to 2.7% in branch network and 1.6% to 1.5% in business – most of the time it was 1.3%) **despite special efforts for business development and inclusive growth is a matter of serious concern which needs to be probed in a focused study**, separately.

7.8. Another dimension is the productivity[xix] of branches, region-wise, at regular intervals. The gist is tabulated in the table hereunder:

PER BRANCH PRODUCTIVITY ACROSS REGIONS 1969-2018

YEAR	1969 (Rs mill)		1975 (Rs mill)		1991 (Rs mill)		2010 (Rs billion)		2013 (Rs billion)		2018 (Rs bill) SCB	Av annual growth rate at constant prices 1969
REGION/GROUP	SCB	NB	SCB	NB	SCB	NB	SCB	NB	SCB	NB		
NORTH	10.90	-	12.8	14.6	70.9	88.6	1.16	1.29	1.39	1.53	1.68	8.29
NORTH-EAST	7.90	-	7.3	6.7	26.9	34.0	0.46	0.44	0.60	0.53	0.79	5.41
EASTERN	18.4	-	17.8	14.5	41.1	47.8	0.55	0.60	0.73	0.78	0.94	2.75
CENTRAL	6.60	-	8.2	8.1	32.7	45.1	0.44	0.52	0.59	0.68	0.81	6.62
WESTERN	14.7	-	17.0	16.5	91.0	88.8	1.92	1.71	2.38	2.23	2.82	10.31
SOUTHERN	5.60	-	7.6	8.5	46.6	54.7	0.77	0.78	0.99	0.99	1.30	12.41
NATION	10.10	-	11.7	12.3	52.6	63.1	0.91	0.96	1.15	1.20	1.43	7.59

7.9. Overall, per branch productivity of nationalised banks was better than that of SCBs between 1975 and 2018. It was more than or equal to the productivity of SCBs in Northern, Central and Southern Regions. In eastern India, per branch productivity of NBs improved over time and took over SCBs during the review period. The per branch productivity of NB branches was lower than the productivity of SCBs in Western Region, could be more on account of foreign bank branches located predominantly in Mumbai. The per branch productivity of banks in north eastern region, which was fourth out of six in 1969, slid down to last position from 1975.

7.10. At constant prices (1969), the average annual growth in per branch productivity of banks across regions ranged was better than national average in South, West and Northern regions and was less than national average in central and north-eastern regions. The growth rate was lowest in Eastern region. Banks together with GoI and State Governments should initiate specific efforts for improving the per branch productivity of bank branches in Eastern, North-eastern and Central regions. **A study of best practices adopted by banks in southern and western regions** may provide the requisite learning in this regard.

3. Distribution of outstanding credit based on occupational groups:

7.11. Though RBI introduced Basic Statistical Returns in 1972 and collated data since 1969, the information about credit flow to occupational groups is available from 1975. After an analytical study of the lending activities, RBI identified 73 occupational groups and collated them under 8 broad heads. From 1991, one more broad head, Personal loans got added. This information is available for 44 years from 1975; both for SCBs and NBs till 2013 and for SCBs and PSBs (NBs along with SBI) till 2018. The

outstanding credit flow to occupational groups both for SCBs and NBs is presented in Appendix table 4, along with summaries of outstanding credit and percentage share of outstanding credit for that occupational group.

7.12. In the initial days, agriculture, together with trade, small scale industries and professional services formed the core occupational groups of SCBs and NBs constituting 53% of the clientele for SCBs and 58% of the clientele for NBs. In terms of asset size, Industries, SMEs, Trade and agriculture formed 85% of loans outstanding for SCBs and 87% of loans outstanding for NBs. The outstanding loan portfolio of NBs formed 52% of the clientele and 57% of the assets of SCBs. The trend continued for the next five years and the NBs share of PSB loan assets improved to 59%. By 1991, the clientele share of these four occupations grew to 80% in SCBs and 78% in NBs. In terms of asset value, five occupations (agriculture, Industries, SME, professional services and Trade) formed 88% of loans outstanding in SCBs and 89% in NBs. The share of loan portfolio of NBs formed 48% of the accounts and 52% of the assets in 1991.

7.13. Post reforms, a new occupational group emerged in the form of personal loans consisting of activities like housing and education loans, credit card loans and other personal loans. Sooner, this group became the significant contributor both in terms of accounts and amount both in SCBs and NBs. In 2003, while Agriculture, personal loans and Trade occupations contributed 79% of accounts in SCBs and 76% of accounts in NBs. In terms of loans outstanding, Industries, personal loans and Trade accounted for 65% in SCBs and 68% in NBs, pushing agricultural loans outstanding to the fourth place in both the institutions. The share of NBs in the business of SCBs came down to 42% of accounts and 47% of assets in this year.

7.14. The dominance of personal loans continued in 2013 (second in accounts and third in amount outstanding). Agriculture took the second place in asset size (first in terms of accounts) both in SCBs and NBs, mainly on account of efforts of banks to double the agricultural credit during the decade. The share of NBs in banking business declined further to 35% of accounts, but 51% of the amounts indicating loss of traditional clients to competitors but improving asset size with big loans to Industries and financial institutions.

7.15. By 2018, while agriculture and personal loans contribute 81% of the clientele of SCBs, Industries and personal loans formed 56% of outstanding loans pushing the traditional occupational groups like Agriculture and Trade to third and fourth places. Another important observation is the share of financial institutions which formed 1% of loans and 8% of assets. **Overall, 1.6% of the clientele availing 68.6% of the outstanding portfolio** (loans above Rs.2.5 million/borrower account) **exposed SCBs and NBs to potential concentration risk.** Though the detailed information regarding Nationalised Banks is not presented separately[xx], the NBs over a period of years followed the same pattern like in SCBs.

4. Priority Sector lending:

7.16. Up to June 1980, within the overall credit disbursement to various occupational groups as stated above, the loans given by banks to identified occupational groups such as Agriculture, Small Scale Industries, Road and Water Transport, Retail Trade and Small Business, Professionals and Self-employed, Education and Establishment of Industrial Estates was reported as priority sector lending under three major heads, namely Agriculture, Industry and other priority Sector. The priority sector was redefined and broadened in 1980 and further revised from time to time.

7.17. The current master circular on Priority sector advances was issued by RBI on 7th July 2016 and updated on 4th December 2018; in which eight areas, viz., Agriculture, Micro small and medium enterprise, Export Credit, education[xxi], housing[xxii], social infrastructure[xxiii], renewable energy[xxiv] and other defined activities constitute the priority Sector. Within the overall goal of achieving 40% of adjusted net bank credit (ANBC) for Scheduled Commercial Banks, sub-goals have been defined for agriculture[xxv] (18% of ANBC), Micro enterprises[xxvi] (7.5% of ANBC) and Weaker sections[xxvii] (10% of ANBC); with Agriculture sector having a further sub-goal for credit flow to small and marginal farmers[xxviii] (@8% of ANBC).

7.18. The advances outstanding under Priority sector in SCBs progressed from Rs.5.04 billion in July 1969 to Rs.30.78 trillion as on 31 March 2018, moving up 15% of outstanding advances under non-food credit to 40% of adjusted net bank credit by 2018. From the year 1980, this was monitored by RBI under a targeted approach, with different targets for Scheduled Commercial Banks, RRBs and Foreign Banks. Most of the individual banks have achieved these targets most of the time.

7.19. To motivate the non-achievers towards better performance and achievement of goals, GOI guided RBI to direct the banks with deficit in achievement of priority sector targets in the previous year, to deposit the amount to the extent of such deficit in the designated funds for a period of nine years at directed (sub-market) deposit rates. This fiat has made the banks to make their best possible efforts to achieve their targets.

7.20. As percentage of outstanding advances, the priority sector advances (PSA) has moved up from 15% in June 1969 (Rs 5 billion) to 37% by June 1980 (Rs.80 billion) and to 39% in 1991 (Rs.487 billion). In the post reform period, the annual priority sector advances achievement by PSBs has reached 42.5% by 2003 (Rs.2031 billion[xxix]) and 40% by SCBs in 2018 (Rs.30.78 trillion). This has substantially helped in reducing the incidence of indebtedness in the rural areas.

7.21. Till 1991, while agriculture, MSME, retail trade and transport formed the chunk of priority sector lending, housing emerged as an important sector between 1991 and 2003. Post 2003, advances to weaker sections, a horizontal parameter started emerging as a major contributor to PSA. As on 31 March 2018, while agriculture, MSME and Housing contributed 74% of the PSA, advances to weaker sections worked out to 18% of the total advances. **Segments like education, renewable energy, rural water supply, export credit, village and cottage industries that are equally important need to be monitored like the monitoring of credit flow to agriculture, small farmers etc.,** Similarly, **loans issued to tenant cultivators against the security of standing crop** (the prime thought for nationalisation of banks) **needs to be brought in as a focused activity under priority sector**, backed by credit guarantee up to the small borrower limit (which is currently at Rs.0.2 million) with proper crop insurance as a mandatory part of scale of finance.

7.22. In achievement of targets under these priority segments, the Nationalised banks were always in the forefront, with their contribution ranging between 50% and 60% of the total performance by Scheduled Commercial Banks under this segment. Needless to state, all the Nationalised banks achieved their goals most of the time in these 38 years (1980-2018), though occasionally, some of these banks failed to reach the ribbon in some years due to both internal and external factors. The performance of SCBs and PSBs/NBs from 1969 to 2015 and the performance of SCBs in the year 2018 are presented in Appendix Table 5 of this report.

5. BORROWER PROFILE:

5.1. Loan size:

7.23. One of the major objectives of nationalisation is to provide large number of small loans to non-affluent sections of the society, most of whom were either small & marginal farmers, rural artisans, tenant cultivators and agricultural labour living mostly in rural areas. The distribution of outstanding credit as per loan size, from 1972 to 2018, at periodic intervals is furnished as appendix Table 6 to this report. Prior to 1971, borrowers with loans < Rs.0.01 million represented the non-affluent sections of the society. In the eighties, while this limit was enhanced as Rs.0.025 million for RRBs, the same was enhanced to Rs.0.1 million to SCBs/NBs. This limit was later enhanced to Rs.0.2 million from the year 2001. Similarly, borrowers with loan outstanding of Rs.2.5 million and more were treated as affluent borrowers, all through. A gist of appendix table 6, reflecting the shares of both the borrowers is presented in the table hereunder.

Year	borrowers in million	Loans o/s in Rs billion	Non-affluent borrowers		Mid range borrowers		Affluent borrowers	
			Accts share	Amt share	Accts share	Amt share	Accts share	Amt share
1971	4.34	55.53	97.72	20.65	1.98	31.05	0.30	48.30
1980	18.03	213.11	98.96	27.18	0.97	23.71	0.07	49.11
1991	61.95	1242.03	98.33	30.25	1.58	21.62	0.09	48.13
2003	59.49	7559.69	95.01	19.19	4.65	15.87	0.34	64.94
2013	128.29	55253.17	79.75	9.31	19.22	18.05	1.03	72.64
2018	196.98	87669.72	75.41	8.33	23.00	22.89	1.59	68.78

7.24. The above table reflects that till 1991, the non-affluent borrower accounted for 30% of credit (98% of accounts) and the affluent borrower accounted for 48% of credit flow of SCBs. From then on, the non-affluent client lost his business share to the affluent counterpart; more specifically since 2003. The raise of mid-segment in accounts is on account of growth of personal segment since 1991, as already noted in occupational analysis. The share of nationalised banks at around 50% reflects the active role played by the nationalised banks in the process of business development, as also in diversification.

5.2. Occupation-wise population-wise small borrower coverage:

7.25. The increase in loan threshold for small borrowers from Rs.10,000 (Rs.0.01m) to Rs.25,000 (Rs.0.025m) in 1980 brought in 95% of the loan accounts accounting for 22% of the loans outstanding in to smallest loan category. The occupation-wise information about the small borrower coverage (by SCBs including NBs) for the period 1998 to 2018 is presented as Appendix Table 7 to this paper. The analysis revealed that the small borrower coverage came down substantially during the 15 years (2003-18) not only in urban/metro-politan (from 9% to 3%) branches, but also in rural (66% to 38%) and semi-urban (49% to 23%) branches.

7.26. While it came down from 12% to 8% across all occupations, the decline was noticeable in agriculture (58% to 39%), transport (20% to 4%), Personal loans (50% to 8%), Trade (13% to 5%), and other purposes (29% to 6%). The increase in the per capita loan from Rs.8765 (1998) to Rs.49165 (2018) is nearly 1.6 times more as per inflation adjusted constant pricing mechanism. Separate details in respect of NBs were not available.

5.3. Segmentation based on organisation:

7.27. The distribution of outstanding loans of the clientele based on organisation is presented in Appendix Table 8 of this report. It is observed that the growth of share of individuals is a positive outcome of nationalisation. The cooperative sector was never able

to forge a business relationship with SCBs. Government corporations and organisations formed a sixth of business, but the lending decision was based either on sovereign guarantee or tacit direction, rather than on merits based on appraisal of the project. Private financial corporate together with micro-finance Institutions and Not for profit organisations had 5-9% share in advances between 2003 and 2015, but the same came down to 6% in 2018 on account of market developments. The raise in the business share of individuals was due to expansion of rural and small trade credit (before 1991) and rise of personal segment (more aggressively after 2003). The share of private corporate (non-financial) came down from 50%(1972) to 34%(1980) reflecting the objective; then rose again to 44% (2003) reflecting business; was oscillating between 33-40% (2003-15) reflecting volume increasing efforts in favourable business cycle; and started declining after 2015 (28% in 2018) indicating either their ineligibility or the caution of the banks towards this segment.

5.4. Segmentation based on type of facility (account):

7.28. The distribution of loans outstanding based on type of loan facility extended to the clientele is presented as Appendix Table 9 to this report. The analysis of the same revealed that the cash credit facility came down from 50.3% to 17.6%; and the overdraft facility came down from 9.4% to 7.6%. The demand loan facility came down from 6.5% (1972) to 3.5% (1991) and moved up from there to 11.5% by 2003 and 14.5% by 2018. The spurt could be on account of personal loan portfolio. The packing credit facility came down from 4.1% to 1.8%; bills purchased from 16.7% to 2.9%; and advances against import bills from 0.8% to negligible.

7.29. This entire share was taken over by term loans which grew from 11.9% (1972) to 30.5% (1991) and 55.8% (2018). While the growth in terms loans prior to reforms helped in reduction of poverty (incidence of indebtedness in rural areas came down from 43% (1971) to 20% (1981) and to 23.4% (1991)); post reform period, it has significantly contributed to capital formation in agriculture and infrastructure. The term loans consisted of both long term loans and medium term loans.

7.30. The increase in the share of medium term loans to around 20% and beyond of total term loan portfolio is a matter of concern. There is a need to analyse the portfolio in terms of appropriateness between the purpose, tenure and cash streams; more so in the light of increase in the impaired/stressed assets in the asset portfolio of the banks, more so the Public Sector Banks(PSBs).

6. Non Performing Assets (NPA):

7.31. Before the financial sector reforms, there was no concept of NPA in Indian Banking system. The banks used to follow a system where in the assets are classified in to satisfactory, irregular, sick-viable/non-viable, advances re-called, suit filed and decreed debts besides bad and doubtful debts. While some banks had the system of only provision against bad and doubtful debts, the State Bank group had both fixed reserves (for a specific asset) and floating reserves (a general provision) as a cover for credit risk. There was no link between the capital of the bank and its risk weighed assets. The financial statements desired an improvement in transparency.

7.32. The introduction of Income Recognition, Asset Classification and provisioning and Capital adequacy norms (IRAC norms) by RBI along with standard accounting system has led to uniform quantification of non-performing assets in banks. Based on the information furnished by Banks (as collated by RBI), the asset classification and provisioning status of SCBs for the period 1991(before IRAC norms) and between 1993 and 2018 (as per IRAC norms) at regular intervals; is presented as Appendix Table 10 of this report. The summary of the same is presented as appendix table 10A and the bank group-wise details of gross and net NPA from 2003 to 2018 is presented as appendix Table 10B. A perusal of the same revealed that prior to IRAC norms (in 1991), the tentative assessment of NPA in SCBs is equivalent to about 27.5%.

7.33. On introduction of NPA, the PSBs (which accounted for >80% of the loan assets of SCBs) have reported an NPA of 23.2% in 1993, which came down to 16% by 1998. In 1998, the NPA of Nationalised Banks (NBs) constituted 66% of the NPA of PSBs. While 10 out of the 19 banks had a Gross NPA of 10% or more; 6 out of 19 banks had a gross NPA of 20% or more. Only 3 banks had net NPA <5% and gross NPA <10%. But, among PSBs, the NBs were performing better than the SBI group Banks. The coverage of Gross NPA by provisions (provision coverage ratio – PCR – provisions as % to gross NPA) was 53.5%.

7.34. Between 1998 and 2003, the banks have made concerted efforts to reduce their NPA. This has resulted in reduction of gross NPA to 8.8% in SCBs and from 16% to 9.36% in PSBs. The NPAs of NBs constituted 68% of NPAs of PSBs. The net NPAs of SCBs and PSBs in 2003 was 4.95% and 4.65% respectively. The PCR of PSBs at 53.8% was better than the PCR of SCBs at 46.35% on account of more provisions and write-offs made by PSBs. The capital infusion by GoI helped the PSBs to improve the loan books, which also resulted in reduction of NPA ratios.

7.35. During the period 2003-10, the gross advances of SCB increased from Rs.7.78 trillion to Rs.32.7 trillion. This was on account of a good business cycle, aided by capital infusion in PSBs by GoI. The Agricultural debt waiver and debt relief scheme, 2008 has reduced both the outstanding advances as also gross NPAs to the extent of Rs.231 billion (out of total Rs.520 billion). Aided to this, the concerted efforts made by the banks had resulted in bringing down the gross NPA from 8.8% to 2.5% in the

case of SCBs, from 9.36% to 2.27% in case of PSBs and from 9.72% to 1.95% in case of NBs. The net NPAs too declined during this period from 4.95% to 1.12% in the case of SCBs, from 4.65% to 1.09% in case of PSBs and from 4.74% to 0.92% in case of NBs.

7.36. During the period 2010-18, the gross advances of SCBs increased from Rs.32.7 trillion to Rs.92.662 trillion. This was aided by capital infusion in PSBs by GoI (to facilitate larger credit flow), despite gross GDP growth touching a low of 3.2% in 2013 and tertiary sector GDP touching 5.9% in 2012; both resurging thereafter to a healthy 6+% growth rate. Though the growth cycle revived out of trough, the NPA continued their incline that started in the financial year 2010-11. When the NPA moved north in 2011-12, the RBI justified it by stating the slow-down in domestic economy, inadequacies in appraisal and monitoring of credit proposals as the reasons for the mark up in NPA.

7.37. The financial stability report of RBI (December 2014) brought out one more factor, i.e., the stressed assets (which are on the verge of becoming NPA). The report stated that as on September 2014, the stressed assets as percentage to gross advances of SCBs were around 10% and were 12.9% for the PSBs. It has identified five groups of industries namely, infrastructure, Iron and steel, textiles, mining and aviation as the sectors that were substantially contributing to problem loans of banks.

7.38. Between 2010 and 2018, the gross NPA ratio increased from 2.5% to 11.2% in SCBs, from 2.27% to 14.28% in case of PSBs and from 0.92% to 17.7% in case of NBs. The quantum of gross NPA touched a high of Rs.10.362 trillion in SCBs, of which Rs.8.956 trillion was in PSBs and Rs.6.166 was in NBs (excluding IDBI Bank). The net NPA increased from 1.12% to 5.4% in SCBs, from 1.09% to 7.07% in PSBs. The PCR declined from 55.7% to 54.4% in case of SCBs and from 52.8% to 49.2% in case of PSBs. In response, RBI directed Banks to improve their PCR to a minimum of75%.

7.39. The spurt in NPAs during 2015-18 has resulted in subdued credit flows from banks; on account of which many a corporate looked towards Non Banking Finance Companies (NBFCs) as alternative. This has resulted in stagnation in the advances portfolios of many banks, of which, in some it led to shrinkage and narrow banking. In order to increase the balance sheet size, the banks increased their lending to NBFCs. Liquidity issues in a few NBFCs led to committed devolvement delays/failures had its market implications in the financial year 2018-19.

7.40. A resultant affect on the revenues and provisioning requirements led to 19 out 21 PSBs, including the State Bank of India declaring losses (with only Indian Bank and Vijaya Bank declaring net profits) for the financial year 2017-18. The issue of stressed assets in banks became a matter of national concern. A Parliamentary estimates committee (Chairman: Dr.Murali Manohar Joshi, MP) started examining the issues relating to Non Performing Assets in Banks.

7.41. Dr Raghuram Rajan, former Governor, RBI (2013-16) submitted a note[xxx] to the committee, listing possible reasons for NPAs as – banker's over optimism, slowing down of economy, delays in Government decisions leading to time and cost overruns, loss of interest in the project to both banker and promoter leading to zombie (neither dead nor alive) projects, granting additional loans for debt servicing, leading to deceptive accounting, malfeasance, over confident bankers skipping due diligence and independent analysis, inefficient debt recovery system, unscrupulous promoters, inattentive monitoring leading to over-financing and well connected promoters able to get loans, despite history of past defaults (please see Annexure 4 for its gist).

7.42. Among others, the spurt in NPA in the year 2018 was attributed to huge NPA in Industries sector (share of total advances 37%; share in NPA 75%), large industries turning in to NPA (more specifically in steel, engineering, vehicles, construction and textiles), NPA in Gems and Jewellery sector due to frauds and disproportionate NPA in Non-priority sector (78%) (Refer Appendix Table 10.3). During the year 2017-18, write-off of more impaired assets than the recoveries made during the year, by 11 nationalised banks[xxxi], SBI and IDBI banks has sent a wrong signal to the defaulters about the NPA recovery efforts of the PSBs. On the contrary, private sector banks and foreign banks recovered more amounts than their write-off during the year.

7.43. The RBI mounted special asset quality Reviews from the second half of 2015 and directed banks to come out with the actual asset quality status of a loan account along with requisite provisioning, completing the process positively before March 2017. This on one hand reduced the profits (on account of decrease in recognized income), on the other, increased the provisioning requirements. Despite the increased provisioning, the asset coverage ratio of Scheduled Commercial Banks fell to 43% in 2017 and was at 48% in March 2018. This could also be due to the growth in Gross NPA from large borrower accounts (limits >Rs.50 million) by 23% in 2018. The Public Sector Banks in general and the Nationalised Banks in particular were the major casualty in this exercise, with their share in problem loans (87%), exceeding their market share in business (71%).

7.44. The empirical research on annual loan loss provisioning in 75 Indian banks (including 27 PSBs) between 1997 and 2002 by Ghosh and Nachane[xxxii] revealed that –

- There is a positive correlation between LLPs and bank's earnings before taxes and provisions (EBP), indicating that banks do provide more with the increase in earnings (+0.199); thus, average banks do exercise income smoothening.

- The correlation between LLPs and loan growth (delta G) is -ve (-0.202), indicating that during the periods of high loan growth, the average banks tend to provide less than incremental loan growth rate.
- The correlation between LLP and GDP growth (delta GDP) is -ve (-0.117) indicating that during the periods of positive growth cycles, the average banks tend to provide less than delta GDP.
- Overall, the study revealed that banks tend to delay provisioning for bad loans until too late, possibly magnifying the impact of the economic cycles on their income and capital. This could be one of the reasons for the higher net NPA ratios during the period 2011-18, more specifically between 2013 and 2018.

But, to establish, it needs an in-depth study of LLPs, EBIP, GDP growth between 2004 and 2011 and between 2011 and 2015, applying sector disaggregated data for agriculture, industry and non-priority sector.

7.45. The Reserve Bank of India[xxxiii] summed up the causes to the growth in NPA (2013-18) was due to – 1) credit boom between 2006 and 2011 along with the resultant deterioration in the asset quality of banks on account of – a) lax credit appraisal, b) inadequate post-sanction monitoring, c) time and cost overruns in project implementation, and d) delays in putting in place bankruptcy regime (till 2016), etc.,

7. Profitability:

7.46. As on the date of nationalisation, all the 14 nationalised banks together earned a net profit of Rs. 57 million. Thereafter, till 1991 though the banks were reporting profits year after year, the actual profitability (as per current norms) could not be compared as it was based on interest receivable instead of interest received. Secondly, there was no practice of income recognition, asset classification and provisioning, capital adequacy, till the introduction of IRAC norms in Banks.

7.47. While the SCBs reported a profit of Rs.11 billion in 1992, they reported for the first time a net loss of Rs.41.5 billion for 1992-93 (as per prudential accounting system); of which, the net loss incurred by NBs was Rs.36.5billion[xxxiv]. While the SBI group of banks have recorded net profits all through (except SBOP in 1995-96), the PSB group reported adverse net profit ratio during 1992-93 and 1993-94. This was on account of 12 banks reporting net losses, 8 and 6 banks reporting gross losses in 1993 and 1994 respectively. The number of problem banks came down to 3 by 1998. Concerted NPA reduction efforts by banks, aided by capital infusion (Rs.181 billion by GoI) in PSBs between 1993 and 2003, helped the PSBs to record positive gross net results by 2003.

7.48. The details of profit together with relevant ratios for the period 1994-95 to 2017-18 for SCBs, PSBs, NBs and SBI group is presented as Appendix Table 11 to this report. Analysis revealed that the banks made increased profits year after year between 2003 and 2013. Among the banks, the margins and profitability of Nationalised banks was lower than the SCBs and was working as a drag on the profitability of PSBs.

7.49. After 2013, the profitability parameters were on decline. In the year 2018, for all the four groups of banks, while the operational profit margins were positive (though lesser than previous years), the net profit margins were negative. During 2018, the net profit margin was worse for Nationalised Banks (-1.20), better for SBI (-0.19), resulting in a bad net profit margin for SCBs (-0.85) resulting in overall negative net profit margin for SCBs (-0.21). This indicates that the other bank groups among SCBs, namely the private sector banks, foreign banks, small finance banks and local area banks have had positive net profit margins during 2017-18. Thus, the profitability and turnaround of NBs is critical for the Indian Banking system.

7.50. As the adverse results of PSBs and NBs were on account of NPA beyond tolerable limits, the banks need to bring down the NPA to manageable and affordable levels, for their own survival and sustenance.

Critical Indicators of profitability:

7.51. The financial stability report which was a review document of the status, progress and path ahead of the financial system in India; identified three major parameters, namely, Return on Assets (net profit to total assets), Return on Equity (net profit to paid up equity capital) and Net interest margin (Spread) as the three critical indicators of profitability. The performance of Scheduled Commercial Banks, Public Sector Banks and Nationalised Banks on these three parameters during 1998-2018 is presented in Appendix Table 12.

7.52. It may be observed there-from that during the review period, in the NIM, while the SCBs lost 53 basis points, PSBs lost 87 basis points and NBs lost 101 basis points. This has resulted in a loss of 87 basis points, 76 basis points and 146 basis points respectively in operating profit margin. Net of taxes and provisions, the losses in net interest margin (ROA) were 125, 181 and 218 basis points.

7.53. On account of shrinkage of margin and increase in costs and provisions, all the three groups of banks (SCBs, PSBs and NBs) have recorded negative results in 2018, with such results the highest in Nationalised Banks. On account of better performance of SBI, the performance of PSBs was better. On account of the good performance by private sector banks and foreign banks, the losses in SCBs were the least.

8. INDICATORS OF FINANCIAL SOUNDNESS

7.54. The Capital to Risk Weighed Assets Ratio (CRAR), Non Performing Assets as ratio to Advances (Gross), Leverage ratio and liquidity coverage ratio are reckoned as Indicators of financial soundness of the system by the Financial Stability Report of RBI. These indicators are regularly monitored by the RBI for bank groups (Public Sector Banks, Private Sector Banks, and Foreign Banks etc) to take requisite actions at appropriate time. The gist of available information in this regard is presented in Appendix Table 12 to this report. The analysis of Table 12, parameter-wise is presented hereunder.

7.55. All the SCBs are complying with CRAR norms ever since 2010. The gross NPA ratio, which was at acceptable level till 2010, was within the tolerable levels till 2013. Thereafter, the spurt in GNPA ratio went beyond tolerance levels and ultimately affected the profitability parameters of the system in the year 2018.

7.56. Despite this development, on account of the prudent CRR and SLR levels maintained by banks, the liquidity coverage ratio was adequately met by both SCBs and PSBs, even in 2018 as also in the earlier years. The leverage ratio, which is the ratio of tier I capital to total exposure (including off balance sheet exposures), at 6.7% in 2018 and at 6.6% in 2010 was much more than the Basel I prescription of 3% and RBI's own yardstick of 4.5%.

7.57. The leverage ratio for PSBs in 2018 @5% is still above the benchmarks, but needs to be strengthened in comparison with private banks and foreign banks. Overall, the Public Sector Banks, with Nationalised Banks as their major constituent are financially sound to carry on their operations, despite the adverse working results that they faced during the period 2015-18.

7.58. As needed at that hour, the Reserve Bank of India brought in the revised Prompt Corrective Action (PCA) framework in April 2017, wherein the Central Bank monitored the dynamic status of the banks on three important parameters namely, profitability, asset quality and capital adequacy. Bank specific thresholds were fixed for each bank on the parameters like incremental advances, NPA ratio and profitability. The breach of threshold by the bank brought it under PCA framework. By March 2018, 11 banks were being monitored under the revised PCA framework. Though some of them came out the framework, many are still there and most of them are resorting to narrow banking practices.

7.59. According to press reports, between December 2015 and June 2018 (covering 11 quarters from October- December 2015 to April-June 2018), the 21 public Sector banks have recorded losses of Rs.1.7 trillion, eating away most of the Rs.2.1 trillion recapitalisation infused/committed by the Government of India.

7.60. Though 15 out of the 20 public sector banks have reported tentative losses in financial year 2018-19, it is hoped that most of them may come out of red in the financial year 2019-20; based on their efforts in NPA recovery and reduction.

7.61. As on 31 March 2019, the 147 SCBs including 53 RRBs have a branch network of 141756 branches including 89144 branches in rural areas. These banks have recorded a growth rate of 9.4% in deposits and 13.1% in advances during 2018-19; better than 6.8% and 9.5% respectively in the previous year. This was largely contributed by the Private Sector Banks (15.4%, 20.2%) and RRBs (9.4%, 11.3%).

7.62. The growth rates of Public Sector Banks continued to be the lowest in 2018-19 too (6.0%, 9.2%), but it was better than their growth rate last year (3.2%, 4.7%). These figures indicate that the public sector banks are slowly losing their market share in deposits and advances to their peers in private sector.

7.63. On 29th August 2019, the Union Finance Minister has announced the proposed merger of 10 nationalised banks in to 4 major banks, thus reducing their number to 11 nationalised banks besides SBI. The banks are in the process of obtaining requisite approvals from their boards and regulators.

9. The demand angle - Persistence of informal credit

7.64. Despite the progress made by the SCBs, PSBs and NBs, the rural credit continues to be unsaturated component of the credit demand of the nation. The contribution of both informal and formal institutions to rural credit, during the period 1951-2013 is presented as Annexure-5 to this report. Important findings from this presentations are:

- The share of institutional sources is on a decline after reaching 64% in 1991.
- In 2013, after a 58% share capture by banks, the rural money lender still has a share of 25.8%, which moved up from 15.7% in 1991. How to arrest this resurgence?
- The small borrower limit of Rs.0.2 million and less was covering up to the 9th decile in rural areas (Rs.0.133 million) and up to 6th decile in urban areas (0.157million). Does this mean that the banks are under financing or not financing the borrowers in these deciles? Is this inclusive?

4.Discussion and suggested course of action:

8. Discussion

8.1. Based on the analysis of the performance of Nationalised Banks (along with PSBs and SCBs) the study has observed that the following are the major issues that need to be discussed for suggesting appropriate action points to the Nationalised Banks.

1. Meeting the objectives of creation:

8.2. As on 31 March 2018, the 19 Nationalised banks were truly at crossroads. Strangely for a near fifty year old orgnisation, they were struggling for their independent existence. Some of them lost a part of their market share to their peers in private sector; many were not able to make profitable business out of the new business opportunities on account of the limitations in appraisal and monitoring. They were also not able to saturate the credit needs of their designated clientele (acquired between 1969 and 1991) majority of them being small ticket customers. At this juncture, an examination of their achievements vis-à-vis their objectives (stated at the time of their formation in 1969) is attempted in Annexure-6.

8.3. The comprehensive review of objectives vis-a-vis the achievements revealed that during the five decades of their existence, the Nationalised banks have achieved either fully or substantially many of the objectives of their establishment. They include –

1. Directing their credit flow to the needy and neglected.
2. Removing the monopoly control of business houses and credit widening to weaker sections of the society.
3. Expansion of branch network, particularly in rural and remote areas.
4. Ensuring credit flow to priority sectors through target approach.
5. Promoting banking habit among the rural poor.

8.4. The other four partly or largely achieved objectives, with substantial potential for improved performance are –

- Removing the regional imbalances;
- Monetisation of economy in rural areas,
- Shift in the orientation of the bank (most of them slid down from the status of sustainable viability to not being able to achieve current viability) and
- Providing credit to tenant cultivators against their personal guarantee.

8.5. As they have achieved most of their critical objectives and contributed substantially to the achievement of the other objectives, it is summarised that the nationalisation of twenty large private banks by Government of India (in 1969 and 1980) is successful.

2. The issue of rising NPA in Nationalised Banks:

8.6. The current status of NPA in SCBs and PSBs in general and Nationalised Banks in particular is – among others, is on account of the concentration risk. As already visible from the data presented and analysed in this study, the banks have shifted their credit attitude post 1991, though financial sector reforms never prescribed that the banks should discard the small clientele and traditional lending opportunities. The table hereunder extracted from Appendix table 6 reveals the same.

Year	Total borrowers in million	Loans o/s in Rs billion	Non-affluent borrowers		Mid range borrowers		Affluent borrowers	
			Accts share	Amt share	Accts share	Amt share	Accts share	Amt share
1991	61.95	1242.03	98.33	30.25	1.58	21.62	0.09	48.13
2003	59.49	7559.69	95.01	19.19	4.65	15.87	0.34	64.94
2013	128.29	55253.17	79.75	9.31	19.22	18.05	1.03	72.64
2018	196.98	87669.72	75.41	8.33	23.00	22.89	1.59	68.78

8.7. From 1991 to 2018, the share of rural advances came down from 15% to 8% and the share of rural and semi urban credit came down from 31% to 21% (Appendix table 1).

8.8. The share of Industries (as occupational group), which moved up from 35% to 42% by 2013, had 22.8% share of gross NPA by March 2018. The infrastructure sub-sector of Industries sub-sector (34% of o/s advances of the sector) and Basic Metal and their products sub-sector (14%) of the industries sector advances accounted for 22.6% and 46.3% as GNPAs of the sub sector. 10 out of the 13 sub-sectors of the industries sector had GNPA above 20% (range 22.3% to 46.3%).

8.9. The second concentration is in the large borrowers. The share of large borrowers moved up from 48% in 1991 to nearly 69% in 2018. The large borrowers accounted for 54.8% of the gross advances and 85.6% of the GNPA in March 2018. The top 100 borrowers accounted for nearly 15.2% of the advances and 26% of the GNPA in March 2018.

8.10. Another important factor responsible for the NPA status of PSBs/NBs is the quality of credit appraisal and monitoring. The variance in GNPA ratio of the sector among different bank groups brings this out. It is observed from the Financial Stability report of RBI (June 2018) that in the Industrial sector advances while the GNPA of the SCBs was around 23%, the GNPA of PSBs (Nationalised banks +SBI) was around 30% as against approximately 8% for Private Sector banks and 5% for foreign banks, which were also operating in the same environment. This indicates the lacunae of the public sector banks in project appraisal, borrower appraisal and monitoring of a project throughout the project cycle.

8.11. Though it was often stated that the GNPA in banks increase in a bad economic year in an economic cycle; studies by RBI revealed that a bad economic year had its affect on the NPA status of an account/sector mostly after one or two years[xxxv].

8.12. Another reason for the increase in GNPA is the nature of default, whether it is liquidity default (the borrower is unable to generate adequate income to meet the debt service obligations) or strategic defaults (voluntary defaults by borrowers with negative or negligible equity stake in the firm). As this data is not published, individual banks have to do a case by case analysis and act accordingly.

8.13. A silver lining in this dark cloud is status as on March 2019 presented by the financial stability report of RBI for June 2019. It was indicated there in that the GNPA of the SCBs had come down to 9.3% by March 2019, with GNPA in PSBs coming down to 12.6% (net NPA coming down to 3.8% and 5.2% respectively), the provision coverage ratio in SCBs & PSBs increasing to 60.6%, 35 out of the large 55 SCBs having their GNPA ratio <10%, the decrease in GNPA ratio of Industry sector and all its sub-sectors. Though the adverse operational results of many NBs could be due to provisioning requirements, the future is appearing to be optimistic.

3. The diminishing share of small borrower and the rise of rural money lender:

8.14. The small borrowers, who were mostly small and marginal farmers or rural artisans or small businessmen or small and micro entrepreneur were the back-bone of Indian Banking. The credit limit enjoyed by small borrower grew from Rs.10,000 to Rs.0.2 million over the review period.

8.15. The small borrower enjoyed a history of credit worthiness, as he was nurtured over a period of time by the banks with incentives for good credit behavior. As brought out previously, the small borrower's share in accounts moved down from 98% in 1991 to 75% in 2018 and the outstanding loan from 30% to 8%. While a small part of small borrower accounts would have migrated to mid-level borrower accounts, the decline in the share of loan out-standings across all populations, with a steep decline in rural (66% to 38%) and semi-urban populations (from 49% to 23%); and in agriculture (58% to 39%), Trade (20% - 4%), Personal loans (50% to 8%) and Trade (13% to 5%) occupations is a matter of serious concern.

8.16. The occupations of agriculture, small scale industries, professional and personal services and trade (retail trade in particular) witnessed decline in number of accounts by 6.42 million, 0.6 million, 8.5 million and 4.65 million respectively between 1991 and 2003, most of whom were small borrowers. During the same period, the share of money lender in the rural economy increased from 15% to 27% and the share of commercial banks in rural credit arrangements came down from 29% to 24.5%. Despite substantial growth in the share of Commercial Banks in rural credit to 42.9% in 2013, the share of money lender declined only to 25.8% (Annexure 5).

8.17. Another fact that came out in the study was that while in rural areas, the small borrower limit is covering the first 9 deciles; it is covering the first 6 deciles in the urban areas (Annexure 5). Meaning that the banks are more willing to lend only to the top 10% of rural families and the top 40% of urban families. This preference could be driving the neglected families to the money lenders, NBFCs and other players in the informal institutional credit arrangements. As the Indian banking system is working on attaining total financial inclusion on a project approach since 2010, this issue needs serious attention and monitoring both by the policy makers and CEOs of PSBs/NBs.

4. Whether consolidation is the right at this juncture:

8.18. Government of India has been adopting this approach for the last decade. The process of amalgamation of constituents to form a large consolidated bank with pan India presence started with the amalgamation of subsidiaries of SBI with the parent and completed on 31st March 2017; with SBI functioning as the single largest public sector bank with effect from 1st April 2017. Enthused by this, GoI brought in the next consolidation, Bank of Baroda with Vijaya Bank and Dena Bank with effect from 1st April 2018. Enthused by the positive performance of the consolidated Bank of Baroda in 2018-19, GoI announced the next set of mergers on 29th August 2019. The benefits of consolidation are well known, including releasing of surplus staff for field work.

8.19. But, it was observed in the field conditions that consolidation of banks quite often results in a stagnation in the performance of the banks on account of issues like loss of identity of merged banks, acclimatisation to the new environment and work culture, personnel policies, software issues in merger of accounts (despite working on common software platform) etc. These issues quite often push the client to the last preference and recovery to the least, as observed by this researcher in the field.

Suggested course of action:

1. Attaining objectives of formation:

8.20. **Addressing regional imbalances**: The current approach is more numerical in nature as proportion to All India progress. A better method could be to arrive at the regional imbalances by quantifying the banking needs in terms of bankable centers, deposit and credit potentials, the share of money lender in institutional credit arrangements in that region, special economic features and

special requirements of the area/region. This will provide a focused direction both for the planners and banks to address this problem.

8.21. **Monetisation of economy:** Post demonitisation, from January 2017 focused efforts are being made both by banks and Government to promote monetisation of economy through incentivised cash-less payments. This is also an area of attention in the financial inclusion as sustainable inclusion is possible only through participation and user education. The efforts of RBI and Banks in conducting financial literacy camps to promote client education on use of non-cash transactions for daily-needs deserves special mention. The Nationalised Banks should continue these efforts.

8.22. **Profitability/viability concerns:** As revealed by the Union Finance Minister, GOI in her press address on 29th August 2019, 14 out of the 17 Nationalised banks have reported profits in the quarter ended June 2019. It is expected that majority of the NBs will record net profits during the financial year 2019-20. Increasing CASA (to 40-45%), improving rural business, focused NPA reduction coupled with proper profit planning will lead the banks towards current viability in 2019-20 and sustainable viability in next 2-3 years. GOI, as the single largest owner, may have to take a call in respect of those banks which are unable to attain these goals.

8.23. **Providing credit to tenant cultivators against personal guarantee**: Besides credit support provided for livelihood promotion efforts of weaker sections, special efforts have been made by GOI/RBI/NABARD for promotion and credit linkage of Joint liability groups (by banks), the informal credit groups of small and marginal farmers and tenant cultivators to meet their production credit needs which could not be supported by Bank credit. The loans are disbursed on the basis of collective guarantee of the members of the group. But, provision of credit to individual tenant cultivator is linked to issue of tenant cultivator card by the provincial government, duly indicating the area of the land and the tenure of the lease. This requires passing of a special legislation by the concerned provincial government duly indicating the rights and responsibilities of land owner and tenant. This was passed only in a few states. The other states may be persuaded by GoI to pass the requisite legislation, duly supported by requisite directions for issue of credit by the RBI.

2. Addressing the issue of rising NPA in Public Sector Banks:

8.24. **Concentration**: Concentration of credit increases the credit risk. For this purpose, the bank should explore lending to all the approved sectors and sub-sectors in a gradual manner, so as to build a balanced portfolio over a period of time. The analysis of the data and information revealed that the Nationalised Banks and the public Sector Banks have not preferred to have adequate credit portfolio in the first 9 deciles of rural sector and first 5 deciles of urban sector; for reasons like increases in transaction costs, workloads etc. After experiencing the affects of concentration of credit in Industries sector, term loans and big borrowers for one and half decades, the NBs should focus on these neglected clientele and sectors/sub-sectors for building a balanced portfolio in a period of 2-3 years.

8.25. **Project appraisal and monitoring skills**: The analysis of this study also the announcements GOI and RBI from time to time have brought out the need for improving the project appraisal and monitoring skills of banks, particularly in the areas of –

- Appraising and monitoring Governments, as nearly 17% of the outstanding loans were based on Government guarantee (Appendix Table 8);
- Appraising and monitoring corporate clients – both financial and non-financial institutions (Appendix Table 8);
- Appraising and monitoring of micro finance institutions and NBFCs for their on-lending requirements (Appendix Table 8);
- Appraisal and monitoring of infrastructure projects, either by corporate or by Government.
- Refreshing the project appraisal and monitoring skills of staff in agricultural, industrial, service and priority sectors and personal segment.

This needs to be accomplished in a time line of one to one and half years.

8.26. In addition, large projects involving a credit exposure of Rs.500 million or more should be subject to appraisal by an external expert besides in-house appraisal.

8.27. The action plan for bringing down the NPAs is well known to all the Commercial Bankers. Even at the cost of repetition, the process should start with NPA mapping. The top management of the bank should lead this process by example, with each executive up to AGM level leading the recovery, revival and monitoring drive (of top 25 clients for each GM, 50 clients for each DGM, 100 clients for each AGM) so as to cover the top 5000 loan and NPA accounts.

8.28. Bottom up, each branch should strive for recovery and revival efforts through distribution of accounts to teams of staff right from messenger to manager. The chief managers in branches and controlling offices should aid and support the recovery efforts of identified branches with staff shortage. Each branch should have fortnightly, monthly and quarterly targets for improving asset quality. In this way, each bank should attempt to reduce the NPA to the barest minimum possible.

8.29. The asset quality audits by RBI revealed that some of the accounts which have become NPA were wrapped up for long periods (some of them were as old as 2001) till they were identified. Similarly, authenticity of transactions that appear to be suspicious should be verified and probed, so as to establish their genuinity. The medium term loans portfolio which is forming around 10% total credit outstanding should be audited account by account, to ensure that some of these loans were either accommodation loans or ever greening loans. The branch manager along with one officer from the controlling office should complete this process, at the end of which both the officers should certify the authenticity of their verified accounts. This is to prevent frauds and embezzlements, which has also contributed to the current NPA status.

8.30. The segregation of accounts between liquidity defaults and voluntary defaults should be done by branches through case by case analysis within a month and appropriate strategy should be devised by the branch together with the controller.

8.31. All the suggestions made by Sri Raghuram Rajan for addressing the NPA issues in public sector banks (listed in Annexure-4) need serious consideration of the GOI and managements of these banks. They are not repeated again for reasons of brevity.

8.32. RBI may examine whether the time is ripe to shift from provisioning based on historical status to anticipated losses based on asset monitoring reports and market conditions. This step would prepare the Public Sector Banks to value at risk based provisioning.

3. Increasing the share of small borrower and reducing share of rural money lender:

8.33. The nationalised banks should increase their market share of credit in rural and semi urban areas from 21% (8% rural & 13% semi urban) to 35-40% (rural 15-20% & semi urban 20%-25%) of the total credit disbursed and outstanding. The banks should also concentrate on meeting the credit needs of all the borrowers from the service area of their branches spread across all deciles, particularly the bottom 5 deciles both in rural and urban areas. This will improve the small borrower coverage of the branches. Sanctioning of personal loans to bottom five deciles of the families both in rural and urban areas would reduce their dependence on the money lender.

8.34. The present status is indicating a disinclination on the part of Nationalised Banks to strive for improving rural business through rural and semi-urban branches. As the entire resource poor, self employed production spectrum operates from rural and semi-urban areas, the top managements of the Banks should motivate the staff and incentivise them, away from the current system of mandatory rural posting for 2 years. The bank should go to the place of business, not the other way.

4. Consolidation – is it correct at this juncture:

8.35. Based on the current status, attaining current viability and NPA reduction should have taken precedence over consolidation of banks. However, it is an owner's choice and Government of India, as the single largest owner has all the rights to consolidate the banks, as it deems fit. However, prior to actual implementation, through a special audit by RBI, the GOI should ensure that the books of accounts are ready for issue-less integration, the bank has disclosed all the NPA accounts and potential NPA accounts and brought down the NPA to the barest minimum possible level, even before integration. One another record that needs to be preserved and used is the list of written off accounts, account-wise, branch-wise and habitation-wise since 2003, as the recovery of written off amounts directly adds to the operational profit of the bank in the year of recovery. This would help in seam-less integration of the banks, post consolidation.

5. Summary and Conclusion:

9. Summary and conclusion:

9.1. Based on the findings of this study/analysis, the Nationalised Banks, as a group have substantially contributed to the development of the self employment oriented production spectrum in India between 1969 and 1991; which is evident from the decline in the share of rural money lender to the least (15%) in Institutional credit arrangements in 1991.

9.2. The financial sector reforms (1991-2003) have given them both operational freedom to lend (policy support) and funds to lend (six fold increase in deposits), which they tried in housing sector with success (increase in income with tolerable NPA). This was also the period in which the share of affluent customers in the outstanding advances went up from 48% to 65% with reduction in the shares of small borrower by 13% and that of the mid segment by 4%.

9.3. Between 2003 and 2010, decline in the statutory ratios (liquidity and cash reserve) together with substantial increase in deposits has augmented the lendable surplus with the nationalised banks. This was deployed in Industries, infrastructure and personal segment loans. As the denominator increased in exponential terms, the NPA ratios have reached the least by 2010 (GNPA around 2% and NNPA <1).

9.4. This has led to further deployments between 2010 and 2013, though the NPA started rising (GNPA <4, NNPA <2). By 2013, the share of large borrower touched 72.6 and that of the small borrower fell to 9.3. There was diversion of portfolio from small borrower to mid segment and large borrower by 10% of outstanding loans in this period. Outstanding loans to Industries (42%)

and Personal segment (16%) pushed down agriculture (12) and trade (10%) to lower spots. Paradoxically, this was the same period where GOI was directing the banks to work for total financial inclusion.

9.5. Disguised non-performance of assets did not come out, till RBI started its detailed asset quality reviews from October 2015. From then on, Banks started declaring quarterly losses one after another, quarter after quarter, till it culminated in to total adversity in 2018. The then RBI Governor has subtly hinted the asset quality concerns in many of his speeches in 2014. Disguising the NPAs either through accommodation or ever-greening is an error committed by NBs too, unintentional or otherwise. This could be, for the fear of adverse publicity that the bank may suffer both in public and before the owner (GOI).

9.6. The question is, were the NBs compelled to change their portfolio? Was there no other choice? From the analysis, it is clear that it was the business choice of nationalised banks to move to big borrower and large loans, so as to optimise on transaction costs. The **effort to optimise the transaction costs resulted in increased risk costs-** both concentration risk and industry risk. The inadequacies in credit appraisal and monitoring of large industrial and infrastructural loans have added their share to this adverse situation.

9.7. It may not be fair to state that the results would have been better even with a smaller balance sheet, had they continued for credit deepening with small borrowers, cautious exposure to other activities; till they gained expertise in that sector. The selfish borrowers have made merry of this opportunity. The delayed arrival of legal reforms (IBC was introduced only in 2016) and the tardy progress in existing legal processes have given the audacity to the intentional defaulter.

9.8. The learnings from this study are – caution is required in credit diversification. In-depth appraisal and monitoring skills improve the asset quality. Concentration may help in quick building of assets, but is fraught with risk. It is better to anticipate risk than to take historical trends or wait till the event.

9.9. The Nationalised Banks are robust enough to revive out of this situation, as they have successfully demonstrated their capability to come out of adverse NPA scenarios in the period 1993-2003. Consolidated or stand alone, NPA reduction and credit diversification among the small borrowers of rural and urban segments is the key to their revival.

Utility and Issues for future research:

9.10. This research paper, during its process of documentation and analysis of the journey of the Nationalised banks, has identified and flagged many potential areas for future study and analysis. It will be a reward for this paper, if any/some of these potential issues for study is/are taken up for in-depth study as an independent research problem.

9.11. Though it was not the purpose of this research, this paper came out cogently as a case study for understanding the concentration risk in Commercial Banks. If this paper is used as a case study for teaching the effects/affects of concentration risk on the performance of Banks to undergraduate students, it will the greater reward and honour to this work.

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ANNEXURES

Annexure 1

History and progress of Modern Banking in India leading to Nationalisation of Banks

1.1. Modern Commercial Banking in India began with the establishment of The Bank of Hindustan, in 1770. This was followed by good number of others, most of which were founded, prospered, liquidated or amalgamated in the next 180 years. The Allahabad Bank (1865) and the Punjab National Bank (1894), the current day Nationalised Banks have started as joint stock banks in pre-independent era. The Reserve Bank of India was established in the year 1935 and was

nationalised in 1948, immediately after Independence. The largest Commercial Bank in pre-independent India was formed by the merger of Bank of Bengal (1809) with Bank of Bombay (1840) and Bank of Madras (1843) in 1921; then known as the Imperial Bank of India.

1.2. The first banking problem perceived by the Independent India was the inadequacy of Institutional arrangements for rural credit delivery system, which was shared by the Cooperative Banks (7%) and Rural Money lender (93%). The commercial Banks were largely meeting the credit needs of their affiliated business houses and the general banking needs of business clientele in urban areas. The All India Rural Credit Survey by the Committee of Direction (1951-54) commissioned by the Reserve Bank of India (Chairman:A.D.Gorwala) was stuck by the insignificant contribution of cooperative credit institutions to the rural credit and recommended for creation of State Bank of India to give boost to direct flow of funds from the banking system in to certain neglected and important sectors of the economy like agriculture and allied activities and to spread banking facilities in rural areas. Thus, the State Bank of India (SBI) was created in July 1955 by nationalization of the then Imperial Bank of India. This was followed by a second round in 1959-60, wherein eight large regional banks working in erstwhile princely states were nationalized as eight associate banks of SBI[1], which worked as its subsidiaries. The creation of SBI and its Associate Banks improved the credit flow to rural areas, but was much in short of demand, particularly for productive investment. To boost the depositor's confidence in the banking system, insurance cover was extended to bank deposits in 1961.

1.3. The All India Rural Credit Review Committee (1966-69) (Chairman: B. Venkatappaiah) recommended for the adoption of multi-agency approach to meet the unfulfilled credit requirements of rural areas in general and agriculture and allied activities in particular. The recognition of the importance of Commercial Banks as healthy competitors to the Cooperative system in rural areas by the National Credit Council in 1967; and the adoption of social control as a policy measure by RBI in 1968 provided the required policy push to motivate the significant expansion of Commercial Banks in to the area of Agricultural and Rural Credit. The goal to attain self-sufficiency in food grain production by 1971; the positive impression created by the State Bank of India and its associate banks in the field of agriculture and rural credit in that decade, among others, influenced the Government of India (GOI) to recognise the role that Banks play as timely, adequate and economic capital providers in economic development.

1.4. This insight of the Government led to the first round of nationalization of banks (14 banks on 19.6.1969); followed by a second round in 1980 (6 banks on 15th April 1980). In the interregnum came a specific rural credit institution in 1975, the regionally based, rural oriented, low cost, Scheduled Commercial Banks known as the Regional Rural Banks (RRBs) - bringing in with them, the professionalism of Commercial Banks, the local touch of the cooperatives, together with a joint ownership (50% shareholding by GoI, 15% shareholding by the provincial Government and 35% shareholding by the Commercial Bank which is sponsoring the RRB; known as Sponsor Bank). Thus, in eleven years, the GOI was able to transform twenty scheduled commercial banks from Private Banks in to Nationalised Banks, popularly known as Public Sector Banks (a sub group of Commercial Banks operating in India); the RRBs which grew from 5 to 196, covering the length and breadth of the country. Together with eight banks in SBI group, these 28 big banks together with 196 RRBs played a major role in the development banking history of India. To strengthen the confidence of banks in the new direction given to credit flow, a credit guarantee corporation was established in the year 1971.

1.5. The issue of nationalisation, bringing in banks under social control (as a goal under vision to assure provision of minimum needs to the entire community by 1975), including among others, credit against personal security to agricultural labourers was flagged by the then Prime minister (in her address titled stray thoughts on bank nationalisation) in the All India Congress Committee in its Faridabad meeting in 1969.

Annexure-2

Financial Sector Reforms (FSR) in India – Narasimham Committee -1991 & 1997

Banks in their role as financial intermediaries play a critical role in economic development of a nation by providing - safe and attractive parking to the depositors, together with timely and adequate supply of resources to the borrowers at optimal market prices. However, In the Indian context of 1991, banks were acting more as resource provider to the government (by statutory preemption of resources)[2] and to the individual beneficiaries of credit linked Government Programmes (directed credit). Further, the interest rates on deposits and lending (including the model rate, cap and floor rates) were decided by GOI. Thus the banks lagged behind both in operational efficiency (in investment and lending) and profitability.

FSR 1991: The report of the committee observed that the poor performance of the banks was due to directed lending to priority sector, pre-emptive statutory reserves, overstaffing together with lack of work/organizational culture, excessive controls over branch licencing.

The committee termed the situation as financial repression which occurs on account of excessive controls leading to distortion of financial prices, inhibiting proper functioning of the banking system. This, according to the committee was on account of three policies – 1) statutory pre-emption using SLR and CRR; 2) regulated interest rates on deposits and lending; and 3) directed credit. In this background, the committee has recommended for reforms both in banking sector and real sector, to prevent further erosion in the real value and return on savings. The gist of major recommendations, which aimed to create a healthy, vibrant and competitive financial system are as follows.

- Prudential reserves (SLR and CRR) with market interest on SLR and average cost of deposits on CRR as returns.
- Phasing out directed credit programme (not accepted and implemented).
- Introduction of Income recognition, asset classification and provisioning, capital adequacy norms with attainment of recommended minimum capital adequacy by 1996 (7% including capital and subordinated debt).
- Special tribunals for speedy recovery of overdues and Asset reconstruction funds for factoring of bad debts.
- Consolidation of banks with three tier banking system (international, national, local).
- Freedom to banks in opening of branches and abolition of branch licencing system (except for rural branches).
- Entry to foreign banks and private sector banks.
- Operational freedom and autonomy to banks which are sustainably viable, with freedom to recruit staff based on their own requirements.
- Professional CEO and Board members.
- To end the dual control of RBI and GOI over banks (not implemented).

For implementing its recommendations, the committee laid down five ground rules – 1) cautious and sequential implementation, 2) mutually reinforcing measures, 3) complementarily between banking sector reforms and fiscal and monetary policies, 4) development of financial infrastructure and 5) development of financial markets.

BSR, 1997: To strengthen the banking system further, the committee recommended for

[1] Later became seven, when State Bank of Bikaner was merged with State Bank of Jaipur to form State Bank of Bikaner and Jaipur.

[2] Banks were required to invest nearly 40% of their net demand and time liabilities (NDTL) in Government securities (issued by GOI and State Governments at rates decided by GOI; and deposit nearly 15% of their NDTL in cash with RBI at a rate determined by RBI, based on fortnightly average NDTL of the scheduled banks. Thus banks became a cheap source of funds to GOI and RBI.

- Strengthening of bank supervision with Capital adequacy, Asset quality, Managerial ability, Earning efficiency, Liquidity and Systems (CAMELS) as the framework and Board for Financial Supervision (BFS) as independent entity.
- Introduction of Asset Liability Management and Risk Management systems in Banks.
- Early resolution of Management and structural issues including restructuring of banks, synergy based mergers, functional autonomy.
- Appropriate Legal and Legislative framework.

In addition to the measures initiated earlier, the implementation of this report led to dilution of Government equity in Banks, greater operational freedom to sustainably viable banks, entry of private sector banks and foreign banks in Indian banking operations, new business opportunity to banks (like insurance, credit cards, infrastructure financing, leasing, bullion and investment banking, asset management and factoring services etc), universal banking, technology based payment and settlement systems, increase in limits for overseas investments by banks, new instruments, creation of financial infrastructure, risk management committees in banks, SHG banking and micro-credit, risk based supervision and increase in limits for Foreign Direct Investment in banks.

Annexure 3

BROAD OBJECTIVES OF NATIONALISATION OF BANKS (IN 1969 AND 1980) - WITH VERIFIABLE PARAMETERS AND KEY PERFORMANCE INDICATORS

Table 1: Objectives of Nationalisation of Banks by Government of India – 1969 & 1980

Objective	Verifiable parameters	Key performance indicator
1. social welfare through credit control	Directed lending to improve credit flow to agriculture and allied activities, small scale industries, off farm employment generation activities in rural/semi-urban areas.	1. Credit flow to the occupation indicated by increase in loans outstanding or loans issued during the year.
2. Controlling monopoly of the banks by private business houses and credit diversification.	Controlling stake in ownership to Government of India Increasing the credit flow in favour of the weaker and vulnerable sections of the society (weaker sections)	1. % ownership to GOI in a bank 2. Credit flow to weaker sections
3. Expansion of banking network to unbanked and under-banked areas.	Branch network particularly the bank branch network (branches/banking outlets) in rural and remote areas.	1. % share of rural branches. 2. % share of branches/banking outlets in unbanked areas. 3. Population per branch
4. Reducing regional imbalances	Percentage share of branch network, credit outflow in geographical regions.	1. % increase or decrease in branch network. 2. Flow of credit or share of outstanding credit in a region to the nation.
5. Directing the credit flow to the sectors that contribute significantly to national income	Directed lending to Priority sector – agriculture; micro, small and medium enterprises, Housing, microcredit, education loans, credit to SC/STs, Weaker Sections, Export credit (priorities as they emerge)	1. % share of priority sector to total credit (Adjusted net bank credit). 2. % share of Agriculture, MSME, education, housing and weaker sections to the adjusted net bank credit (ANBC).
6. Promoting banking habit and providing financial services to citizens, particularly in rural areas.	Efforts in financial inclusion, particularly in rural areas and among urban poor.	1. progress in BSB accounts opening and operations, 2. progress in General Credit card and Kisan Credit Card 3. Progress in payment and remittance services including insurance. 4. Number of ATMs and Business correspondents (total banking outlets)
7. Monetisation of economy, rural economy in particular	Share of rural banking to the total banking business and network, including other banking services	Share of rural banking in – 1. branch, ATM, BC network 2.business (deposits + advances) 3. Banking operations and services.
8. Shift in orientation from profit maximisation to contribution to economic development through sustainably viable institutions.	Stress on contributions to National income (direct and indirect) through profit making institutions.	1. Share in Net National Income. 2. Gross NPA as % to Gross Advances. 3. Asset coverage ratio and slippage ratio. 4. Operational profit ratio and Net profit ratio
9. Provision of credit against personal security to tenant cultivators.	Loans to tenant cultivators.	1. Loans issued to tenant farmers based on loan eligibility card issued by the State Government.

Annexure 4

Gist of Sri Raghuram Rajan's[3] note to the Parliamentary committee on Estimates on Bank NPAs

- NPAs occur due to over optimism on the continuity of growth cycles, leading to irrational exuberance.
- Slow growth of economy, contrary to expectations that economic boom would continue in perpetuity.
- Slow decision making by Government leading to time and cost overruns.
- Loss of interest to the promoter in project; due to project delays, which were not accommodated.
    - Restructuring of delayed projects not attempted - promoter not willing to bring in additional equity, banker not willing to compromise on initial exposure; leading to zombie (neither dead nor alive) projects.
    - Banker together with borrower resorting to ever-greening and deceptive accounting, instead of announcing actual asset status.
- Malfeasance - on account of over confidence or other reasons; banker outsourcing project appraisal and analysis, not reading the market properly, not exercising due diligence - leading to financing of cost-inflated projects by the banks.
- Increase in frauds in loaning and monitoring system leading to NPAs.
- RBI's efforts (in the light of overburdened DRTs, underperforming SARFAESI, inefficient loan recovery system) was to provide more teeth to banks in recovery; including –
    - Sharing of information regarding large loans (above Rs.50 million) with banks, duly indicating the status of the existing loan account and its potential path
    - Coordination through a Joint lender's forum (JLF), wherever early signals were seen. JLF was empowered with deciding a path for resolution, with incentive for quick decision making. Improving efficiency of the forum by replacing unanimity with majority in decision making with opportunity to exit for unconvinced.
    - 5/25 scheme to provide longer repayment period to infrastructure projects, with an option to refinance the loan every five years, subject to financial viability. This was to stop ever-greening of projects.
    - Strategic debt restructuring enabling banks to convert part of debt in to equity till the bank finds a new promoter.
- Timely recognition of the bad loan by a banker helps to initiate the requisite steps to revive the unit with the shared commitment of the promoter, banker, Government and all other stakeholders of the project. Recognising the loan as NPA prepares the loan for the requisite revival action, like preparing a patient before a major surgery. Loan recognition reflects the true value of the loan and realistic provisioning helps the bank in preparing for the eventuality, besides reflecting the true and fair picture of the balance sheet of the bank.
- A regulator is only a referee and not a substitute for the banker in a loan decision making or in loan monitoring and management. A regulator's job is to direct and guide the banks in timely recognition of the NPAs, to ensure the requisite bank capitalisation.
- Asset quality reviews (AQRs) by RBI helped the banks in adopting uniform norms for asset recognition, classification, provisioning and was intended to motivate them to initiate requisite remedial action at the earliest.
- The slowdown in the bank lending was not on account of regulator's interference, but on account of risk aversion or otherwise, of banks. The credit growth trends in non-food credit, Industry, micro and small enterprises and Agriculture between private and public sector banks from July 2014 depict the fact, as both of them were operating in the same environment.
- On the other hand their behavior in lending to personal segment and of it, housing is similar.
- While the private sector banks were aggressive in deposit mobilization, the public sector banks made fewer efforts after July 2014. One among the important measures as a part of solution seeking is to cleansing of the balance sheets of public sector banks at the earliest.
- The revival and transformation of problem loans in to good loans require concerted action on the part of banks, Government, the judicial system and not the least, the promoters. A bankruptcy court is a good threat, but not a panacea to units with problem loans. The banks need cleansing up of the balance sheets at the earliest.
- RBI could have raised more flags on problem loans in banks early and should not have agreed to forbearance. The RBI should have been more decisive in enforcing penalties on erring banks.
- Preventive measures:

  1. Improve governance in public Sector banks and distance them from Government.
    - Professional and strong boards accountable for their actions;
    - Bank board bureau to ensure timely appointment of CEOs of banks;
    - Address talent deficit in PSBs and rethink on compensation structures;
    - Improve risk management processes and their compliance in banks.

  2. Improve process of project evaluation and monitoring to reduce the resurgence of NPAs.
    - Improve in-house expertise in project appraisal and evaluation through capacity building.
    - Identify and quantify risks. Mitigate the possible risks and share the immitigable through transparent processes. More the risk, more the equity.
    - Put in place a robust system of project monitoring and appraisal. Incentivize performers.

  3. Strengthen the recovery process.

  4. Government should focus on future.
    - Credit target achievements should not overlook due diligence, examination of potential credit risk and the risk of contingent liability. Thus Government should refrain from setting ambitious credit targets.
    - Governments should refrain from loan waivers as they vitiate credit culture and put stress on their budgets.

Annexure-5

Summary of studies on Institutional arrangements in Rural Credit (1951-2013)

[3] Sri Raghuram Rajan was the Governor of RBI between 2013 and 2016

The institutional arrangements for meeting the emerging credit requirements of rural production spectrum including their consumption needs is a matter of concern to the Government of India since Independence. The All India Rural Credit Survey (1951-54) is the first of such efforts, followed by All India Rural credit Review (1961) (please see Annexure 1 for details). After 1961, the National Sample survey organisation (NSSO) took over this responsibility and conducted decennial surveys regularly. The latest in this series was conducted in 2013. These are known as All India Debt and Investments surveys. The latest survey also included mapping of productive assets. The gist of these survey findings is presented in the Table hereunder.

Institution	1952	1961	1971	1981	1991	2002	2013
Government	3.3	5.3	6.7	4.0	5.7	2.3	2.1
Cooperative Society and Coop Banks	3.1	9.1	20.1	28.6	18.6	27.3	14.8
Commercial Banks including RRBs	0.8	0.4	2.2	28.0	29.0	24.5	42.9
Insurance	-	-	0.1	0.3	0.5	0.3	-
Provident Fund	-	-	0.1	0.3	0.9	0.3	-
Others	-	-	-	-	9.3	2.4	-
Total Institutional	7.2	14.8	29.2	61.2	64.0	57.1	59.8
Land lord	1.5	0.9	8.6	4.0	4.0	1.0	0.8
Money lender (both agricultural & professional)	69.7	60.8	36.9	16.9	15.7	29.6	25.8
Trader/Commission Agent	5.5	7.7	8.7	3.4	7.1	2.6	2.9
Relatives	14.2	6.8	13.8	9.0	6.7	7.1	9.1
Others	1.9	8.9	2.8	4.9	2.5	2.6	1.6
TOTAL NON-INSTITUTIONAL	92.8	85.2	70.8	38.8	36.0	42.9	40.2

Sources: 1. Persistence of informal credit in Rural India- evidence from AIDIS and beyond, N C Pradhan – RBI working paper 5/2013, RBI.2. NSSO survey report 576, 2013

Further, the GOI committee (Sri U C Sarangi) which studied the Credit related issues of farmers in 2006 found out that the share of money lender in the total debt of cultivator is increasing, with size of land being inversely proportional to the share of debt from the informal sources.

The face of rural money lender is also changing with micro finance institutions (mFIs) both for profit and not for profit along with rural oriented NBFCs is making inroads in rural areas. The report of Malegaon Committee that studied the micro finance crisis in AP found out that the mFIs and NBFCs were in no way more empathetic than the rural money lender. The committee recommended for regulatory control by RBI, registration of mFIs with RBI and cap on lending rates by mFIs.

Important findings of 70th round of NSSO survey, 2013 are as under :

- 98.3% of the rural households (HHs) and 93.5% of urban HHs reported possession of physical/financial assets.
- The average value of assets (AVA) of rural cultivators was Rs.2.87 million (100%) and AVA of non-cultivator was Rs.0.67 m (98%); the average being Rs.1.00 million. The AVA of urban self employed was Rs.5.08 m (100%) and urban others was Rs.1.99 m (93%); with average being Rs.2.28 m (93.5%); which was observed only in 9th and 10th deciles in both the segments. The AVA of both the segments was similar till the 5th decile.
- Land and buildings formed 91% of the assets with land forming around 75% of the assets held.
- 31% of the rural households (HHs) reported incidence of indebtedness (IOI) with an average amount of debt (AOD) being Rs.33,000 with the AOD of indebted HH being Rs.0.103 million. While 46% of the indebted cultivator households reported AOD of Rs.0.154 m; 29% of the non-cultivator indebted households reported an AOD of Rs.0.089 m.
- 22% of the urban households (HHs) reported IOI with an AOD of Rs.0.085 million with the AOD of indebted HH being Rs.0.378 million. While 36% of the self employed indebted households reported an AOD of Rs.0.303 m; 21% of the other indebted households reported an AOD of Rs.0.392 m; which was higher than AOD of self employed indebted HHs.
- The IOI was 31.44% in rural areas and 22.37% in urban areas, with average AODs of Rs.0.325 m and Rs.0.846 million; with the average AOD of indebted HH being Rs.103 m and Rs.0.378 million. The IOI was least in the first and second deciles in both the segments (Rural: 1st: IOI: 19.62%. AOD-IHH: Rs.0.049m; 2nd: IOI: 22.3%, AOD-IHH: Rs.0.039m; Urban: 1st: IOI: 9.34%. AOD-IHH: Rs.0.060 m; 2nd: IOI: 14.63%, AOD-IHH: Rs.0.082m).
- The indebtedness status of agricultural households with landholding details is presented overleaf:

Agricultural households – indebtedness, average loan size and source (loan provider)-2013								
Indebtedness based on land size				Source of loan (as % to total loan providers)				
Land Size in ha	Estimated number of households in million	% of indebted households	AOD o/s in Rupess	Bank	Cooperative Society	Total institutional sources	money lender	Total non-institutional sources
<0.1	2.4	41.9	31100	12.9	1,6	14.9	65.1	85.1
0.1- 0.4	28.8	47.3	23900	31.0	14.6	46.9	34.9	53.1
0.4 -1.0	31.5	48.3	35400	37.6	13.9	53.2	34.0	46.8
1.0 – 2.0	15.5	55.7	54800	47.5	14.7	64.8	24.8	35.2
2.0- 4.0	8.4	66.5	94900	50.0	15.6	67.5	25.0	32.5
4.0 -10.0	3.3	76.3	182700	50.2	17.5	71.5	20.1	28.5
> 10	0.4	78.7	290300	63.5	14.3	78.9	16.6	21.1
All sizes	90.2	51.9	47000	42.9	14.8	59.8	28.7	40.2

- The AOD was below Rs.0.2 million up to 9th decile in the rural areas (Rs.0.133 m) and was below the 6th decile in the urban areas (0.157 m).

ANNEXURE 6

ANNEXURE 6: Achievements vis-à-vis stated objectives – Nationalised Banks – 1969-2018			
Stated Objective	Key performance indicator (KPI) for the objective	Performance	Assessment

1. Social welfare through Credit control : directing the credit flow to needy and neglected sectors	**Credit flow (loans outstanding to)**	**1969**	**2018**	**The credit flow was substantial and multifold. Yet, successive debt and investment surveys have brought out the dependence of the small farmers and poor people on money lenders and other non-institutional sources, which indicates unmet demand.**
	Agriculture and allied activities	**Rs.5.009 b as on Dec 1972**	**PSB: Rs.11993 b Of which, nearly 50% was by NBs; & around Rs.3000 b was through Rural branches.**	
	Small scale sector	**Rs.6.593 b as on Dec 1972**	**Rs.9964 b, of which >55% was by NBs**	
	Rural credit	**Rs.1.543 b**	**SCB:Rs.7231 b of which around 50% was by NBs.**	
2. Controlling monopoly of private business houses	**GoI shareholding in the banks**	**100% acquired by GOI both in 1969 and 1980**	**GoI share-holding[4] ranged between 62.8% and 89.7%.**	**Objective achieved through majority holding by GOI and the rest widely held by public, financial institutions and market players. Substantial progress achieved in provision of credit to weaker sections of the society.**
	Diversification of credit portfolio – credit to weaker sections	**Dis-aggregated data not readily available.**	**SCB: Rs.5693 billion, of which nearly 75% was by NBs.**	
3. expansion of branch network to unbanked and under-banked areas	**Rural branch network:**			**Substantial network of rural banking units established consisting of both branches and other than branch banking outlets.**
	Rural Branches	**1443**	**21022[5]out of 65860 of NB as on June 2018.**	
	Population per branch	**64000**	**10000**	
	Business Correspondents	**Nil**	**518742 of PSB**	
	ATMs	**Nil**	**NB: 81765 as on June 2018.**	
4. Reducing Regional Imbalances : Region-wise advances (Rs billion) and branch network (number of branches)	**Northern Region**	**6.60 (1294)**	**19092 (25868)**	**The branch network in Eastern and central regions improved substantially. The share of eastern region (in %) in outstanding credit has come down. The share of NE region in o/s credit improved. Yet, eastern and north eastern India continues to lag behind.**
	North Eastern Region	**0.35 (95)**	**859 (3847)**	
	Eastern Region	**9.80 (895)**	**6280 (22698)**	
	Central Region	**3.43 (1101)**	**7431 (28168)**	
	Western Region	**19.33 (1990)**	**29544 (21174)**	
	Southern Region	**12.80 (2986)**	**24464 (39615)**	
	Total	**52.31 (8361)**	**87670 (141370)**	
5. Directing the credit flow to the sectors that contribute significantly to the national Income	**Priority Sector Credit, of which credit flow for**	**1969: Rs.4.39 billion[6] 1980: Rs.72.3 b (37% of total adv)**	**PSB: Total Rs.20723[7] billion**	**There was no priority sector in 1969. The PSL became prominent from 1980s. Priority sector lending by the Nationalised banks has helped the reducing incidence of poverty in rural areas, as revealed by successive Debt& investment surveys by NSSO.**
	Agriculture		**Rs. 9321 billion**	
	Micro enterprises		**Rs. 3317 billion**	
	Weaker sections		**Rs.5946 billion**	
			Total Priority Sector lending by SCBs other than RRBs in 2017-18 : Rs.30171 b.	

[4] Appendix Table IV.5, Report on Trend and Progress of Banking in India, 2018, RBI, December 2018, page 149
[5] Appendix Table IV.7, Report on Trend and Progress of Banking in India, 2018, RBI, December 2018, page 152
[6] Table 1.1, BSR, RBI, 1972 Page 1.
[7] Table IV.20, Report on the Trend and Progress of Banking in India, 2018, RBI, December 2018; Page 70. Public Sector Banks include 19 Nationalised Banks, SBI and IDBI.

6. Promoting banking habit and providing financial services to the citizens, particularly in the rural areas	**Financial inclusion efforts**	**Rural dep: Rs.3.2 bil; Rural adv: Rs.1.5 bil; No of rural accounts not readily available**	**328 m accounts; o/s bal Rs.851b**	**Share of Nationalised Banks is substantial, exact figures as on March 2018 are not readily available.**
	PMJDY accounts		**536 m accounts; o/s bal:Rs.1121 b**	
	BSBDA details			
	KCC issued		**Total : 69 m cards; o/s bal Rs.6709 b; of which PSB : 25.3 m, Rs.4331 b[8]**	
	ICT transactions		**1489m transactions involving Rs.4292 b[9]**	
7. Monetisation of Economy	**Share of rural banking in total banking business (sum of o/s deposits & advances; Rs in billions)**	**RB-4.739 TB-128.0 % share :3.7%**	**SCB: RB:19329 b TB:202014 b % share :9.5% PSB: RB:14003 b TB:131893 b % share:10.6%**	**The percentage share of rural business, of the total business has gone up 2.87 times in nearly 50 years. Much more was possible, as revealed by successive rural debt and investment surveys.**
8. Shift in the orientation of the Banks (profit maximisation to sustainable economic development with profit)	**Profitability of Banks (no of banks in profit and amount of profit Rs in millions)**	**All the 14 banks in 1969 and all the 20 banks in 1980 were in profit**	**2 out of 19 nationalised banks have made profit in 2017-18. Profit Rs.19.8 billion for 2 banks. Loss Rs.725.7 billion for 17 banks. Acc losses of 19 Nationalised banks were Rs.944.1 billion and those of 17 loss making banks were Rs.977.7 b.[10]**	**Leaving two banks, which made marginal profits, the losses made by Nationalised Banks were substantial in 2018. Profitability together with sustainable economic development needs strategic action plan.**
9. Provision of credit against personal security to tenant cultivators.	**Loans to tenant cultivators on personal security.**	**Credit support to JLGs, GCCs and overdraft in BSBDA.**	**Credit flow is miniscule in relation to the demand magnitude.**	**Financing tenant cultivators need legislative support from Provincial Governments.**

[8] Appendix table 4.3 progress of KCC as on March 2018; Report on Trend and progress of Banking in India, 2018, Reserve bank of India, page 147.
[9] Table IV.25, Report on Trend and progress of Banking in India, 2018, Reserve bank of India, page 80.
[10] Statistical tables relating to banks in India, 2018; tables based on annual accounts, table 7. Appropriation of profit of SCBs, RBI, 2018

APPENDICES – DATA AND INFORMATION TABLES OF STUDY

APPENDIX 1

TABLE 1 : GENERAL BANKING INDICATORS 1969 -2018

S NO	PARTICULARS/YEAR	Jun-69	Jun-75	Jun-80	Mar-91	Mar-98	Mar-03	Mar-10	2013	2015	2018
	BANKS										
1	TOTAL COMMERCIAL BANKS	89	83	153	276	300	294	169	155	152	156
2	SCHEDULED COM BANKS	73	74	148	272	299	289	165	151	148	152
3	REGIONAL RURAL BANKS	0	0	73	196	196	196	82	64	56	56
4	NATIONALISED BANKS	14	14	20	20	19	19	19	19+1	19+1	19+1
5	NON-SCHEDULED BANKS	16	9	5	4	1	5	4	4	4	4
6	TOTAL BRANCHES OF ALL BANKS	8187	18730	32412	61724	65828	68078	86960	109279	130482	140133
	of which for NBs	4142	9862	18083	30640	32896	33979	42965	54301	65764	73303
	% of br of NB to total br	51%	53%	56%	50%	50%	50%	49%	50%	50%	52%
	RURAL BRANCHES	1443	6807	14818	35134	32854	32283	32320	39233	48536	49384
	SEMI URBAN BRANCHES	3337	5598	8304	11566	14174	15042	20601	28529	34131	38481
	TOTAL OF RURAL& SEMI URBAN B	4780	12405	23122	46700	47028	47325	52921	67762	82667	87865
	% TO TOTAL	58%	66%	71%	76%	71%	70%	61%	62%	63%	63%
	POPULATION PER BRANCH (000s)	64	32	21	14	15	16	14	12	10	10
7	OUTSTANDING DEPOSITS (Rs in Bill	46.65	126.37	333.21	2005.68	5964.68	12761.96	45610.29	70126.20	89221.11	114344.50
	NBs/PSBs in 2018	26.37	70.39	207.51	1222.84	3262.37	6465.19	23655.98	36885.73	45472.84	xxxxxxxx
	% of DEP of NB to total dep	57%	56%	62%	61%	55%	51%	52%	53%	51%	#VALUE!
	RURAL DEPOSITS OF SCBs	1.45	10.29	39.75	310.09	867.06	1765.02	4203.38	6698.88	9156.76	12097.86
	SEMI URBAN DEP OF SCBs	10.24	28.11	76.53	414.39	1156.44	2417.56	6140.47	9791.94	13172.51	18513.68
	% of RSU dep to total dep of SCBs	25%	30%	35%	36%	34%	33%	23%	24%	25%	27%
	CASA	21.04	56.76	105.55	864.86	2221.82	1878.37	17857.23	6622.99	32106.04	48407
	TERM DEPOSITS	25.42	69.61	227.66	1140.82	3742.86	11239.24	27753.06	60881.55	57115.07	65938.00
	CASA as % of total deposits	45%	45%	32%	43%	37%	15%	39%	9%	36%	40%
	CASA OF NBs/PSBs		32.56	88.76	500.13	1249.15	2382.79	8419.6	11442.36	13930	xxxxxxxx
	CASA as % of total deposits of NBs/PSBs		46%	43%	41%	38%	37%	36%	31%	31%	#VALUE!
	DEPOSITS AS % TO NATIONAL INCC	15.3	19.9	35.8	48.3	47.9	58.6	86.6	80.7	80	80+
8	OUTSTANDING ADVANCES	36.09	91.19	223.81	1242.03	3299.44	7559.69	33451.69	55253.17	68784.72	87669.72
	NBs/SCBs in 2018	18.37	50.71	130.82	714.02	1607.74	3539.29	17379.25	28229.89	34474.39	xxxxxxxx
	% of adv of NB to total adv	51%	56%	58%	57%	49%	47%	52%	51%	50%	#VALUE!
	RURAL ADV OF SCBs	0.54	5.35	21.65	185.99	375.98	771.53	2492.77	5239.71	5983.46	7231
	SEMI URBAN ADV of SCBs	4.07	13.76	36.15	203.07	423.6	854.12	3199.73	6756.52	7591.88	10787.49
	% of RSU adv to total adv of SCBs	13%	21%	26%	31%	24%	22%	17%	22%	20%	21%
	O/S ADV TO PRIORITY SECTOR	5.04	22.42	72.78	445.72	1089.05	2546.48	1138.39	16952.67	23781.71	30782.56
	PSL AS % TO NON FOOD CREDIT	15	27.5	37	37.7	34.6	35.1	35.1	34.3	37.2	40
9	CD RATIO	77%	72%	67%	62%	55%	59%	73%	79%	77%	74%
	INVESTMENT DEPOSIT RATIO (MOS	29%	33%	35%	38%	36%	41%	36%	30%	29%	35%
	CASH DEPOSIT RATIO INCLUDING (	8.2%	6.8%	12.3%	17.6%	10.1%	6.3%	7.7%	4.8%	5.6%	6.2%
10	Balance sheet size of SCBs					8252	16967	60251	95733	120370	152533

NB: AUTHENTIC DISAGGREGATED DATA NOT READILY AVAILABLE.
june 69 figures are taken from BSR 1973 table 2

APPENDIX 2

APPENDIX TABLE 2: FINANCIAL INCLUSION EFFORTS OF SCBs as on 31st March 2018		
S NO	**PARTICULARS**	**DETAIL**
1	**Total number of rural branches of all banks**	**50805**
2	**Business Correspondents (BCs) in villages**	**578542**
3	**Total**	**569547**
4	**Urban BCs**	**142959**
5	**ATMs (both on-site and off-site) installed by banks**	**207052**
6	**BSBDA accounts (in millions)**	
	Opened through branches	**247**
	Opened by BCs	**289**
	TOTAL BSBDA accounts	**536**
7	**Balance in BSBDA accounts (Rs in billions)**	
	In branches	**731**
	Through BCs	**391**
	Total	**1121**
8	**Overdraft facility in BSBDA accounts**	
	Accounts (in millions)	**4**
	Amount outstanding (Rs in billions)	**4**
9	**Prime Minister's Jan Dhan Yojana (PMJDY) accounts (in millions)**	**328**
	Outstanding balance in PMJDY accounts (Rs in billions)	**851**
10	**Kisan Credit Cards (issued to farmers)**	
	Number (in millions)	**46**
	Amount outstanding (Rs in billions)	**6096**
11	**General Credit Cards (issued to other general clients)**	
	Number	**12**
	Outstanding amount	**1498**
12	**ICT transactions through BCs (during 2017-18)**	
	Total number of transactions (in millions)	**1489**
	Amount transacted (Rs in billions)	**4292**
13	**Banking through Self Help Groups (SHGs)**	
	Savings bank accounts (in millions)	**8.7**
	Amount (Rs in billions)	**196**
	Loan accounts (million)	**5.0**
	Loans outstanding (Rs in billions)	**756**
	Loans disbursed during 2017-18 – no of accounts (million)	**2.30**
	Loans disbursed during the year 2017-18 (in billions)	**472**
14	**Joint Liability Groups (mostly of tenant cultivators)**	
	Loan accounts (millions)	**1**
	Amount outstanding in loan accounts (in Rs billion)	**140**
15	**On lending through MICRO FINANCE INSTITUTIONS (mFIs)**	
	Cumulative client outreach (in millions)	**5073**
	Amount outstanding (Rs in billions)	**323**
	During 2017-18 (in millions)	**1922**
	Loans disbursed during the year 2017-18 (Rs in billions)	**255**

APPENDIX TABLE 3 REGIONAL DISTRIBUTION OF BRANCHES AND DEPOSITS TABLE 1 continued page 2

YEAR	REGION	BRANCH	DEPOSITS	ADVANCES	BRANCH	DEPOSITS	ADVANCE	NETWORK AND BUSINESS CONSOLIDATION								NB AS % OF SCB	
Jun-69	**REGION**	**BRANCH**	**DEPOSITS**	**ADVANCES**	**BRANCH**	**DEPOSIT**	**ADVANC**	**NETWORK AND BUSINESS CONSOLIDATION**								**NB AS % OF SCB**	
								SCB br	**NB BR**	**SCB BUS**	**NB bus**	**scb br sh**	**nb br sh**	**scb bus sh**	**nb bus sh**	**BR**	**BUS**
	NORTHERN	1252	8.70	4.94				1252		13.64		15.3%		16.5%			
	NORTH EASTERN	84	0.49	0.17				84		0.66		1.0%		0.8%			
	EASTERN	876	8.44	7.69				876		16.13		10.7%		19.5%			
	CENTRAL	1081	4.76	2.38				1081		7.14		13.2%		8.6%			
	WESTERN	1952	15.76	12.86				1952		28.62		23.8%		34.6%			
	SOUTHERN	2942	8.50	8.05				2942		16.55		35.9%		20.0%			
	TOTAL	8187	46.65	36.09				8187		82.74		100.0%		100.0%			
Jun-75		BRANCH	DEPOSITS	ADVANCES	BRANCH	DEPOSITS	ADVANCES										
	NORTHERN	3174	23.93	16.64	1390	11.79	8.53	3174	1390	40.57	20.32	17.1%	14.1%	18.6%	16.8%	43.8%	50.1%
	NORTH EASTERN	275	1.44	0.57	178	0.82	0.38	275	178	2.01	1.2	1.5%	1.8%	0.9%	1.0%	64.7%	59.7%
	EASTERN	2189	23.89	15.14	1342	11.84	7.62	2189	1342	39.03	19.46	11.8%	13.6%	17.9%	16.1%	61.3%	49.9%
	CENTRAL	2795	14.58	8.24	1547	8.25	4.30	2795	1547	22.82	12.55	15.0%	15.7%	10.5%	10.4%	55.3%	55.0%
	WESTERN	3873	37.76	28.03	2697	25.72	18.80	3873	2697	65.79	44.52	20.9%	27.3%	30.2%	36.8%	69.6%	67.7%
	SOUTHERN	6269	24.77	22.57	2708	11.98	11.08	6269	2708	47.34	23.06	33.7%	27.5%	21.8%	19.0%	43.2%	48.7%
	TOTAL	18575	126.37	91.19	9862	70.40	50.71	18575	9862	217.56	121.11	100.0%	100.0%	100.0%	100.0%	53.1%	55.7%
Jun-80		BRANCH	DEPOSITS	ADVANCES	BRANCH	DEPOSITS	ADVANCES										
	NORTHERN	5409	71.37	54.28	3022	42.5	33.51	5409	3022	125.65	76.01	16.7%	16.7%	22.6%	22.5%	55.9%	60.5%
	NORTH EASTERN	703	4.82	1.71	406	2.81	1.17	703	406	6.53	3.98	2.2%	2.2%	1.2%	1.2%	57.8%	60.9%
	EASTERN	4778	55.40	31.10	2641	32.11	17.1	4778	2641	86.50	49.21	14.7%	14.6%	15.5%	14.5%	55.3%	56.9%
	CENTRAL	5588	42.01	19.19	3076	25.4	10.62	5588	3076	61.20	36.02	17.2%	17.0%	11.0%	10.6%	55.0%	58.9%
	WESTERN	5790	89.46	63.08	4041	64.37	38.97	5790	4041	152.54	103.34	17.9%	22.3%	27.4%	30.5%	69.8%	67.7%
	SOUTHERN	10144	70.15	54.45	4897	40.32	29.45	10144	4897	124.60	69.77	31.3%	27.1%	22.4%	20.6%	48.3%	56.0%
	TOTAL	32412	333.21	223.81	18083	207.51	130.82	32412	18083	557.02	338.33	100.0%	100.0%	100.0%	100.0%	55.8%	60.7%
Mar-91		BRANCH	DEPOSITS	ADVANCES	BRANCH	DEPOSITS	ADVANCES										
	NORTHERN	9426	434.50	233.49	4666	280.76	132.83	9426	4666	667.99	413.59	15.3%	15.2%	20.6%	21.4%	49.5%	61.9%
	NORTH EASTERN	1870	34.28	16.08	785	18.07	8.64	1870	785	50.36	26.71	3.0%	2.6%	1.6%	1.4%	42.0%	53.0%
	EASTERN	11362	311.86	155.58	5538	182.54	82.34	11362	5538	467.44	264.88	18.4%	18.1%	14.4%	13.7%	48.7%	56.7%
	CENTRAL	13005	282.71	142.12	5708	175.3	82.26	13005	5708	424.83	257.56	21.1%	18.6%	13.1%	13.3%	43.9%	60.6%
	WESTERN	9526	516.83	349.74	6148	323.67	222.05	9526	6148	866.57	545.72	15.4%	20.1%	26.7%	28.2%	64.5%	63.0%
	SOUTHERN	16535	425.50	345.02	7795	242.49	183.91	16535	7795	770.52	426.4	26.8%	25.4%	23.7%	22.0%	47.1%	55.3%
	TOTAL	61724	2005.68	1242.03	30640	1222.83	712.03	61724	30640	3247.71	1934.86	100.0%	100.0%	100.0%	100.0%	49.6%	59.6%
Mar-98		BRANCH	DEPOSITS	ADVANCES	BRANCH	DEPOSITS	ADVANCES										
	NORTHERN	10401	1342.40	654.71	5233	774.1	338.02	10401	5233	1997.11	1112.12	15.8%	15.9%	21.6%	22.8%	50.3%	55.7%
	NORTH EASTERN	1939	94.83	28.79	823	48.05	15.6	1939	823	123.62	63.65	2.9%	2.5%	1.3%	1.3%	42.4%	51.5%
	EASTERN	11802	790.65	323.44	5825	447.1	160.77	11802	5825	1114.09	607.87	17.9%	17.7%	12.0%	12.5%	49.4%	54.6%
	CENTRAL	13498	822.08	294.07	6098	476.28	152.1	13498	6098	1116.15	628.38	20.5%	18.5%	12.0%	12.9%	45.2%	56.3%
	WESTERN	10267	1589.01	1056.46	6495	886.8	530.01	10267	6495	2645.47	1416.81	15.6%	19.7%	28.6%	29.1%	63.3%	53.6%
	SOUTHERN	17921	1325.71	941.95	8422	630.04	411.24	17921	8422	2267.66	1041.28	27.2%	25.6%	24.5%	21.4%	47.0%	45.9%
	TOTAL	65828	5964.68	3299.42	32896	3262.37	1607.74	65828	32896	9264.10	4870.11	100.0%	100.0%	100.0%	100.0%	50.0%	52.6%

* from BSR 1973 tables

TABLE 3 PAGE 2 REGIONAL DISTRIBUTION OF BRANCHES AND BUSINESS

								SCB br	NB BR	SCB BUS	NB bus	scb br sh	nb br sh	scb bus sh	nb bus sh	BR	BUS	scb br	s
Mar-03		BRANCHE	DEPOSITS	ADVANCES	BRANCHI	DEPOSITS	ADVANCES												
	NORTHERN	11073	2937.26	1644.69	5560	1548.2	841.09	11073	5560	4581.95	2389.32	16.3%	16.4%	22.5%	23.9%	50.2%	52.1%	6.5%	
	NORTH EASTERN	1910	203.99	55.92	791	97.5	31.24	1910	791	259.91	128.74	2.8%	2.3%	1.3%	1.3%	41.4%	49.5%	-1.5%	
	EASTERN	11977	1620.21	641.39	5929	887.56	338.46	11977	5929	2261.60	1226.02	17.6%	17.4%	11.1%	12.3%	49.5%	54.2%	1.5%	
	CENTRAL	13737	1737.01	578.99	6404	987.62	320.59	13737	6404	2316.00	1308.21	20.2%	18.8%	11.4%	13.1%	46.6%	56.5%	1.8%	
	WESTERN	10624	3317.41	2686.21	6535	1629.6	1136.2	10624	6535	6003.62	2765.76	15.6%	19.2%	29.5%	27.6%	61.5%	46.1%	3.5%	
	SOUTHERN	18757	2946.08	1952.49	8760	1314.7	871.73	18757	8760	4898.57	2186.43	27.6%	25.8%	24.1%	21.9%	46.7%	44.6%	4.7%	
	TOTAL	68078	12761.96	7559.69	33979	6465.2	3539.3	68078	33979	20321.65	10004.5	100.0%	100.0%	100.0%	100.0%	49.9%	49.2%	3.4%	
Mar-10		BRANCHE	DEPOSITS	ADVANCES	BRANCHI	DEPOSITS	ADVANCES												
	NORTHERN	15087	10064.97	7486.58	7465	5534.5	4132.1	15087	7465	17551.55	9666.53	17.3%	17.4%	22.2%	23.6%	49.5%	55.1%	36.3%	
	NORTH EASTERN	2268	769.48	273.50	942	317.59	97.25	2268	942	1042.98	414.84	2.6%	2.2%	1.3%	1.0%	41.5%	39.8%	18.7%	
	EASTERN	14359	5272.61	2679.76	7200	2919.8	1424.3	14359	7200	7952.37	4344.04	16.5%	16.8%	10.1%	10.6%	50.1%	54.6%	19.9%	
	CENTRAL	17280	5201.91	2458.84	8165	2871	1401	17280	8165	7660.75	4271.94	19.9%	19.0%	9.7%	10.4%	47.3%	55.8%	25.8%	
	WESTERN	13543	14488.17	11459.56	7916	7582.6	5983.2	13543	7916	25947.73	13565.8	15.6%	18.4%	32.8%	33.1%	58.5%	52.3%	27.5%	
	SOUTHERN	24423	9813.15	9093.45	11277	4430.6	4341.5	24423	11277	18906.60	8772.08	28.1%	26.2%	23.9%	21.4%	46.2%	46.4%	30.2%	
	TOTAL	86960	45610.29	33451.69	42965	23656	17379	86960	42965	79061.98	41035.2	100.0%	100.0%	100.0%	100.0%	49.4%	51.9%	27.7%	
Mar-13		BRANCHE	DEPOSITS	ADVANCES	BRANCHI	DEPOSITS	ADVANCES												
	NORTHERN	19681	14474.52	12860.33	9633	7806.6	6899.6	19681	9633	27334.85	14706.2	18.0%	17.7%	21.8%	22.6%	48.9%	53.8%	30.5%	
	NORTH EASTERN	2769	1247.72	419.33	1218	496.6	152.84	2769	1218	1667.05	649.44	2.5%	2.2%	1.3%	1.0%	44.0%	39.0%	22.1%	
	EASTERN	17469	8531.74	4217.68	9073	4779.9	2292.2	17469	9073	12749.42	7072.05	16.0%	16.7%	10.2%	10.9%	51.9%	55.5%	21.7%	
	CENTRAL	21581	8585.41	4083.98	10787	4882.3	2399.1	21581	10787	12669.39	7281.4	19.7%	19.9%	10.1%	11.2%	50.0%	57.5%	24.9%	
	WESTERN	17013	21819.43	18648.44	9667	12025	9554.6	17013	9667	40467.87	21579.7	15.6%	17.8%	32.3%	33.1%	56.8%	53.3%	25.6%	
	SOUTHERN	30766	15467.38	15023.41	13923	6895.3	6931.6	30766	13923	30490.79	13826.9	28.2%	25.6%	24.3%	21.2%	45.3%	45.3%	26.0%	
	TOTAL	109279	70126.2	55253.17	54301	36886	28230	109279	54301	125379.37	65115.6	100.0%	100.0%	100.0%	100.0%	49.7%	51.9%	25.7%	
Mar-15		BRANCHE	DEPOSITS	ADVANCES	BRANCHI	DEPOSITS	ADVANCES												
	NORTHERN	23843	17935.50	15867.50	XXX	XXX	XXX	23843	XXX	33803.00	#VALUE!	21.8%	#VALUE!	27.0%	#VALUE!	#VALUE!	#VALUE!	21.1%	
	NORTH EASTERN	3345	1554.80	536.06	XXX	XXX	XXX	3345	XXX	2090.86	#VALUE!	3.1%	#VALUE!	1.7%	#VALUE!	#VALUE!	#VALUE!	20.8%	
	EASTERN	20893	11113.50	5173.27	XXX	XXX	XXX	20893	XXX	16286.77	#VALUE!	19.1%	#VALUE!	13.0%	#VALUE!	#VALUE!	#VALUE!	19.6%	
	CENTRAL	25926	11396.70	5501.70	XXX	XXX	XXX	25926	XXX	16898.40	#VALUE!	23.7%	#VALUE!	13.5%	#VALUE!	#VALUE!	#VALUE!	20.1%	
	WESTERN	19821	26853.63	23399.30	XXX	XXX	XXX	19821	XXX	50252.93	#VALUE!	18.1%	#VALUE!	40.1%	#VALUE!	#VALUE!	#VALUE!	16.5%	
	SOUTHERN	36654	20366.98	18306.89	XXX	XXX	XXX	36654	XXX	38673.87	#VALUE!	33.5%	#VALUE!	30.8%	#VALUE!	#VALUE!	#VALUE!	19.1%	
	TOTAL	130482	89221.11	68784.72	0	0	0	130482	0	158005.83	0	119.4%	0.0%	126.0%	0.0%	0.0%	0.0%	19.4%	
Mar-18		BRANCHE	DEPOSITS	ADVANCES	BRANCHI	DEPOSITS	ADVANCES												
	NORTHERN	25868	24436.56	19091.86	XXX	XXX	XXX	25868	XXX	43528.42	#VALUE!	23.7%	#VALUE!	34.7%	#VALUE!	#VALUE!	#VALUE!	8.5%	
	NORTH EASTERN	3847	2187.60	858.93	XXX	XXX	XXX	3847	XXX	3046.53	#VALUE!	3.5%	#VALUE!	2.4%	#VALUE!	#VALUE!	#VALUE!	15.0%	
	EASTERN	22698	15112.04	6279.78	XXX	XXX	XXX	22698	XXX	21391.82	#VALUE!	20.8%	#VALUE!	17.1%	#VALUE!	#VALUE!	#VALUE!	8.6%	
	CENTRAL	28168	15499.75	7430.82	XXX	XXX	XXX	28168	XXX	22930.57	#VALUE!	25.8%	#VALUE!	18.3%	#VALUE!	#VALUE!	#VALUE!	8.6%	
	WESTERN	21174	30069.31	29544.54	XXX	XXX	XXX	21174	XXX	59613.85	#VALUE!	19.4%	#VALUE!	47.5%	#VALUE!	#VALUE!	#VALUE!	6.8%	
	SOUTHERN	39615	27039.24	24463.79	XXX	XXX	XXX	39615	XXX	51503.03	#VALUE!	36.3%	#VALUE!	41.1%	#VALUE!	#VALUE!	#VALUE!	8.1%	
	TOTAL	141370	114344.5	87669.72	0	0	0	141370	0	202014.22	0	129.4%	0.0%	161.1%	0.0%	0.0%	0.0%	8.3%	
NB:	XXX: ACCURATE DISAGGREGATED DATA NOT AVAILABLE																		

Appendix TABLE 4: DISTRIBUTION OF OUTSTANDING CREDIT BASED ON OCCUPATION 1969-2018 PAGE 1/2

YEAR	OCCUPATION	SCH COM BANKS		NATIONALISED BANI		analysis				nb/scb	
		NO OF A/	Amount	No of a	amount	scb a/cs	scb amts	nb acs	nb amt	acs	amt
Jun-75											
	AGRICULTURE	2.34	9.69	1.30	5.92	38%	11%	40%	12%	56%	61%
	INDUSTRIES	0.05	40.91	0.04	22.87	1%	45%	1%	45%	80%	56%
	SMALL SCALE INDUSTRIES	0.25	11.17	0.14	6.02	4%	12%	4%	12%	56%	54%
	TRANSPORT	0.09	2.61	0.06	1.17	1%	3%	2%	2%	67%	45%
	PERSONAL & PROF SERVICES	0.22	1.65	0.17	0.99	4%	2%	5%	2%	77%	60%
	TRADE	0.41	15.00	0.29	8.97	7%	17%	9%	18%	71%	60%
	FINANCIAL INSTITUTIONS	0.01	1.44	0.00	0.86	0%	2%	0%	2%	0%	60%
	MISCELLANEOUS	2.81	7.64	1.24	4.43	45%	8%	38%	9%	44%	58%
	TOTAL	6.18	90.11	3.24	51.23					52%	57%
Jun-80	AGRICULTURE	9.01	31.52	4.01	17.26	50%	15%	45%	14%	45%	55%
	INDUSTRIES	0.16	77.04	0.09	43.21	1%	36%	1%	34%	56%	56%
	SMALL SCALE INDUSTRIES	0.60	25.34	0.30	15.70	3%	12%	3%	13%	50%	62%
	TRANSPORT	0.35	9.14	0.21	4.21	2%	4%	2%	3%	60%	46%
	PERSONAL & PROF SERVICES	1.19	4.71	0.80	3.26	7%	2%	9%	3%	67%	69%
	TRADE	1.65	47.41	0.84	30.14	9%	22%	9%	24%	51%	64%
	FINANCIAL INSTITUTIONS	0.01	1.72	0.00	1.20	0%	1%	0%	1%	0%	70%
	MISCELLANEOUS	5.06	16.23	2.64	10.39	28%	8%	30%	8%	52%	64%
	TOTAL	18.03	213.11	8.89	125.37					49%	59%
Mar-91	AGRICULTURE	27.26	185.73	12.56	102.78	44%	15%	42%	14%	46%	55%
	INDUSTRIES	3.07	435.82	1.08	228.39	5%	35%	4%	32%	35%	52%
	SMALL SCALE INDUSTRIES	2.09	155.12	1.07	101.64	3%	12%	4%	14%	51%	66%
	TRANSPORT	1.44	36.39	0.68	22.35	2%	3%	2%	3%	47%	61%
	PERSONAL & PROF SERVICES	10.04	132.66	4.90	75.13	16%	11%	16%	11%	49%	57%
	PERSONAL LOANS	0	0	0.00	0.00	0%	0%	0%	0%		
	TRADE	10.55	182.96	4.78	115.04	17%	15%	16%	16%	45%	63%
	FINANCIAL INSTITUTIONS	0.01	28.06	0.01	13.88	0%	2%	0%	2%	100%	49%
	MISCELLANEOUS	7.48	85.28	4.78	54.81	12%	7%	16%	8%	64%	64%
	TOTAL	61.94	1242.02	29.86	714.02					48%	57%
Mar-98	AGRICULTURE	21.72	352.63	9.60	179.19	41%	11%	39%	11%	44%	51%
	INDUSTRIES	2.77	1324.68	1.07	574.75	5%	40%	4%	36%	39%	43%
	SMALL SCALE INDUSTRIES	1.60	286.28	0.84	160.17	3%	9%	3%	10%	53%	56%
	TRANSPORT	1.14	64.69	0.50	32.16	2%	2%	2%	2%	44%	50%
	PERSONAL & PROF SERVICES	2.03	114.45	1.22	62.79	4%	3%	5%	4%	60%	55%
	PERSONAL LOANS	11.26	347.52	4.67	155.10	21%	11%	19%	10%	41%	45%
	TRADE	8.4	458.04	3.74	254.70	16%	14%	15%	16%	45%	56%
	FINANCIAL INSTITUTIONS	0.02	122.37	0.01	53.74	0%	4%	0%	3%	50%	44%
	MISCELLANEOUS	4.64	228.78	2.75	135.13	9%	7%	11%	8%	59%	59%
	TOTAL	53.58	3299.44	24.40	1607.73					46%	49%
Mar-03	AGRICULTURE	20.84	759.35	9.17	395.72	35%	10%	37%	11%	44%	52%
	INDUSTRIES	2.41	2718.87	1.62	1298.49	4%	36%	7%	37%	67%	48%
	SMALL SCALE INDUSTRIES	1.43	379.40	0.00	0.00	2%	5%	0%	0%	0%	0%
	TRANSPORT	0.58	94.1	0.25	45.72	1%	1%	1%	1%	16%	13%
	PERSONAL & PROF SERVICES	1.54	339.08	0.85	146.48	3%	4%	3%	4%	4%	13%
	PERSONAL LOANS	20.3	1139.42	7.02	493.87	34%	15%	28%	14%	35%	43%
	TRADE	5.9	1040.5	2.73	618.60	10%	14%	11%	17%	46%	59%
	FINANCIAL INSTITUTIONS	0.12	506.45	0.08	244.97	0%	7%	0%	7%	67%	48%
	MISCELLANEOUS	6.37	582.52	3.17	295.44	11%	8%	13%	8%	50%	51%
	TOTAL	59.49	7559.69	24.89	3539.29					42%	47%
Mar-10	AGRICULTURE	42.77	3902.98	18.44	2040.37	36%	12%	50%	12%	43%	52%
	INDUSTRIES	3.25	13552.33	1.56	7407.79	3%	41%	4%	43%	48%	55%
	SMALL SCALE INDUSTRIES	0	0	0.00		1%	3%	0%	0%	0%	0%
	TRANSPORT	0.96	857.57	0.22	436.20	4%	9%	1%	3%	23%	51%
	PERSONAL & PROF SERVICES	4.52	3053.75	1.38	1869.37	4%	9%	4%	11%	3%	33%
	PERSONAL LOANS	50.69	5588.95	9.88	1998.77	43%	17%	27%	12%	19%	36%
	TRADE	6.81	3054.82	2.83	1506.62	6%	9%	8%	9%	42%	49%
	FINANCIAL INSTITUTIONS	1.07	2431.39	0.20	1492.26	1%	7%	1%	9%	19%	61%
	MISCELLANEOUS	8.58	1009.9	2.27	627.87	7%	3%	6%	4%	26%	62%
	TOTAL	118.65	33451.69	36.78	17379.25					31%	52%

Appendix TABLE 4: DISTRIBUTION OF OUTSTANDING CREDIT BASED ON OCCUPATION 1969-2018 CONTD PAGE 2

YEAR	OCCUPATION	SCH COM BANKS		NATIONALISED BA		analysis				nb/scb	
		NO OF A	Amount	No of a/	amount	scb a/cs	scb amts	nb acs	nb amt	acs	amt
Mar-13	AGRICULTURE	59.98	6761.76	27.14	3508.30	47%	12%	61%	12%	45%	52%
	INDUSTRIES	2.68	23159.88	1.19	12388.64	2%	42%	3%	44%	44%	53%
	SMALL SCALE INDUSTRIES	0	0	0.00	0.00	0%	0%	0%	0%	0%	0%
	TRANSPORT	2.12	1234.27	0.35	502.81	2%	2%	1%	2%	17%	41%
	PERSONAL & PROF SERVICES	2.38	4043.33	1.12	2210.48	2%	7%	3%	8%	2%	25%
	PERSONAL LOANS	47.54	8712.91	9.91	3003.88	37%	16%	22%	11%	21%	34%
	TRADE	7.6	5737.01	3.73	3226.62	6%	10%	8%	11%	49%	56%
	FINANCIAL INSTITUTIONS	0.85	4295.34	0.17	2694.74	1%	8%	0%	10%	20%	63%
	MISCELLANEOUS	5.12	1308.59	0.80	694.41	4%	2%	2%	2%	16%	53%
	TOTAL	128.27	55253.09	44.41	28229.88					35%	51%
Mar-15	AGRICULTURE	73.89	9042.72	XXX	XXX	51%	13%	#VALUE!	#######	#####	######
	INDUSTRIES	3.17	28360.5	XXX	XXX	2%	41%	#VALUE!	#######	#####	######
	SMALL SCALE INDUSTRIES	0	0	XXX	XXX	0%	0%	#VALUE!	#######	#####	######
	TRANSPORT	2.07	1341.18	XXX	XXX	1%	2%	#VALUE!	#######	#####	######
	PERSONAL & PROF SERVICES	3.73	4965.8	XXX	XXX	3%	7%	#VALUE!	#######	#####	######
	PERSONAL LOANS	49.23	11439.86	XXX	XXX	34%	17%	#VALUE!	#######	#####	######
	TRADE	6.64	6627.36	XXX	XXX	5%	10%	#VALUE!	#######	#####	######
	FINANCIAL INSTITUTIONS	0.5	5606.56	XXX	XXX	0%	8%	#VALUE!	#######	#####	######
	MISCELLANEOUS	5.01	1400.75	XXX	XXX	3%	2%	#VALUE!	#######	#####	######
	TOTAL	144.24	68784.73	0.00	0.00					0%	0%
Mar-18	AGRICULTURE	90.85	11992.61	XXX	XXX	46%	14%	#VALUE!	#######	#####	######
	INDUSTRIES	8.18	30387.34	XXX	XXX	4%	35%	#VALUE!	#######	#####	######
	SMALL SCALE INDUSTRIES	0	0	XXX	XXX	0%	0%	#VALUE!	#######	#####	######
	TRANSPORT	2.82	1951.35	XXX	XXX	1%	2%	#VALUE!	#######	#####	######
	PERSONAL & PROF SERVICES	6.25	6364.02	XXX	XXX	3%	7%	#VALUE!	#######	#####	######
	PERSONAL LOANS	68.31	18648.85	XXX	XXX	35%	21%	#VALUE!	#######	#####	######
	TRADE	12.54	8442.47	XXX	XXX	6%	10%	#VALUE!	#######	#####	######
	FINANCIAL INSTITUTIONS	1.17	7288.86	XXX	XXX	1%	8%	#VALUE!	#######	#####	######
	MISCELLANEOUS	6.86	2594.22	XXX	XXX	3%	3%	#VALUE!	#######	#####	######
	TOTAL	196.98	87669.72	0.00	0.00					0%	0%

NB: XXX: ACCURATE DISAGGREGATED DATA NOT AVAILABLE

Summary of Appendix table 4 occupation-wise outstanding Rupees in billion

Occupation	1975		1980		1991		2003		2013		2018
	PSB	NB	PSB	NB	PSB	NB	PSB	NB	PSB	NB	PSB
AGRICULTURE	10	6	32	17	186	103	759	396	6762	3508	11993
INDUSTRY(SSI)	52 (11)	29(6)	102(25)	59 (16)	591 (155)	330(102)	3098(379)	1299	23160	12389	30387
TRANSPORT	3	1	9	4	36	22	94	46	1234	503	1951
PER & PROF SER	2	1	5	3	133	75	339	146	4043	2210	6364
PERSONAL LOAN	0	0	0	0	0	0	1139	494	8713	3004	18649
TRADE	15	9	47	30	183	115	1041	619	5737	3227	8442
FINANCIAL INST	1	1	2	1	28	14	506	245	4295	2695	7289
MISCELLANEOUS	8	4	16	10	85	55	583	295	1309	694	2594
TOTAL	90	51	213	125	1242	714	7560	3539	55253	28230	87670

Summary of appendix table 4 occupation-wise activity share to total

Occupation	1975		1980		1991		2003		2013		2018
	PSB	NB	PSB	NB	PSB	NB	PSB	NB	PSB	NB	PSB
AGRICULTURE	11	12	15	14	15	14	10	11	12	12	14
INDUSTRY(SSI)	57(12)	57(12)	48(12)	47(13)	47(12)	46(14)	41(5)	37	42	44	35
TRANSPORT	3	2	4	3	3	3	1	1	2	2	2
PER & PROF SER	2	2	2	3	11	11	4	4	7	8	7
PERSONAL LOAN	0	0	0	0	0	0	15	14	16	11	21
TRADE	17	18	22	24	15	16	14	17	10	11	10
FINANCIAL INST	2	2	1	1	2	2	7	7	8	10	8
MISCELLANEOUS	8	9	8	8	7	8	8	8	2	2	3
NB/SCB (% share)		57		59		57		47		51	

APPENDIX TABLE 5: PRIORITY SECTOR ADVANCES - 1969-2018- SCBs RS IN BILLION

SNO	YEAR / PARTICULARS/YEAR	1969 PSB	1975 SCB	1975 NB	1975 % share SCB	1975 % NB/SCI SCB	1980 NB	1980 SCB	1980 % share SCB	1980 % NB/SCB
1	NON FOOD CREDIT/ANBC	30.16	90.11	51.23		57%	213.12	125.37		59%
2	PRIORITY SECTOR ADV									
	AGRICULTURE	1.62	9.69	5.92	35%	61%	31.52	17.27	39%	55%
	MICRO & SMALL ENTERPRISES	2.57	11.17	6.02	40%	54%	25.34	15.70	32%	62%
	OTHER PRIORITY SECTOR	0.22								
	ROAD AND WATER TRANSPORT		2.07	1.17	7%	57%	9.14	4.21	11%	46%
	RETAIL TRADE AND SMALL BUSINESS		2.34	1.56	8%	67%	6.82	4.59	8%	67%
	ARTISANS AND VILLAGE INDUSTRIES		1.65	0.99	6%	60%	4.72	3.26	6%	69%
	EDUCATION		0	0	0%	0%	0.00	0.00	0%	0%
	SETTING UP OF INDUSTRIAL ESTATES		0.05	0.01	0%	20%	0.38	0.26	0%	68%
	ADVANCES TO WEAKER SECTIONS									
	HOUSING		0.99	0.66	4%	67%	2.35	1.70	3%	72%
	EXPORT CREDIT									
	MICRO CREDIT									
	TOTAL OF PRIORITY SECTOR	4.41	27.96	16.33		58%	80.27	46.99		59%
	% OF PSA TO ANBC/NFC	14.6%	31.0%	31.9%			37.7%	37.5%		

SNO	YEAR	1991 SCB	1991 NB	1991 % share SCB	1991 % NB/SCI SCB	1998 SCB	1998 NB	1998 % share SCB	1998 % NB/SCI SCB	2003 NB	2003 SCB	2003 % share SCB	2003 % NB/SCB
1	NON FOOD CREDIT/ANBC	1242.02	714.02		57%	3299.44	1607.73		49%	7559.69	3539.29		47%
2	PRIORITY SECTOR ADV												
	AGRICULTURE	185.73	102.78	38%	55%	352.63	179.19	35%	51%	759.35	395.72	36%	52%
	MICRO & SMALL ENTERPRISES	155.12	101.64	32%	66%	286.28	160.17	29%	56%	379.40	236.34	18%	62%
	OTHER PRIORITY SECTOR												
	ROAD AND WATER TRANSPORT	36.23	22.23	7%	61%	64.68	32.16	6%	50%	94.09	45.72	4%	49%
	RETAIL TRADE AND SMALL BUSINESS	68.03	37.46	14%	55%	183.23	94.56	18%	52%	335.28	183.24	16%	55%
	ARTISANS AND VILLAGE INDUSTRIES	9.34	4.32	2%	46%	19.42	7.81	2%	40%	52.25	14.72	2%	28%
	EDUCATION	0.00	0.00	0%	0%	0.00	0.00	0%	0%	0.00	0.00	0%	0%
	SETTING UP OF INDUSTRIAL ESTATES	0.00	0.00	0%	0%	0.00	0.00	0%	0%	0.00	0.00	0%	0%
	ADVANCES TO WEAKER SECTIONS												
	HOUSING	32.97	22.29	7%	68%	96.31	50.31	10%	52%	490.67	223.79	23%	46%
	EXPORT CREDIT												
	MICRO CREDIT												
	TOTAL OF PRIORITY SECTOR	487.42	290.72		60%	1002.55	524.2		52%	2111.04	1099.53		52%
	% OF PSA TO ANBC/NFC	39.2%	40.7%			30.4%	32.6%			27.9%	31.1%		

APPENDIX TABLE 5: PRIORITY SECTOR ADVANCES - 1969-2018- SCBs PAGE 2 RS IN BILLION

YEAR	2010		% share		2013		% share		2015		% share		2018	% share
	SCB	NB	SCB	% NB/SCB	SCB	NB	SCB	% NB/SCB	SCB	NB	SCB	% NB/SCB	SCB	SCB
1 NON FOOD CREDIT/ANBC	30400.00	14436.19		47%	55253.17	24846.00		45%	61134.00	31897.00		52%	76884.23	
2 PRIORITY SECTOR ADV														
AGRICULTURE	4161.33	2552.53	29%	61%	6454.33	3578.00	28%	55%	9422.00	5312.00	36%	56%	10215.91	33%
MICRO & SMALL ENTERPRISES	3735.30	2075.04	26%	56%	0.00	3675.00	0%	#DIV/0!	8902.00	5231.00	34%	59%	9963.64	32%
OTHER PRIORITY SECTOR	0.00		0%		0.00		0%				0%		0.00	0%
ROAD AND WATER TRANSPORT	0.00		0%	#DIV/0!	0.00		0%	#DIV/0!			0%	#DIV/0!		0%
RETAIL TRADE AND SMALL BUSINESS	1634.80		11%	0%	3212.86		14%	0%			0%	#DIV/0!		0%
ARTISANS AND VILLAGE INDUSTRIES	28.26		0%	0%	0.00		0%	#DIV/0!			0%	#DIV/0!		0%
EDUCATION	369.23	225.18	3%	0%	5504.42	335.00	24%	0%	594.00	390.00	2%	0%	607.13	2%
SETTING UP OF INDUSTRIAL ESTATES	0.00		0%	0%	0.00		0%	0%			0%	0%		0%
ADVANCES TO WEAKER SECTIONS	1797.06	1346.09	12%		3474.00	2340.00	15%		5651.00	3346.00	22%		5693.44	18%
HOUSING	2308.17	1022.03	16%	44%	4647.11	1271.00	20%	27%	1423.49	1521.00	5%	107%	3755.87	12%
EXPORT CREDIT	302.00		2%		0.00		0%				0%		283.05	1%
MICRO CREDIT	217.99	53.41	1%		0.00		0%				0%		263.52	1%
TOTAL OF PRIORITY SECTOR	14554.14	7274.28		50%	23292.72	11199		48%	25992.49	15800		61%	30782.56	
% OF PSA TO ANBC/NFC	47.9%	50.4%			42.2%	45.1%			42.5%	49.5%			40.0%	

APPENDIX TABLE 6 : DISTRIBUTION OF LOANS ACCORDING TO SIZE OF LOAN

S NO	YEAR	1972				1975			
	LOAN RANGE Rs million	no of acs mill	amt in Rs billion	% sh ac	% sh amt	no of acs mill	amt in Rs bill	% sh ac	% sh amt
	< = 0.01	3.923	5.017	90.39%	9.03%	5.607	8.308	90.73%	9.22%
	0.01 -0.1	0.318	6.454	7.33%	11.62%	0.473	11.565	7.65%	12.83%
	0.1- 0.5	0.069	7.370	1.59%	13.27%	0.072	10.442	1.17%	11.59%
	0.5-2.5 (1972)/0.5-1.0	0.017	9.872	0.39%	17.78%	0.011	5.562	0.18%	6.17%
	1.0-2.5				0.00%	0.008	8.916	0.13%	9.89%
	>2.5	0.013	26.818	0.30%	48.29%	0.009	45.317	0.15%	50.29%
	TOTAL	4.340	55.531			6.180	90.110		
	YEAR	1980							
	LOAN RANGE Rs million	no of acs mill	amt in Rs billion	% sh ac	% sh amt				
	< = 0.01	16.832	28.856	93.33%	13.54%				
	0.01 -0.1	1.015	29.065	5.63%	13.64%				
	0.1- 0.5	0.140	23.180	0.78%	10.88%				
	0.5-1.0	0.020	10.641	0.11%	4.99%				
	1.0-2.5	0.014	16.709	0.08%	7.84%				
	>2.5	0.013	104.665	0.07%	49.11%				
	TOTAL	18.034	213.116						
	YEAR	1991				1998			
	LOAN RANGE Rs million	no of acs mill	amt in Rs billion	% sh ac	% sh amt	no of acs mill	amt in Rs bill	% sh ac	% sh amt
	< = 0.025	58.784	273.225	94.89%	22.00%	46.828	410.95	87.39%	12.46%
	0.025-0.10	2.130	102.435	3.44%	8.25%	4.249	196.91	7.93%	5.97%
	0.1- 0.2	0.576	70.237	0.93%	5.66%	1.479	197.66	2.76%	5.99%
	0.2 - 0.5	0.270	72.524	0.44%	5.84%	0.638	175.04	1.19%	5.31%
	0.5-1.0	0.079	51.090	0.13%	4.11%	0.161	101.63	0.30%	3.08%
	1.0-2.5	0.054	74.689	0.09%	6.01%	0.107	148.4	0.20%	4.50%
	>2.5	0.054	597.829	0.09%	48.13%	0.122	2068.85	0.23%	62.70%
	TOTAL	61.947	1242.029			53.584	3299.440		
	YEAR	2003 SCBs				2003 NBs			% share
	LOAN RANGE Rs million	no of acs mill	amt in Rs billion	% sh ac	% sh amt	no of acs mill	amt in Rs bill	% sh ac	% sh amt	NB/SCB amt
	< = 0.025	36.87	410.38	61.98%	5.43%	14.99	173.76	60.25%	4.91%	42%
	0.025-0.20	19.65	1040.19	33.03%	13.76%	8.49	511.47	34.12%	14.45%	49%
	0.2 - 0.5	2.050	575.290	3.45%	7.61%	0.910	275.180	3.66%	7.78%	48%
	0.5-1.0	0.490	312.750	0.82%	4.14%	0.250	166.330	1.00%	4.70%	53%
	1.0-2.5	0.230	312.130	0.39%	4.13%	0.120	170.570	0.48%	4.82%	55%
	>2.5	0.201	4908.950	0.34%	64.94%	0.120	2241.980	0.48%	63.35%	46%
	TOTAL	59.491	7559.690			24.880	3539.290			47%
	YEAR	2010 SCBs				2010 NBs			% share
	LOAN RANGE Rs million	no of acs mill	amt in Rs billion	% sh ac	% sh amt	no of acs mill	amt in Rs bill	% sh ac	% sh amt	NB/SCB amt
	< = 0.025	45.18	435.89	38.08%	1.30%	11.5	156.1	31.26%	0.90%	36%
	0.025-0.20	57.45	3171.56	48.42%	9.48%	19.47	1360.46	52.93%	7.83%	43%
	0.2 - 0.5	10.68	2563.60	9.00%	7.66%	3.750	1033.080	10.19%	5.94%	40%
	0.5-1.0	2.94	1632.74	2.48%	4.88%	1.110	682.170	3.02%	3.93%	42%
	1.0-2.5	1.59	1924.47	1.34%	5.75%	0.600	785.410	1.63%	4.52%	41%
	>2.5	0.81	23723.43	0.68%	70.92%	0.354	13362.040	0.96%	76.88%	56%
	TOTAL	118.65	33451.69			36.784	17379.260	100.00%	100.00%	52%
	YEAR	2013 SCBs				2013 NBs			% share
	LOAN RANGE Rs million	no of acs mill	amt in Rs billion	% sh ac	% sh amt	no of acs mill	amt in Rs bill	% sh ac	% sh amt	NB/SCB amt
	< = 0.025	30.88	736.83	24.07%	1.33%	8.73	364.34	19.66%	1.29%	49%
	0.025-0.20	71.43	4411.50	55.68%	7.98%	26.28	1904.39	59.18%	6.75%	43%
	0.2 - 0.5	17.77	4299.55	13.85%	7.78%	6.37	1738.78	14.34%	6.16%	40%
	0.5-1.0	4.30	2407.01	3.35%	4.36%	1.55	961.62	3.49%	3.41%	40%
	1.0-2.5	2.59	3262.15	2.02%	5.90%	0.94	1265.65	2.12%	4.48%	39%
	>2.5	1.32	40136.13	1.03%	72.64%	0.54	21995.11	1.22%	77.91%	55%
	TOTAL	128.29	55253.17			44.41	28229.89			51%
	YEAR	2015 SCBs				2018 SCBs			
	LOAN RANGE Rs million	no of acs mill	amt in Rs billion	% sh ac	% sh amt	no of acs mill	amt in Rs bill	% sh ac	% sh amt
	< = 0.025	29.86	359.95	23.28%	0.65%	36.51	439.84	28.46%	0.80%
	0.025-0.20	81.27	5315.04	63.35%	9.62%	112.04	6863.22	87.33%	12.42%
	0.2 - 0.5	21.56	5322.15	16.81%	9.63%	28.68	6987.96	22.36%	12.65%
	0.5-1.0	6.05	3362.72	4.72%	6.09%	10.80	5787.19	8.42%	10.47%
	1.0-2.5	3.60	4597.27	2.81%	8.32%	5.81	7294.94	4.53%	13.20%
	>2.5	1.90	49827.59	1.48%	90.18%	3.14	60296.57	2.45%	109.13%
	TOTAL	144.24	68784.72			196.98	87669.72		

APPENDIX TABLE 7 : SMALL BORROWER ACCOUNTS -SCBs -1998 to 2018
(accounts in millions; amount in Rs billion; SBA share is percentage of occupation to total loan outstanding)

YEAR	1998			2003			2010		
BANK		SCB			SCB			SCB	
PARTICULARS	ACCTS	AMOUNT	SBA SHAF	ACCTS	AMOUNT	SBA SHAF	ACCTS	AMOUNT	SBA SHARE
OCCUPATION									
AGRICULTURE	20.27	162.84	46%	20.44	439.99	58%	20.44	1636.75	42%
INDUSTRY	2.29	15.28	1%	2.14	39.94	1%	2.14	134.67	1%
SMALL SCALE UNITS	1.15	12.74	4%	1.27	39.27	10%			
TRANSPORT	0.81	6.93	11%	0.50	18.39	20%	0.50	22.82	3%
PROF & OTHER SERVICES	1.77	14.07	12%	1.43	35.10	10%	1.43	105.87	3%
PERSONAL LOANS	8.55	92.49	27%	18.91	566.37	50%	18.91	1226.38	22%
TRADE	7.50	59.97	13%	5.58	136.83	13%	5.58	221.30	7%
FINANCIAL INST	0.00	0.00	0%	0.09	4.82	1%	0.09	40.17	2%
OTHERS	4.49	46.17	20%	6.16	169.86	29%	6.16	219.49	22%
TOTAL	46.83	410.49	12%	56.52	1450.57	19%	55.25	3607.45	11%
ARTISANS & VILLAGE IND	1.94	12.20	63%	1.37	18.93	36%			
RURAL	24.99	188.31	50%	25.12	505.67	66%	33.73	1300.24	52%
SEMI URBAN	13.28	123.50	29%	14.77	418.44	49%	23.40	1065.19	33%
URBAN/METRO	8.56	98.68	4%	16.63	526.46	9%	45.50	1242.01	4%

YEAR	2013			2015			2018		
BANK		SCB			SCB			SCB	
PARTICULARS	ACCTS	AMOUNT	SBA SHAF	ACCTS	AMOUNT	SBA SHAF	ACCTS	AMOUNT	SBA SHARE
OCCUPATION									
AGRICULTURE	52.76	2952.29	44%	63.62	3852.21	43%	76.78	4736.66	39%
INDUSTRY	1.38	248.44	1%	1.62	84.74	0%	6.27	190.49	1%
SMALL SCALE UNITS						0%	0.00	0.00	0%
TRANSPORT	1.16	50.52	4%	1.03	58.96	4%	1.30	74.05	4%
PROF & OTHER SERVICES	1.58	88.02	2%	2.61	113.51	2%	4.72	167.69	3%
PERSONAL LOANS	34.26	1369.60	16%	32.75	1246.84	11%	42.93	1529.70	8%
TRADE	5.96	287.98	5%	4.78	217.14	3%	9.88	399.27	5%
FINANCIAL INST	0.57	38.21	1%	0.29	16.45	0%	0.83	38.10	1%
OTHERS	4.64	113.27	9%	4.42	85.13	6%	5.84	167.10	6%
TOTAL	102.31	5148.33	9%	111.12	5674.98	8%	148.55	7303.06	8%
ARTISANS & VILLAGE IND									
RURAL	39.07	1962.79	43%	42.92	2378.15	40%	46.56	2777.54	38%
SEMI URBAN	27.94	1668.67	30%	31.61	1950.58	26%	40.12	2453.85	23%
URBAN/METRO	35.29	1516.87	3%	36.59	1346.25	2%	61.86	2071.66	3%

APPENDIX TABLE 8 : DISTRIBUTION OF OUTSTANDING CREDITTO CLIENTS BASED ON ORGANISATIOI

FIGURES AS PERCENTAGE TO LOANS OUTSTANDING

YEAR	PUBLIC SECTOR	COOP	PVT FIN	PVT NON FIN CORPS	HOUSEHOLD	MICRO FINAN	NOT FOR PROFIT	NON RESIDENT	others	TOTAL
1972	15.5	1.9		50.3	5.8				26.5	100
1975	22.9	1.8		43.1	6.7				25.5	100
1980	28.3	1.7		33.8	9.7				26.5	100
1991	13.5	1.5		37.6	16.4				31.0	100
1998	12.7	1.1		42.6	18.6				25.0	100
2003	19.9	3.0		43.8	17.1				16.2	100
2010	18.6	4.6	**4.6**	**39.4**	31.6	0.3	0.8	0.0		100
2013	17.9	0.7	**5.2**	**34.7**	39.3	1.7	0.4	0.1		100
2015	19.3	0.7	**8.2**	**34.3**	36.7	0.5	0.3	0.0		100
2018	17.1	0.7	**5.0**	**27.8**	48.3	0.8	0.2	0.1		100

APPENDIX 9 : DISTRIBUTION OF O/S CREDIT BASED ON TYPE OF FACILITY

APPENDIX TABLE 9 : DISTRIBUTION OF OUTSTANDING LOANS OF SCBs ON TYPE OF FACILITY

Rs in billion **all figures as percentage to total**

YEARS	LOAN O/S	CASH CREDIT	OVER DRAFT	TERM LOANS	DEMAND LOAN	PACKING CRED	ADV AG IMP BI	BILLS PURCHAS	UNCLASSIFIED	TOTAL
1972	50.51	50.3	9.4	11.9	6.5	4.1	0.8	16.7	0.3	100
1975	90.29	46.9	7.9	14.5	5.9	4.2	0.7	19.9	0.0	100
1980	303.85	42.5	6.6	21.3	4.9	4.1	1.1	19.5	0.0	100
1991	968.80	35.7	7.8	30.5	3.5	4.4	1.3	15.1	1.7	100
2003	6109.11	26.3	5.7	43.5	11.5	4.6	0.4	7.9	0.1	100
2010	29844.24	16.6	4.3	51.2	11.3	2.6	0.0	14.0	0.0	100
2013	55253.17	19.5	5.7	52.3	16.3	2.2	0.1	3.9	0.0	100
2015	68784.72	19.5	6.6	54.1	14.0	2.3	0.0	3.5	0.0	100
2018	80366.66	17.6	7.6	55.8	14.2	1.8	0.0	2.9	0.1	100

APPENDIX TABLE 10 : ASSET STATUS OF ADVANCES OF SCHEDULED COMMERCIAL BANKS 1991 TO 2018

FIGURES AS PERCENTAGE TO TOTAL — **Rupees in Billion**

S NO	PARTICULARS	1991 SCB AMOUNT	1991 SCB PERC	1993 PSB AMOUNT	1993 PSB PERC	1998 PSB AMOUNT	1998 PSB PERC	2003 SCBs AMOUNT	2003 SCBs PERC	2003 PSBs AMOUNT	2003 PSBs PERC
	STANDARD	900.46		1300.87		2393.18		7092.6		5237.24	
1	SATISFACTORY	900.45	72.5		76.8		84		91.2		90.6
	SUB STANDARD	213.62		152.17		144.63		200.78		149.09	
2	IRREGULAR	155.25	12.5		9		5.1		2.6		2.6
3	SICK VIABLE - UNDER NURSING	58.37	4.7								
	DOUBTFUL	88.18		201.06		258.19		397.31		323.4	
4	SICK NON-VIABLE	32.29	2.6		11.9		9.1		5.1		5.6
5	ADVANCES RECALLED	14.90	1.2								
6	SUIT FILED	40.99	3.3								
	LOSS ASSETS	39.74		39.3		53.71		89.71		68.39	
7	DECREED DEBTS	7.45	0.6		2.3		1.9		1.2		1.2
8	BAD & DOUBTFUL DEBTS	32.29	2.6								
	TOTAL ADV	1242.00		1693.40		2849.71		7780.40		5778.12	
	TOTAL NPA	341.54		392.53		456.53		687.80		540.88	
	% GNPA/G ADV	27.50%		23.18%		16.02%		8.84%		9.36%	
9	PROVISIONS					244.21		318.81		291.23	
10	NET ADVANCES					2605.50		7461.59		5486.89	
11	NET NPA					212.32		368.99		255.37	
12	% NNPA/NADV					8.15%		4.95%		4.65%	
13	cumulative prov/GNPA OF THE GROSS NPA					53.49%		46.35%		53.84%	
	PSB							528.07	77%		
	SBI GROUP					155.22	34%			169.58	31%
	NATIONALISED BANKS					301.31	66%			358.49	66%
	IDBI Bank										

S NO	PARTICULARS	2010 SCBs AMOUNT	2010 SCBs PERC	2010 PSBs AMOUNT	2010 PSBs PERC	2010 NBs AMOUNT	2010 NBs PERC	2013 SCB AMOUNT	2013 SCB PERC	2013 PSB AMOUNT	2013 PSB PERC	2013 NBs AMOUNT	2013 NBs PERC
	STANDARD	31895.48		24620.3		18270.61		51873		39000		30396	
1	SATISFACTORY		97.6		97.81		98.05		96.58		96.6		96.8
	SUB STANDARD	412.94		276.88		185.2		853		766		558	
2	IRREGULAR		1.2		1.05		0.99		1.59		1.61		1.8
3	SICK VIABLE - UNDER NURSING												
	DOUBTFUL	326.68		246.85		150.34		873		735		424	
4	SICK NON-VIABLE		0.94		0.93		0.81		1.63		1.65		1.3
5	ADVANCES RECALLED												
6	SUIT FILED												
	LOSS ASSETS	78.5		49.28		28.41		113		58		35	
7	DECREED DEBTS		0.24		0.21		0.15		0.2		0.14		0.1
8	BAD & DOUBTFUL DEBTS			PSB		NB		SCB		PSB		NB	
	TOTAL ADV	32713.60		25193.31		18634.56		53712.00		40559.00		31413.00	
	TOTAL NPA	818.12		573.01		363.95		1839.00		1559.00		1017.00	
	% GNPA/G ADV	2.50%		2.27%		1.95%		3.42%		3.84%		3.24%	
9	PROVISIONS	456.21		302.82		194.82		954		750		403	
10	NET ADVANCES	32257.39		24890.49		18439.74		52758.00		39809.00		31010.00	
11	NET NPA	361.91		270.19		169.13		885.00		809.00		614.00	
12	% NNPA/NADV	1.12%		1.09%		0.92%		1.68%		2.03%		1.98%	
13	cumulative prov/GNPA OF THE GROSS NPA	55.76%		52.85%		53.53%		51.88%		48.11%		39.63%	
	PSB	573.01	70%					1559	85%				
	SBI GROUP			235.32	41%			600	33%	600	33%		
	NATIONALISED BANKS			363.95	64%	333.41	92%	959	52%	959	52%	894.5	93%
	IDBI Bank					21.29	6%					64.5	7%

APPENDIX TABLE 10 Page 2 : ASSET STATUS OF ADVANCES OF SCHEDULED COMMERCIAL BANKS 1991 TO 2018
FIGURES AS PERCENTAGE TO TOTAL **Rupees in Billion**

	YEAR	2015	SCB	2015	PSB	2018	SCB	2018	PSB
S NO	PARTICULARS	AMOUNT	PERC	AMOUNT	PERC	AMOUNT	PERC	AMOUNT	PERC
	STANDARD	72391		53382		82300		52461	
1	SATISFACTORY		95.7		95		88.8		96.6
	SUB STANDARD	1186		1054		2510		2146	
2	IRREGULAR		1.6		1.9		2.7		1.61
3	SICK VIABLE - UNDER NURSING								
	DOUBTFUL	1861		1631		7248		6277	
4	SICK NON-VIABLE		2.5		2.9		7.8		1.65
5	ADVANCES RECALLED								
6	SUIT FILED								
	LOSS ASSETS	182		100		604		533	
7	DECREED DEBTS		0.2		0.2		0.7		0.14
8	BAD & DOUBTFUL DEBTS	SCB		PSB		SCB		PSB	
	TOTAL ADV	75620.00		56167.00		92662.00		61417.00	
	TOTAL NPA	3229.00		2785.00		10362.00		8956.00	
	% GNPA/G ADV	4.27%		4.96%		11.18%		14.58%	
9	PROVISIONS	1475		1185		5642		4411	
10	NET ADVANCES	74145.00		54982.00		87020.00		57006.00	
11	NET NPA	1754.00		1600.00		4720.00		4545.00	
12	% NNPA/NADV	2.37%		2.91%		5.42%		7.97%	
13	cumulative prov/GNPA	45.68%		42.55%		54.45%		49.25%	
	OF THE GROSS NPA								
	PSB	2785	86%			8956	86%		
	SBI GROUP		0%	735	23%	2234	25%		
	NATIONALISED BANKS		0%	1923	60%	6722	75%	6166	92%
	IDBI Bank			127	5%			556	8%
NOTES	BANK GROUP					SBI GROUP	NB GROI	PSBs	
	BANKS					8	19	27	
1998	BANKS WITH >10% GNPA					7	10	17	
	BANKS WITH >20% GNPA					1	6	7	
	BANKS WITH >5% NNPA					4	10	14	
	BANKS WITH >10% NNPA					4	5	9	

APPENDIX TABLE 10.1: SUMMARY OF ASSET STATUS OF SCBs/PSBs/NBs FROM 1991 TO 2018

YEAR/BANK GROUP	RS BILLION ASSETS	GNPA	SUMMARY PROV	% NPA	NB EXCLUDING IDBI BANK STD%	SUB ST	DOUBT	LOSS	NNPA%	PCR%	% SHARE OF PSB IN SCB	NB IN PSB
1991/SCB/OLD SYSTEM	1242	341.5	***	27.5	72.5	17.2	7.1	3.2	****	****		
2003/SCB	7780.4	687.8	319	8.8	91.2	2.6	5.1	1.2	4.95	46.35	77	68
2010/SCB	32713.6	818.1	456.2	2.5	97.6	1.2	0.9	0.3	1.12	55.7	70	64
2013/SCB	53712	1839	954	3.4	96.6	1.6	1.6	0.2	1.7	51.9	85	62
2015/SCB	75620	3229	1475	4.3	95.7	1.6	2.5	0.2	2.4	45.7	86	60
2018/SCB	92662	10362	5642	11.2	88.8	2.7	7.8	0.7	5.4	54.4	86	69
1993/PSB	1693.4	392.5	***	23.2	76.8	9	11.9	2.3	****	*****		
1998/PSB	2849.7	456.5	244	16	84	5.1	9.1	1.8	8.15	53.5		66
2003/PSB	5778	541	291	9.36	90.6	2.6	5.6	1.2	4.65	53.8		68
2010/PSB	25193	573	303	2.27	97.8	1.1	0.9	0.2	1.09	52.8		64
2013/PSB	40559	1559	750	3.84	96.6	1.6	1.7	0.1	2.03	48.1		62
2015/PSB	56167	2785	1185	4.96	95	1.9	2.9	0.2	2.91	42.5		60
2018/PSB	61417	8956	4411	14.58	85.4	3.5	10.2	0.9	7.97	49.2		69
2010/NB	18634	364	195	1.95	98	1	0.8	0.2	0.92	53.5		
2013/NB	31413	1017	403	3.24	96.8	1.8	1.3	0.1	1.98	39.6		

**** AUTHENTIC DATA NOT READILY AVAILABLE

Appendix Table 10.2 : Indicators of NPA in Scheduled Commercial Banks in India -2003-18 (ratio as percentage)[11]

Year	Gross NPA				NET NPA				REMARKS
	SCB	PSB	SBI	NB	SCB	PSB	SBI	NB	
2003	8.80	9.36	8.68	9.72	4.40	4.53	4.12	4.74	Banks with Gross NPA >10%: 10; & banks with Net NPA >5%: 9.
2004	7.20	7.79	6.98	8.21	2.90	2.99	2.70	3.14	-do- 4 & 3
2005	5.20	5.53	5.32	5.82	2.00	2.06	2.33	1.85	-do- 1 & 2
2006	3.30	3.70	3.51	3.96	1.20	1.30	1.63	1.16	No bank has reported Gross NPA of >10% and Net NPA of >5%.
2007	2.51	2.66	2.59	2.69	1.01	1.05	1.32	0.92	
2008	2.25	2.23	2.58	2.06	1.00	0.99	0.77	1.43	
2009	2.30	2.00	2.50	1.80	1.10	0.70	1.50	0.70	
2010	2.39	2.19	2.70	1.95	1.12	1.10	1.50	0.91	
2011	2.50	2.40	3.40	2.10	1.10	1.20	1.70	1.00	
2012	3.10	3.30	4.60	2.80	1.40	1.70	2.00	1.60	
2013	3.60	4.10	5.00	3.60	1.70	2.00	2.00	2.00	
2014	4.10	4.70			2.20	2.70			Restructured advances to gross advances ratio : SCB:5.90; PSB:7.20
2015	4.30	4.96			2.40	2.91			
2016	7.50	9.30			4.40	5.70			Data reported as PSB (SBI+NB+IDBI). Disaggregated data not reported separately.
2017	9.30	11.70			5.30	6.90			
2018	11.20	14.60			6.00	8.00			

[11] The year-wise, bank group-wise information is collated from the chapter on operations of Scheduled commercial Banks (Chapter 4) of the Report on Trends and progress of Banking in India (published by RBI every year) from the report for the respective year. For the year 2014, the information is collated from the Annual Report of RBI, March 2014.

Appendix Table 10.3 : Sector-wise details of NPA of Scheduled Commercial banks in India (amount in Rs billion; share as %)[12]											
Particulars/ Year/ Bank group	**Total NPA**	**NPA in Priority sector**	**share to total**	**NPA in Agri**	**Share to total**	**NPA in Ind**	**Share to total**	**NPA in others**	**Share to total**	**NPA in Non-priority sector**	**Share to total**
2003											
Public Sector Banks (PSB)	578	249	47	77	15	102	19	71	13	268	51
Nationalised Banks (NB)	358	169	47	47	13	71	20	50	14	184	51
2010											
PSB	573	309	34	83	15	115	20	110	19	246	46
NB	355	199	56	57	16	87	24	55	15	155	44
2013											
PSB	1559	669	43	280	18	284	18	105	7	890	57
NB	959	405	42	156	16	178	19	70	7	554	58
2018											
SCB	9626	2076	21	832	9	910	10	334	4	7555	78
PSB	8455	1875	22	753	9	821	10	301	4	6580	78

[12] Report on the Trends and progress of Banking in India, RBI, respective years.

Appendix Table 11: PROFITABLITY OF SCBs vis a vis NATIONALISED BANKS

YEAR		RUPEES IN BILLION											RATIOS		
PARTICULARS	BANKS	INT INC	OTH INC	TOT INC	INT EXP	OP EXP	PROV/C	TOT EXP	NIM	OP PROF	NET PRO	ASSETS	NIM	OPR	NPR
1995															
SCHEDULED COMM BANKS	272	452.4	64.96	517.36	296.72	147.74	56.13	500.59	155.68	72.9	16.77				
STATE BANK GROUP	8	138.62	20.85	159.47	87.51	46.13	17.37	151.01	51.11	25.83	8.46		3.26	1.95	0.54
NATIONALISED BANKS	19	239.84	30.15	269.99	162.6	78.02	26.68	267.3	77.24	29.37	2.69		2.23	1.12	0.1
PUBLIC SECTOR BANKS	27	378.46	51	429.46	250.11	124.15	44.05	418.31	128.35	55.2	11.15		2.92	1.41	0.25
1996															
SCHEDULED COMM BANKS	284	585.27	90.13	675.4	383.2	182.89	93.65	659.74	202.07	109.31	15.66				
STATE BANK GROUP	8	171.14	34.52	205.66	108.72	57.72	31.2	197.64	62.42	39.22	8.02		3.34	2.1	0.42
NATIONALISED BANKS	19	295.06	35.92	330.98	200.89	93.64	47.84	342.37	94.17	36.45	-11.39		2.92	1.14	-0.36
PUBLIC SECTOR BANKS	27	466.2	70.44	536.64	309.61	151.36	79.04	540.01	156.59	75.67	-3.37		3.08	1.49	-0.07
1998															
SCHEDULED COMM BANKS	299	763.45	122.59	886.04	520.58	217.76	82.49	820.83	242.87	147.7	65.21	7955.35	2.95	1.84	0.82
STATE BANK GROUP	8	212.09	36.62	248.71	139.04	62.35	23.21	224.6	73.05	47.32	24.11	2327.47	3.14	2.03	1.06
NATIONALISED BANKS	19	378.58	49.73	428.31	262.6	110.39	29.64	402.63	115.98	55.32	25.68	4164.39	2.55	1.33	0.62
PUBLIC SECTOR BANKS	27	590.67	86.35	677.02	401.64	172.74	52.85	627.23	189.03	102.64	49.79	6491.86	2.91	1.58	0.77
2003															
SCHEDULED COMM BANKS	288	1458.82	320.09	1778.91	969.15	396.54	236.9	1602.59	489.67	413.22	176.32	16989.16	2.88%	2.38	1.04%
STATE BANK GROUP	8	408.69	79.98	488.67	272.07	104.31	67.18	443.56	136.62	112.29	45.11	4939.54	2.77%	2.27	0.91%
NATIONALISED BANKS	19	663.24	132.73	795.97	426.46	184.66	107.02	718.14	236.78	184.85	77.83	7912.81	2.99%	2.33	0.98%
PUBLIC SECTOR BANKS	27	1071.93	212.71	1284.64	698.53	288.97	174.2	1161.7	373.4	297.14	122.94	12852.35	2.91%	2.31	0.96%
2010															
SCHEDULED COMM BANKS	81	4151.79	792.68	4944.47	2720.84	1000.28	652.26	4373.38	1430.95	1223.35	571.09	60251.41	2.37%	2.03%	0.95%
STATE BANK GROUP	7	979.54	183.94	1163.48	662.29	252.83	124.03	1039.15	317.25	248.36	124.33	14125.15	2.25%	1.76%	0.88%
NATIONALISED BANKS	20	2080.29	305	2385.29	1457.12	407.92	252	2117.04	623.17	520.25	268.25	30285.99	2.06%	1.72%	0.89%
PUBLIC SECTOR BANKS	27	3059.83	488.94	3548.77	2119.41	660.75	376.03	3156.19	940.42	768.61	392.58	44411.14	2.12%	1.73%	0.88%
2013															
SCHEDULED COMM BANKS	89	7636.12	977.87	8613.99	5138.03	1565.85	998.45	7702.33	2498.09	1910.11	911.66	95733	2.61%	2.00%	0.95%
STATE BANK GROUP	6	1637.68	197.44	1835.12	1065.33	370.94	221.01	1657.28	572.35	398.85	177.84	20657	2.77%	1.93%	0.86%
NATIONALISED BANKS	20	3911.09	370.37	4281.46	2813.96	647.18	492.33	3953.47	1097.13	820.32	327.99	48962	2.24%	1.68%	0.67%
PUBLIC SECTOR BANKS	26	5548.77	567.81	6116.58	3879.29	1018.12	713.34	5610.75	1669.48	1219.17	505.83	69619	2.40%	1.75%	0.73%
2015															
SCHEDULED COMM BANKS	91	9407.76	1324.09	10731.85	6370.57	2028.03	1442.47	9841.07	3037.19	2333.25	890.78	120370	2.52%	1.94%	0.74%
STATE BANK GROUP	6	2020.86	276.16	2297.02	1327.7	480.75	325.56	2134.01	693.16	488.57	163.01	26067	2.66%	1.87%	0.63%
NATIONALISED BANKS	21	4740.99	479.81	5220.8	3482.06	842.9	683.45	5008.41	1258.93	895.84	212.39	60722	2.07%	1.48%	0.35%
PUBLIC SECTOR BANKS	27	6761.85	755.97	7517.82	4809.76	1323.65	1009.01	7142.42	1952.09	1384.41	375.4	86789	2.25%	1.60%	0.43%
2018															
SCHEDULED COMM BANKS	92	10219.8	1955.81	12175.62	6535.13	2715.67	3249.2	12500	3684.68	2924.82	-324.38	152533	2.42%	1.92%	-0.21%
STATE BANK GROUP	1	2204.99	446.01	2651	1456.46	599.43	660.58	2716.47	748.53	595.11	-65.47	34547	2.17%	1.72%	-0.19%
NATIONALISED BANKS	20	4398.72	701.41	5100.13	3095.75	1043.63	1748.98	5888.36	1302.97	960.75	-788.23	65804	1.98%	1.46%	-1.20%
PUBLIC SECTOR BANKS	21	6603.71	1147.42	7751.13	4552.21	1643.06	2409.56	8604.83	2051.5	1555.86	-853.7	100351	2.04%	1.55%	-0.85%

Appendix table 12: Profitability parameters AND FINANCIAL SOUNDNESS INDICATORS – Scheduled Commercial Banks – 1998 to 2018

(amount Rupees in Billion, figures as %)

Particulars/year	1998	2003	2010	2013	2015	2018
Gross profit ratio						
SCBs	1.84	2.38	2.03	2.00	1.94	1.92
PSBs	1.58	2.31	1.73	1.75	1.60	1.55
NBs	1.33	2.33	1.72	1.68	1.48	1.46
Net profit ratio (Return on Assets or ROA)						
SCBs	0.82	1.04	0.95	0.95	0.74	-0.21
PSBs	0.77	0.96	0.88	0.73	0.43	-0.85
NBs	0.62	0.98	0.89	0.67	0.35	-1.20
Return on Equity (ROE)						
SCBs	NA	0.80	14.31	13.84	10.42	(-)2.81
PSBs	NA	0.86	17.47	13.24	7.76	(-)14.62
NBs	NA	0.59	18.30	12.34	6.44	NA
Net Interest Margin (NIM) or Spread						
SCBs	2.95	2.88	2.37	2.61	2.52	2.42
PSBs	2.91	2.91	2.12	2.40	2.25	2.04
NBs	2.55	2.99	2.06	2.24	2.07	1.98
CRAR						
SCBs	NA	NA	14.5	13.88	NA	13.8
PSBs	NA	NA	13.3	12.38	NA	12.1
NBs	NA	NA	13.2	12.26	NA	NA
GNPA						
SCBs	NA	8.84	2.50	3.42	4.27	11.2
PSBs	16.02	9.36	2.27	3.84	4.96	14.6
NBs	NA	NA	1.95	3.24	NA	17.2
LEVERAGE RATIO						
SCBs	XX	XX	6.6	NA	NA	6.7
PSBs	XX	XX	NA	NA	NA	5.0
NBs	XX	XX	NA	NA	NA	NA
LEVERAGE RATIO						
SCBs	XX	XX	XX	XX	XX	125%
PSBs	XX	XX	XX	XX	XX	125%
NBs	XX	XX	XX	XX	XX	NA

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Various Publications of the Reserve Bank of India (www.rbi.org.in) have been extensively used for sourcing the data and information in the preparation of this research paper. Important among them are:
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3. Annual Report, Reserve Bank of India, Mumbai, India – from 2000-2019.
4. The Report on the Trend and Progress of Banking in India (RTPBI) – annual – 1998-2018.
5. Financial Stability Report – RBI- half-yearly- December 2014 to June 2019.
6. Various committee reports.
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11. website of Finance Ministry, Government of India (www.finmin.nic.in).
12. Many write-ups on the web appearing under the search "Nationalisation of Banks in India" including experiences, write-ups, articles, news items etc.

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[i] Agricultural labourers, tenant cultivators, small and marginal farmers, village artisans, small business, household enterprises and small scale industries predominantly operating in rural India.

[ii] 19 Nationalised Banks, State Bank of India & its associate Banks; and IDBI Bank.

[iii] 21 public sector banks, 21 private sector banks, 45 Foreign Banks, 56 Regional Rural Banks, 3 Local area banks and 10 Small Finance Banks.

[iv] Table IV.1, Report of Trend and Progress of Banking in India, 2018, RBI, December 2018.

[v] Total NPA of SCBs was Rs.9.626 trillion of which Public Sector banks was Rs.8.95 trillion and of 19 nationalised banks was Rs.6.165 trillion.

[vi] Formed by the amalgamation of Dena Bank and Vijaya Bank in Bank of Baroda, with effect from 1.4.2018.

[vii] Oriental Bank of Commerce and United Bank of India with Punjab National Bank; Syndicate Bank with Canara Bank; Andhra Bank and Corporation bank with Union Bank of India; and Allahabad Bank with Indian Bank.

[viii] BSR, an annual compilation of RBI presents comprehensive data on deposits and credit of Scheduled Commercial Banks (SCBs) as on 31 March of each year. The data is collected from all the SCBs (including RRBs) through two statutory (submitted under Section 42 (2) of RBI Act, 1934) fortnightly returns-BSR 1 (Credit) and BSR 2 (Deposits and Employee information), besides annual statistical surveys conducted by the RBI. This compilation was started in 1972 (with base year as 1969) based on the monitoring needs of RBI. The annual compilation for the year 2018 is the 47th Volume. The content and coverage of BSR 1& 2 has undergone change in tune with the regulatory perception and economic environment, based on which the information has also undergone change over the years.

[ix] STRBI, one another annual compilation of RBI is a publication since inception , covering all the banks including SCBs, Foreign Banks, Urban cooperative Banks and other non-scheduled banks. This compilation is currently providing information based on annual accounts, other tables and tables published in Report on the trend and progress of Banking in India. This compilation is used for analyzing information from the year 1996, the year from which the report is available in soft form in RBI archives.

[x] Bank of Baroda, Punjab National Bank, Canara Bank, Union Bank of India, Indian Bank (five mega Banks); Bank of India, Central Bank of India (two big banks); Indian Overseas Bank, Bank of Maharashtra, Punjab and Sind Bank and UCO Bank (four regional Banks).

[xi] Allahabad Bank, Bank of Baroda, Bank of India, Bank of Maharashtra, Canara Bank, Central Bank of India, Dena Bank, Indian Bank, Indian Overseas Bank, Punjab National Bank, Syndicate Bank, UCO Bank, Union Bank of India and United Bank of India.

[xii] Andhra Bank, Corporation Bank, New Bank of India, Oriental Bank of Commerce, Punjab & Sind Bank and Vijaya Bank.

[xiii] Preparedness of the officers and staff of the organisation to provide the banking services to the clientele including appraisal, assessment, monitoring, communication and management of business, clients and communities.

[xiv] Capital adequacy, asset quality, liquidity, risk (cyclical and counter cyclical) absorption capacity, profitability.

[xv] Compliance with enhanced minimum capital and liquidity requirement; enhanced supervisory review process for firm-wide risk management and capital planning and enhanced risk disclosure and market discipline are the three pillars of Basel III.

[xvi] The seven components of Indradhanush (symbolic of the rainbow) are – 1. Separation of MD and CEO posts in banks to check excess concentration of power, 2. Bank Boards Bureau to replace appointments board of PSBs besides guiding the banks 3. To recapitalize banks to the tune of Rs.700 billion to improve their lending power 4. Solve issues of infrastructure sector to de-stress the banks from NPAs, 5. Greater autonomy for banks to hire man-power, 6. Banks to be assessed based on performance under key performance indicators and 7. Governance reforms for resolving current issues and future policy with Government.

[xvii] As of March 2018, there were 39662 rural, 7691 semi-urban, 454 urban and 46 metropolitan banking centers in India. RBI, BSR, 2018.

[xviii] The SLR and CRR in 2018 March were 19.5% and 4% respectively.

[xix] Measured as business per branch = (deposits+advances)/number of branches.

[xx] Presented together with IDBI and SBI as Public Sector Banks group.

[xxi] Credit limits up to Rs.1 million.

[xxii] Credit limits up to Rs.3.5 million in metropolitan centers and up to Rs.2.5 million in other centers.

[xxiii] Individual limits up to Rs.50 million for schools and investments for creating health care, drinking water and sanitation facilities in rural and semi-urban areas.

[xxiv] Credit limit up to Rs.150 million for approved investments.

[xxv] Includes farm credit, Agricultural infrastructure and ancillary activities.

[xxvi] A micro enterprise is one where the investment in plant and machinery does not exceed Rs.2.5 million. These limits for small scale enterprise is between Rs.2.5 million and Rs.50 million & from Rs. 50 million to Rs.100 million for medium scale enterprise. This is applicable for manufacturing enterprises. For service sector enterprises, the credit limits are up to Rs.1 million, Rs.1 million to Rs,20 million and from Rs.20 million to Rs.50 million respectively or as defined by Micro Small Medium Enterprises Development Act,2006. In the year 2015, Government of India proposed an amendment linking it to annual turnover; according to which the enterprises with turnover up to Rs. 50 million are micro enterprises, those between Rs.50 million & Rs.750 million are small enterprises and those with annual turnover between 750 million & 2.5 billion are medium enterprises. There were more than 36 million Micro Small and Medium Enterprises working in India as on 31 March 2017.

[xxvii] Weaker sections include – 1.small and marginal farmers, 2. Artisans and Village, Cottage industries where the individual credit limits does not exceed Rs.0.1 million, beneficiaries of Government sponsored schemes, scheduled Castes and Scheduled tribes, beneficiaries of differential rate of interest (DRI) scheme, self help groups, distressed farmers indebted to non-institutional lenders, distressed persons other than farmers indebted to non-institutional lenders with a loan limit not exceeding Rs.0.1 million, individual women beneficiaries with a credit limit up to Rs.0.1 million, persons with disabilities and overdrafts in Prime Minister's Jan Dhan Yojana (PMJDY) accounts up to Rs.10,000.

[xxviii] Small farmer is one whose agricultural land holding is between 1 ha to 2 ha; and marginal farmer is one whose agricultural land holding is less than 1 ha.

[xxix] Trend and Progress of Banking in India, RBI, 2004, Appendix Table 3.24.

[xxx] Note was submitted by Dr Rajan to the committee on 6th September 2018.

[xxxi] Other than Andhra Bank, Bank of Baroda, Central Bank of India, Dena Bank, Punjab& Sind Bank, Syndicate Bank, UCO Bank and Vijaya Bank.

[xxxii] Are Basel capital standards pro-cyclical? Some empirical evidence from India, Saibal Ghosh and D M Nachane, Economic and Political weekly, volume 38,No.8, Money, Banking and Finance, (February 22-28,2003) pp. 777-778+780-784, https://www.jstor.org/stable/4413.

[xxxiii] Para IV.38, Chapter 4, The Report on Trend and progress of Banking in India, 2018, Reserve Bank of India, December 2018.

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Energy Efficiency and Improvement European countries: Data Envelopment Analysis approach

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Abstract-The challenge that all developed countries are facing is how to grow their economies in a sustainable way. To do this, energy efficiency is proposed as one of the keys solutions. In Europe, energy efficiency is one of the key elements; therefore; Europe the world's largest energy importer worldwide. Considering the core role of energy efficiency to Europe, the main objectives of this study are to measure energy efficiency and examine energy improvement of European countries during 2010-2017 by applying Data envelopment analysis (DEA) Slack-based measure model (SBM) and Malmquist Productivity Index (MPI). Findings of this study indicated France, Hungary, Greece, Italy, Netherland, Poland, Portugal, Switzerland and United Kingdom are efficient in terms of energy. Regarding energy improvement, only one country showed the improvement during observed period 2013-2017. This study provides important information of the current status of energy efficiency and improvement of European countries, which can help policymakers and strategy makers in deciding different energy strategies and policies.

Index Terms- Energy efficiency, Data envelopment analysis, Europe, SBM, MPI.

I. Introduction

According to [1], the challenge that all developed countries are facing is how to grow their economies in a sustainable way. To do this, energy efficiency is proposed as one of the keys solutions since energy efficiency is considered as the input that is indispensable in the creation of value-added. Energy efficiency can help to improve economic growth, ensure energy security and sustainability by cutting down greenhouse gas emissions. Considering the importance of energy efficiency, governments all over the world have implemented policy to stimulate energy efficiency, specially, regions where energy efficiency is the greatest concern such as Europe.

It was found that more attention has been devoted to examining energy efficiency at the cross-national level than that to the cross-regional level. The main reason for this might be explained by the limited relevant data. However, a regional level plays the core role in implementing energy policies and action plans. This is especially important for EU that considers the Nomenclature of Territorial Units for Statistics (NUTS) 2 level as the basic level for planning EU Cohesion Policy interventions [2]. Accordingly, energy efficiency is one of the key elements of European energy policy, which is most evident in current policies as well as major targets for 2020 and 2030 [3]. In December 2015, the COP21 meeting and the Paris Agreement stressed more than ever how crucial it is for the future of mankind to hold the increase in the global average temperature to well below 2°C above pre-industrial levels (and even to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels). According to the International Energy Agency (IEA) [4], energy efficiency is central to any two-degree energy scenario. The IEA considers that, by 2035, investments in energy efficiency need to represent nearly half of all the global energy investments required to stay under the two-degree limit. Accordingly, energy efficiency is one of the key elements of the EU's energy policy. This is reflected in existing legislation and in targets to be reached by 2020 and 2030.

Energy is an extremely important element of the European Union economy. Europe annually consumes 11% of global energy (i.e. 1,606 million toes in 2014), of which 53% of imported energy costs EUR 400 billion (~3% of EU GDP in 2015) per year, making Europe into the world's largest energy importer worldwide. There are many reports and studies that have shown that the economic potential of Europe has not yet been exploited because energy use has not yet achieved significant efficiency [5].

Putting strong emphasis on energy efficiency is in line with the objectives set in the 2030 climate and energy framework and the energy union strategy. By using energy more efficiently, Europeans can lower their energy bills, reduce their reliance on imported fuels and help protect the environment. This is also good for public health (e.g. by reducing air pollution). Doubling the global rate of improvement in energy efficiency by 2030 is a key objective of the Sustainable Development Goals [6].

Considering the core role of energy efficiency to Europe, this study aims to evaluate energy efficiency of European countries during 2010-2017. In this study Data envelopment analysis (DEA) will be applied to measure and forecast energy efficiency of European countries.

Since energy efficiency is one of the most powerful solutions for the sustainable development, it draws the great attentions of not only policymakers but also academic researchers. Many previous measuring and evaluating energy efficiency were found in literature and classified under three groups: cross-level studies [7-18], sub-national level researches and sectional-level studies [19-24].
Data envelopment Analysis (DEA) is one of the most popular non-parametric method used to measure efficiency with its application in many different fields included energy sector. That is a reason why there are many previous studies used DEA to evaluate energy efficiency sectionally and regionally as well as globally.

A DEA slack-based measure (SBM) model and Malmquist productivity index (MPI) were applied in the study of Wang et al [7] which evaluated the efficiency and improvement in terms of energy of 25 different countries over the world. That study found that developed countries tend to have higher energy efficiency than developing countries. By applying DEAM SBM, study of Rui [8] measured energy efficiency of 87 selected countries. Finding of that study revealed that consuming clean energy increase the emissions reduction efficiency and slightly improve the economic output efficiency. Yaser Iftikhar [9] carried on the study concerning the energy and CO2 emissions efficiency of different countries on the world by using network DEA. In this study, non-energy such as labor forces and gross capital formation and energy consumption were selected as inputs while GDP and CO2 emissions represented good output and bad output respectively. Results of this study indicated none overall efficient country and China was the worst country in terms of energy efficiency. Suzuki and Nijkamp [10] examined efficiency in terms of energy, environment and economic of EU-27, APEC countries. Results of Suzuki's study found that that EU countries appear to generally exhibit a higher efficiency than APEC and ASEAN countries.

Moutiho [11] used two methods to assess the economic and environmental performance of European countries in 2001-2012. The first step is to approach the DEA method to measure the performance of selected countries. Then, the quantum regression technique was applied to point out different efficiency points among European countries through indicators such as domestic material consumption, Resources Productivity, Environmental Taxes Revenues. The article presented the opinion that differences in emissions are significantly affected by the rate of keeping renewable energy and non-renewable energy. Robaina-Alves et al. [12] approached the DEA analysis model to evaluate the energy and environment efficiency problems of European countries in two separate periods 2000-2004 and 2005-2011. Camioto et al. [13] connected the DEA with Slacks-Based Measure demonstrate and the window investigation to quantify and dissect vitality effectiveness in the nations that involve the BRICS gathering and the G7 gathering. Data sources are Workforce, net fixed capital development, Energy utilization, and yields are CO2 and GDP. This examination demonstrated that the G7 has a total-factor energy efficiency record well over the BRICS.

Ceylan et al. [14] calculated the total-factor energy efficiency scores for Turkey, then compared with EU-27 in terms of energy efficiency performance and energy saving potential. The authors found the energy efficiency improvement over the years both in Turkey and EU-27. Vlahinic-Dizdarevic [15] examined the change in energy efficiency of 26 countries in European Union over 2000-2010 by applying DEA with the results indicating the improvement in energy efficiency of all 26 EU countries over the observed years. Makridou et al. [16] used DEA with multiple inputs to measure energy efficiency of 26 EU countries during 2000-2010. Madaleno et al. [17] evaluate the energy efficiency of 26 EU countries during 2001-2012 by using deafferent DEA methods as input-oriented model; output-oriented and non-oriented models. The results of that study indicated that the ranking of these countries were varies and depended on the evaluating model, observed years and the efficiency scale.

II. DATA AND RESEARC METHODOLOGY

2.1. Input and Output Selection

We define energy efficiency as using non-energy inputs such as economic indicators and energy inputs as total energy consumption to effectively enhance economy and reduce greenhouse gases [25]. Therefore, Gross domestic product (GDP) is chosen as desirable output while greenhouse gases represent undesirable outputs. For the inputs, energy consumption and the share of renewable energy are chosen as two energy-input while labor productivity and capital stock are two economic inputs. Since CO2 is the most outstanding emissions of greenhouse gases, we; therefore; chose CO2 emissions to represent bad outputs. Due to the data of Capital stock cannot be obtained from any direct sources; therefore; Gross capital formation is chosen as an alternative indicator. Data of this study was collected from two main sources: Ener Data [26] and the World Bank [207.
Since the data of inputs and outputs of some European countries could not be sufficiently provided, the author used 17 countries that provided sufficient data to make an evaluation. Table 1 shows the inputs; outputs of this research. After DMUs collection of DMUs and setting inputs and outputs, the summary of inputs and outputs is shown in Table 2.

Table 1. Research variables - Inputs and outputs

Variables	Code	Name	Measurement
Inputs	X1	The energy use measured	Ton of oil equivalent per capita
	X2	The labor productivity	GDP per employer (US$)
	X3	The share of renewable energy in total final energy consumption	Percentage (%)
	X4	The Gross Capital Formation productivity	Percentage GDP (%)
Desirable output	Y1	GDP per capita	US$
Undesirable output	Y2	CO2 emissions per capita	Metrics tons per capita

After all needed data is collected and set, the analysis step is started and the summary of all variables in this study is presented as table 2 below.

Table 2. Summary of inputs and outputs during 2013-2017

		X1	X2	X3	X4	Y1	Y2
2013	Max	8.82	122,430.20	57.73	27.90	103,059.20	12.55
	Min	2.05	54,314.94	5.02	11.60	13,667.70	4.25
	Average	4.00	83,189.59	21.75	20.19	43,191.44	7.43
	SD	1.62	17,653.46	14.74	3.84	23,364.31	2.32
2014	Max	9.01	123,591.71	57.20	28.10	97,199.90	11.84
	Min	2.06	54,888.94	5.66	11.90	14,201.40	4.14
	Average	3.87	83,773.83	22.29	20.79	43,476.39	6.99
	SD	1.64	17,986.01	14.76	3.92	22,596.21	2.15
2015	Max	9.06	124,707.10	57.77	28.00	82,016.00	12.24
	Min	2.17	56,277.59	5.89	9.80	12,483.90	4.45
	Average	3.90	84,453.64	22.64	20.91	37,491.58	7.09
	SD	1.65	18,065.87	15.16	4.29	19,189.43	2.20
2016	Max	9.04	126,032.54	58.35	28.28	82,836.16	12.37
	Min	2.24	56,390.05	5.95	9.90	12,608.74	4.50
	Average	3.94	84,849.37	22.86	21.11	37,866.49	7.16
	SD	1.65	18,436.81	15.31	4.33	19,381.32	2.23
2017	Max	9.13	127,292.86	58.93	28.80	80,189.70	12.20
	Min	2.26	56,953.95	6.01	11.70	13,863.20	4.54
	Average	3.98	85,697.86	23.09	21.51	39,097.65	7.19
	SD	1.66	18,621.18	15.46	4.17	18,756.19	2.18

2.2. DEA slack-base measure model

According to Tone [28], in accordance with the environmental conservation awareness, undesirable output should be taken into consideration when evaluating the efficiency. To deal with the present of undesirable output, Tone [28] proposed a model named Slack-based Model (SBM) in 2001, then modified in 2003. According to Tone [28], in SBM, each decision-making unit (DMU) is assumed to

have three factors: inputs, good (desirable) outputs and bad (undesirable) outputs and represented by three vectors x $\in R^m$, $Y^g \in R^{s1}$ $Y^b \in R^{s2}$ respectively. The inputs, good outputs and bad outputs matrices are as following:

$$X = [x_1, \ldots, x_n] \in R^{mxn}$$
$$Y^g = [y_1^g, \ldots, y_n^g] \in R^{s1xn}$$
$$Y^b = [y_1^b, \ldots, y_n^b] \in R^{s2xn}$$
$$X, Y^g, Y^b > 0$$

For a DMU (x_o, y_o^g, y_o^b), the production possibility set defined by:

$$P = \{(x, y^g, y^b) | x \geq X\lambda, y^g \leq Y^g\lambda, y^b \geq Y^b\lambda, L \leq e\lambda \leq U, \lambda \geq 0|\}$$

Where $\lambda \in R^n$ is the intensity vector, and L and U are the lower and upper bounds of the intensity vector respectively.

A DMU (x_o, y_o^g, y_o^b) is efficient if and only if there is now vector $(x_o, y_o^g, y_o^b) \in$ P such that $x_0 \geq x, y_o^g \leq y^g, y_o^b \geq y^b$ with at least one strict inequality. SBM of Tone (2001) is modified as follow:

$$[\text{SBM}]\ \rho^* = \min \frac{1 - \frac{1}{m}\sum_{i=1}^{m}\frac{s_{io}^-}{x_{io}}}{1 + \frac{1}{s}\left(\sum_{r=1}^{s_1}\frac{s_r^g}{y_{ro}^g} + \sum_{r=1}^{s_2}\frac{s_r^b}{y_{ro}^b}\right)}$$

Subject to

$$xo = X\lambda + S^-$$
$$y_o^g = Y\lambda - S^g$$
$$y_o^b = Y\lambda + S^b$$
$$L \leq e\lambda \leq U$$
$$S^-, S^g, S^b, \lambda \geq 0.$$

The vectors S^- refers to the surplusage inputs while S^b indicates the excess in undesirable outputs, S^g represents the shortage in desirable outputs. The DMU_o is efficient with consideration of bad output of and only if ρ* = 1 or in the other words, S^{-*}= 0, S^{g*}= 0 and S^{b*}= 0.

2.3. Malmquist Productivity Index (MPI)

According to [29], the output-based Malmquist productivity index is defined by the following equation:

$$MPI = \left[\frac{d_o^s(x_t, y_t)}{d_o^s(x_s, y_s)} \times \frac{d_o^t(x_t, y_t)}{d_o^t(x_s, y_s)}\right]^{1/2}$$

Where d_o^s is a distance function measuring the efficiency of conversion of inputs xs to outputs ys in the period s. DEA efficiency is considered a distance measure because it reflects the efficiency of converting inputs to outputs [29].

Whereas, if there is a technical change in period t, then,

$d_0^t(x_s, y_s)$ = Efficiency of conversion of input in period s to output in period s≠ $d_0^s(x_s, y_s)$

Malmquist productivity index is defined as a geometric average of the efficiency and technical changes in the regarded two periods. Following [29], the Malmquist productivity index can be also written as follows:

$$MPI = \left[\frac{d_o^s(x_t, y_t)}{d_o^s(x_s, y_s)} \times \frac{d_o^t(x_t, y_t)}{d_o^t(x_s, y_s)}\right]^{1/2}$$

MPI = Efficiency change x Technical change

Malmquist productivity index is used to estimate changes in the overall productivity of each pharmaceutical company over time. MPI >1 show productivity increase; MPI= 1 indicates productivity do not change; MPI < 1 means that productivity decreases.

Efficiency change is called "catch-up effect", the efficiency change term related to the degree to which a DMU improves or worsens its efficiency. Efficiency change >1 talk progress in relative efficiency from period s to t, while efficiency change = 1 and efficiency change < 1 respectively mean no change and regress in efficiency.

Technical change is called "frontier-shift effect" (or innovation effect indicating the change in efficient frontiers between the two different time periods with the value > 1 indicating the improvement while the value < 1 means the regress.

III. EMPIRICAL RESULTS

DEA-Solver-Pro version 13 software is used in this study to measure energy efficiency and energy improvement under two models SBM model and MPI.

A. Correlation Analysis

Before measuring energy efficiency, a needed step should be done that is to test the correlation between inputs and outputs. This step is needed because of the prerequisite condition of DEA. Input data for the DEA model must meet the isotonicity criteria which requires the level of output must increase or at least the same when inputs increase. Table 3 presents the results of correlation analysis for the year 2017.

As shown at table 4.4, all the Pearson correlation coefficients are estimated to be positive with desirable output-Y1with the correlation coefficient value ranged from 0.5 to 0.8, indicating the explanatory power of the inputs and outputs in the model which means the choice of inputs and outputs is suitable. In contrary, input-the share of renewable energy has the negative correlation with undesirable output. The reason for this phenomenon is that using more renewable energy can reduce the greenhouse gases. Other inputs showed to have positive but insignificant correlation with CO2 emissions.

Table 3. Results of Correlation Analysis-2017

	X1	X2	X3	X4	Y2	Y1
X1	1	0.7636044	0.6306863	0.6709415	0.28292	0.6777861
X2	0.7636044	1	0.4443673	0.5048966	0.0364256	0.8775034
X3	0.6306863	0.4443673	1	0.4940977	-0.3450647	0.5254103
X4	0.6709415	0.5048966	0.4940977	1	0.0585877	0.5153736
Y2	0.28292	0.0364256	-0.3450647	0.0585877	1	-0.0716156
Y1	0.6777861	0.8775034	0.5254103	0.5153736	-0.0716156	1

B. Energy efficiency during 2013-2017 under DEA SBM.

In this section, the results of energy efficiency obtained from DEA SBM model will be presented. DEA SBM is applied in this section as it can deal with the undesirable output-CO2 emissions.

The obtained energy efficiency scores of these selected countries are presented in Table 4 below. The score closer to 1 indicating the more efficient the country is. As shown at table 4, it is obvious that the average energy efficiency score over sample time period 2013-2017 for all seventeen countries is 0.835. This result implies that there is the presence of inefficiency, which requires these countries to improve energy efficiency or reduce inefficiency proportionately by augmenting their outputs by approximately16.5% without changing the inputs levels. As can be seen at table 4, the efficiency score of seventeen countries across sample time is lower than 1. However, for individual years, we found the fluctuation but decrease trend in average score. For instance, average score slightly drops from 0.872 in 2013 to 0.860 in 2014, then it witnessed the rapid decrease to 0.814 in 2015 and continued declining to the bottom of 0.809 in 2016, after that experienced the minor recovery in 2017 to 0.822.

By looking at individual countries, we observe that there is a notable difference in energy efficiency of these seventeen countries. There are some countries that are on the efficiency frontier such as France, Hungary, Greece, Italy, Netherland, Poland, Portugal, Switzerland and United Kingdom. On contrast, Australia, Belgium, Czech Republic, Finland, Germany, Norway, Spain and Sweden showed that they are quite far from the efficiency frontier.

The results at table 4 shows the extreme variation among these countries. On one hand, the best performance countries score 100% averagely in term of efficiency. On the other hand, the poorest performance is just 55.9%. It is worth to note that during 2013-2017, there are 9 reaches the best performance with efficiency score of 1 and this represent 52.9% of the sample of this study. The rest countries in this study accounted for 47.1% have the score which is notably far from the efficiency frontier with average score from 0.559 to 0.704 in which Finland is the country that has the lowest score of 0.559. Figure 4.1. shows the graphical illustration of average efficiency scores.

Table 4. Energy efficiency over period 2013-2017

DMUs	2013	2014	2015	2016	2017	Average
Austria	0.644	0.643	0.604	0.593	0.603	0.617
Belgium	0.671	0.640	0.613	0.603	0.663	0.638
Czech Republic	0.709	0.669	0.617	0.607	0.662	0.653
Finland	0.582	0.581	0.547	0.539	0.548	0.559
France	1	1	1	1	1	1
Germany	0.7181	0.7022	0.6729	0.6685	0.7016	0.693
Greece	1	1	1	1	1	1
Hungary	1	1	1	1	1	1
Italy	1	1	1	1	1	1
Netherlands	1	1	1	1	1	1
Norway	1	1	0.509	0.504	0.507	0.704
Poland	1	1	1	1	1	1
Portugal	1	1	1	1	1	1
Spain	0.783	0.713	0.655	0.625	0.659	0.687
Sweden	0.724	0.675	0.623	0.611	0.622	0.651
Switzerland	1	1	1	1	1	1
United Kingdom	1	1	1	1	1	1
Average	0.872	0.860	0.814	0.809	0.822	0.835

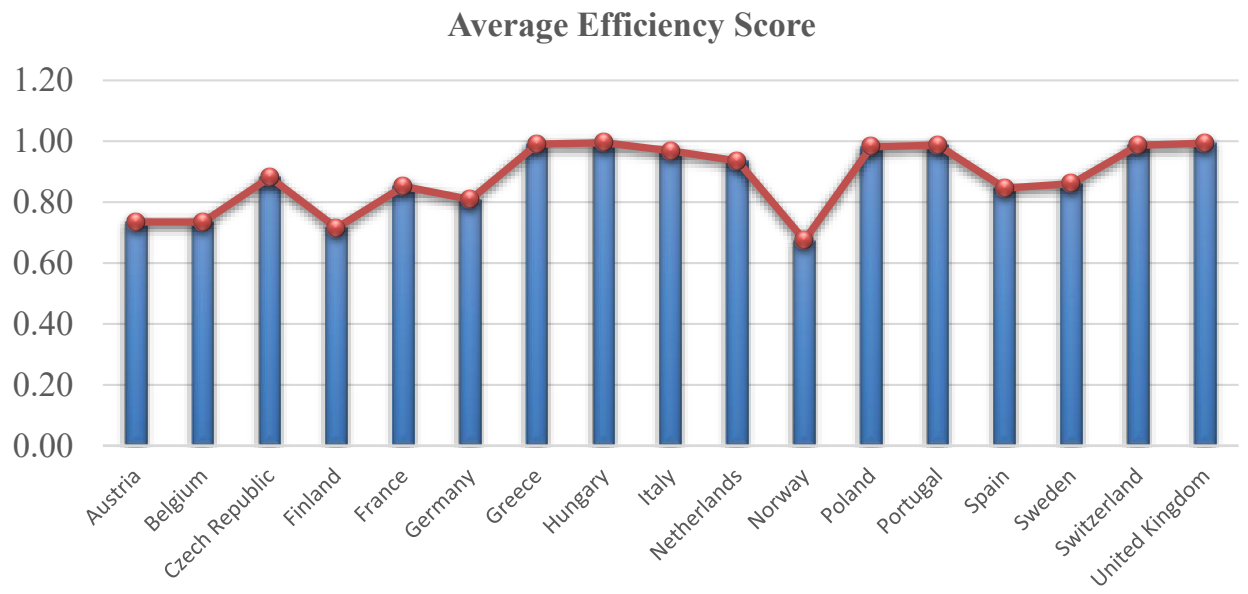

Figure 4.1: Average results of energy efficiency for the period 2013-2017

Conversely, it is observed that there is less variation in efficiency scores for individual countries across the sample years for both top the best performance countries and top the poorest performance ones. For the best performance countries, the efficiency score reached value of 1 in all the year of observation. The same variation is applied for the group having the poor performance. The countries showed the fluctuation in efficiency score year by year. However, this fluctuation is insignificant. Therefore, we can conclude that although all countries experienced the ups-downs momentum but the differences in obtained score over time period 2013-2017 are very little.

In summary, there are nine countries out of total seventeen sample countries in this research are efficient in term of energy efficiency while 8 countries suffered a very poor performance. Such poor performance indicates irregularities in energy efficiency and that a considerable level of improvement in efficiency is needed. However, it is clear that DMU which is efficiency with efficiency value of 1 is just considered as relatively efficient. Therefore; it is still room for all countries to perform better in term of energy efficiency.

C. Energy Efficiency Change under The Malmquist Productivity Index Analysis

This section examines the change of energy efficiency of seventeen sample countries over period 2013-2017. The improvement is examined through three groups included the catch-up indicating technical change, frontier-shift indicating efficiency change and MPI indicating the total productivity change. To obtain the purpose of this, Malmquist Productivity Index (MPI) is applied to measure the change. The change in each group will be presented in the following sub-sections.

- *Malmquist productivity index and its decomposition*

We applied DEA-Solver Pro in this research to run The Malmquist Productivity Index under variable return to scale (VRS) with the input-oriented. The change in efficiency is defined as "catch-up" effect. The annual efficiency change index is collected and presented in Table 5, and then it demonstrated as in figure 4.2.

For the sample periods as a whole, the average efficiency change ranged from 0.2% to 0.8%. Averagely, there is no improvement in term of efficiency for the whole sample period. The average efficiency decrease ranged from 0.2 to 0.8%. The largest decline in efficiency was in period 2014-2015 with 0.8% and the smallest decrease was in 2016-2017 with 0.2%. it is also worth to note that during sample time period 2013-2017, Australia is the countries which always has the decline in efficiency change all the observation time periods while Switzerland showed the unchanged with efficiency change scores equal to 1 for all for subsequent years and Netherland has the best improvement out of seventeen countries with 1.7% improvement for the whole observation time periods.

Table 5. Efficiency change during 2013-2017

Catch-up	2013=>2014	2014=>2015	2015=>2016	2016=>2017	Average
Austria	0.995	0.977	0.987	0.992	0.988
Belgium	1.025	1.038	0.985	0.990	1.009
Czech Republic	0.992	0.990	1.015	1.007	1.001
Finland	1.014	0.970	0.985	1.002	0.993
France	1.004	0.962	0.999	1.002	0.992
Germany	1.025	1.015	0.993	0.996	1.007
Greece	1.015	1.061	1.010	0.943	1.008
Hungary	1.000	0.986	1.009	1.001	0.999
Italy	1.003	0.991	0.997	1.004	0.999
Netherlands	1.026	1.040	1.000	1.000	1.017
Norway	0.925	0.931	0.993	1.004	0.963
Poland	0.992	1.000	0.992	1.000	0.996
Portugal	0.980	0.975	0.994	1.001	0.988
Spain	0.979	0.998	0.992	1.011	0.995
Sweden	0.927	0.946	0.990	1.006	0.967
Switzerland	1.000	1.000	1.000	1.000	1.000
United Kingdom	0.989	0.982	1.001	1.006	0.995
Average	0.994	0.992	0.997	0.998	0.995
Max	1.026	1.061	1.015	1.011	1.017
Min	0.925	0.931	0.985	0.943	0.963
SD	0.029	0.033	0.009	0.015	0.014

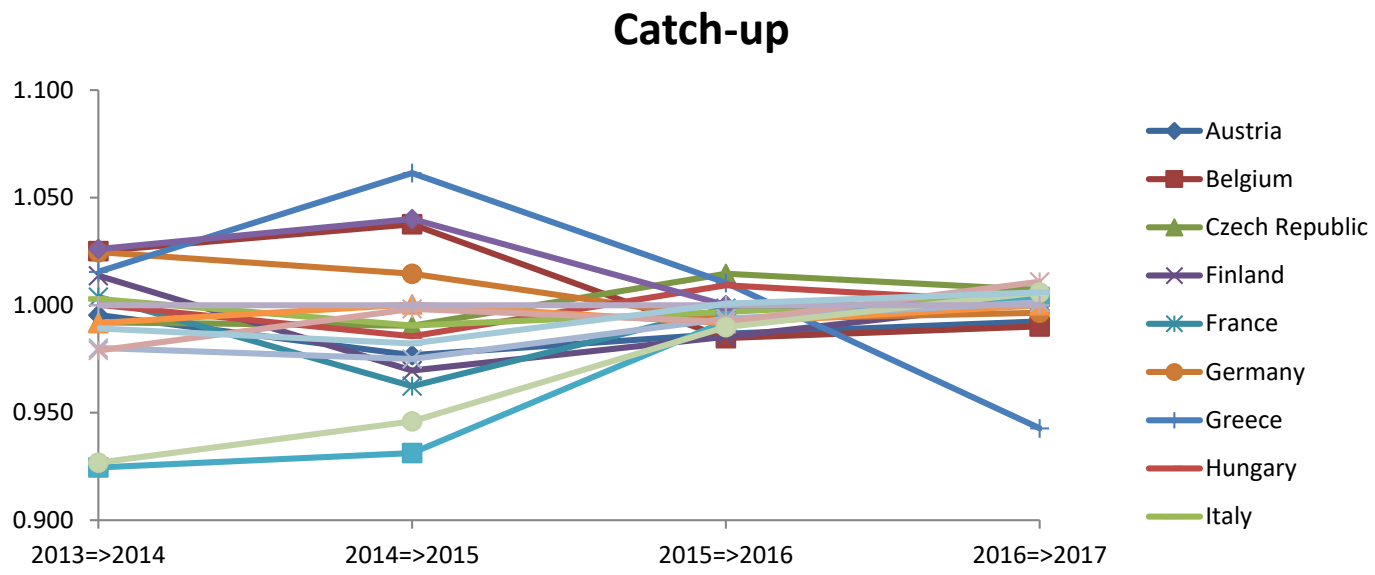

Figure 4.2: Efficiency Change during 2013-2017

- *Analysis of the Malmquist productivity index: technical change*

The results of frontier-shift indicate the change in efficient frontiers between the two different time periods. The results of frontier-shift showed the technical change of sample seventeen countries and these results are presented at table 6.

From 2013-2014, there are ten countries that have the efficiency change scores greater than 1. It indicates that there is a growth in technical efficiency in these ten countries (Australia, Finland, France, Hungary, Italy, Norway, Portugal, Spain, Sweden and Switzerland). The left seven countries in which their technical change scores are smaller than 1 indicating that technical regress or innovation deteriorate in the period. Sweden is the country that has the highest positive change in technical with 6.2% improvement in technical efficiency while Netherland is the country that have the worst technical change with 8% decline.

From 2014-2015, all countries have the technical change smaller than 1 except Switzerland, which reveals that the for sixteen countries and Switzerland has witnessed overall efficiency progression, but this change is so minor that has not reached 1%; therefore; Switzerland's technical change was equates no evidential change. The biggest decline in technical change is from Netherland with 6.3%. the decrease in technical efficiency of sixteen countries leads to the fall of 2.3% in average.

During period 2015-2016, there are three countries (Finland, Sweden and Switzerland) that have the scores greater than 1. However, the change in technical is just too little that we considered there is no change in technical efficiency for these three countries. Other thirteen countries witnessed the negative change with scores lower than 1. Both the positive and negative change is too little. The highest positive change is 0.39% and the largest negative change is 2.9%. The average change of the period is 0.6% of decline in technical efficiency. The same is said for the time period 2016-2017, the decline happened to thirteen countries and the minor improvement is for three countries (Czech Republic, Netherland and Poland). The change is too small that confirm no evidential change.

Table 6. Technical Change during 2013-2017

Frontier	2013=>2014	2014=>2015	2015=>2016	2016=>2017	Average
Austria	1.041	0.984	1.000	0.993	1.004
Belgium	0.946	0.951	0.997	0.995	0.972
Czech Republic	0.984	0.980	0.984	1.004	0.988
Finland	1.020	0.995	1.002	0.983	1.000
France	1.056	0.960	1.000	0.994	1.002
Germany	0.968	0.972	0.998	0.990	0.982
Greece	0.996	0.996	0.994	0.981	0.992
Hungary	1.008	0.992	0.992	0.989	0.995

Italy	1.053	0.956	0.976	0.993	0.994
Netherlands	0.920	0.936	0.988	1.001	0.961
Norway	1.059	0.973	0.999	0.997	1.007
Poland	0.997	0.981	0.986	1.000	0.991
Portugal	1.005	0.996	0.978	0.978	0.989
Spain	1.017	0.993	0.999	0.978	0.997
Sweden	1.062	0.981	1.004	0.990	1.010
Switzerland	1.038	1.000	1.004	0.998	1.010
United Kingdom	0.993	0.970	0.999	0.993	0.989
Average	1.010	0.977	0.994	0.992	0.993
Max	1.062	1.000	1.004	1.004	1.010
Min	0.920	0.936	0.976	0.978	0.961
SD	0.041	0.018	0.009	0.008	0.013

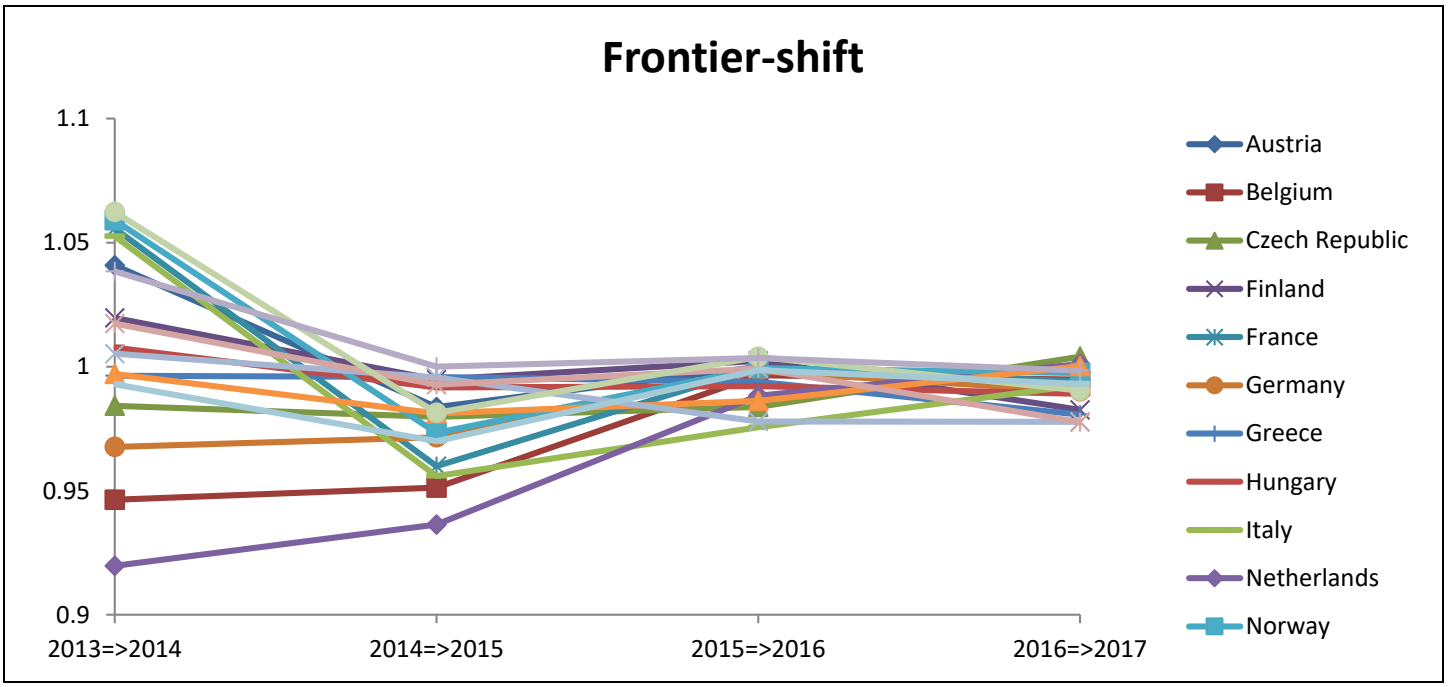

Figure 4.3: Technical change during 2013-2017

- *Productivity changes: the Malmquist productivity index and its decomposition*

The productivity change of energy efficiency of seventeen countries during 2013-2017 is showed at table 7 and figure 4.4 below.

Table 7. Annual productivity change (MPI) from 2013-2017

Malmquist	2013=>2014	2014=>2015	2015=>2016	2016=>2017	Average
Austria	1.036	0.961	0.987	0.985	0.992
Belgium	0.970	0.987	0.981	0.985	0.981
Czech Republic	0.976	0.970	0.998	1.011	0.989
Finland	1.034	0.965	0.988	0.984	0.993
France	1.060	0.924	0.998	0.996	0.994
Germany	0.992	0.986	0.992	0.987	0.989
Greece	1.012	1.057	1.004	0.925	0.999

Hungary	1.008	0.977	1.001	0.990	0.994
Italy	1.056	0.947	0.972	0.997	0.993
Netherlands	0.944	0.974	0.988	1.001	0.977
Norway	0.979	0.906	0.992	1.001	0.970
Poland	0.989	0.982	0.978	1.000	0.987
Portugal	0.985	0.971	0.972	0.979	0.977
Spain	0.996	0.991	0.992	0.988	0.992
Sweden	0.985	0.928	0.994	0.996	0.976
Switzerland	1.038	1.000	1.004	0.998	1.010
United Kingdom	0.982	0.953	0.999	0.999	0.983
Average	1.002	0.969	0.991	0.990	0.988
Max	1.060	1.057	1.004	1.011	1.010
Min	0.944	0.906	0.972	0.925	0.970
SD	0.032	0.034	0.010	0.019	0.010

In summary, there is a very little change in average productivity for the whole sample time periods. During each separate period, we witnessed the minor change, mostly decrease in productivity. However, these changes are so little that have not reached 1%. Therefore, the productivity change during 2013-2017 is considered averagely remain stable.

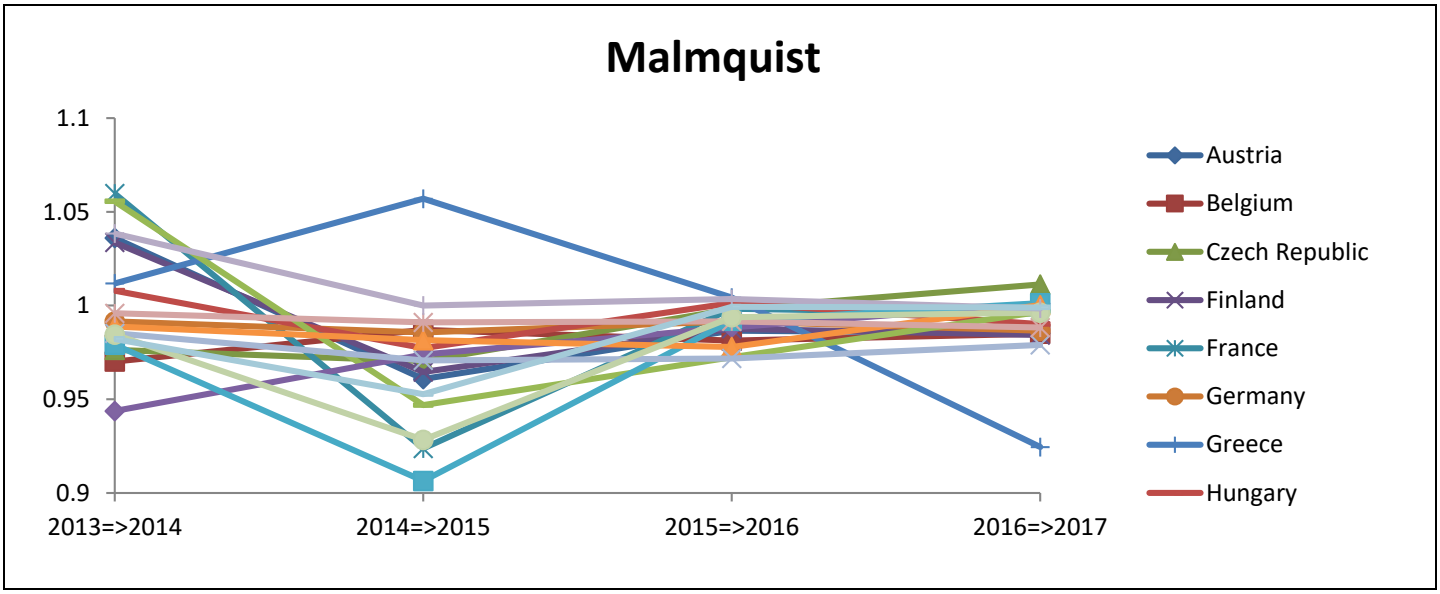

Figure 4.4: Annual productivity change (MPI) from 2013-2017

Since Malmquist productivity index of productivity change is a multiplicative composite of efficiency and technical change. The change in productivity is mainly causes by the value of the efficiency change and technical change or both. In the other words, the growth in productivity can be explained by the increase in efficiency change and technical change while the loss of productivity is the result of the decrease in efficiency change or technical change or both.

Figure 4.5 present the results of these Malmquist productivity indices for the seventeen companies across sample time period 2013-2017.

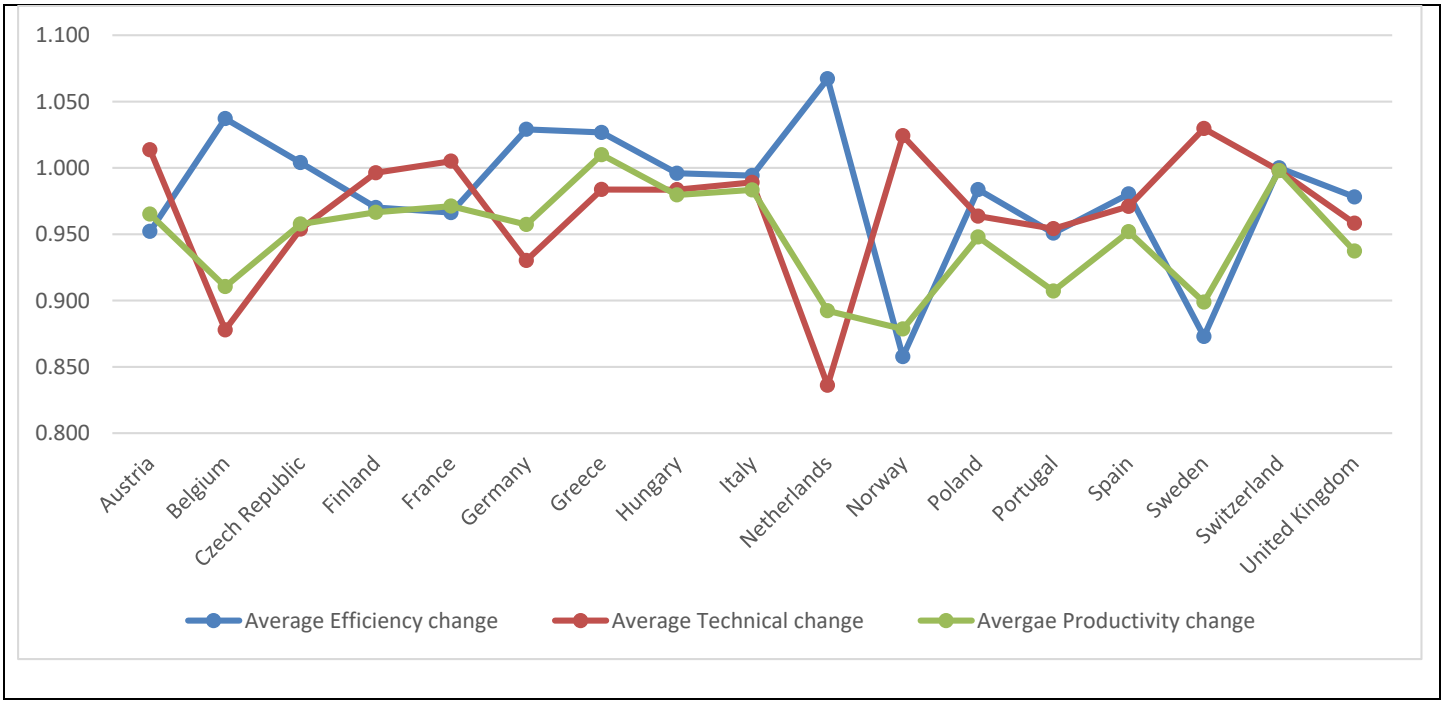

Figure 4.5: Annual average productivity change and its components from 2013-2017

For all countries as a whole, the average productivity change ranged from 1% (Greece) to 12.1% (Norway). Greece has the highest positive change in productivity; however, this increase is not significant with just only 1% growth while Norway is the country that has the greatest loss in productivity with 12.1%. Averagely, during 2013-2017, there is only one country (Greece) that has the productivity growth while the left sixteen countries show the loss in productivity with the average scores are all lower than 1. For the whole observation time period, the average MPI of all countries experienced the loss of 5.2% which mainly caused by the decrease in both efficiency change and technical change with average change scores are 0.980 (2%) and 0.969 (3.1%) respectively.

IV. CONCLUSIONS

The main objectives of this study are to firstly evaluate the energy efficiency and then examine the energy improvement of countries in European Union during 2013-2017 by applying DEA SBM and MPI. Findings of this study have the very important policy implications for policymakers as it provided the real status of energy efficiency and improvement of 17 selected countries in Europe. By evaluating the energy efficiency of seventeen European Union countries, our study reveals that as a whole observation, these countries are 16.5% far from the efficiency frontier implying that there is an unbalance between inputs, output, particularly, between the growth of GPD and CO2 reduction in relative to less input's resources used. Moreover, lower efficiency scores of eight countries denotes that these countries must put more effort on improving energy efficiency. Energy efficiency can be enhanced by using less unrenewable energy in effort to promote GPD growth. Increasing the share of renewable energy in total energy consumption is one of the key solutions for these countries. Moreover, findings of this study also reveal that most sample countries showed to have no improvement in term of efficiency except Greece. This finding implies that although efficient countries are on efficiency frontier, there are room for them to improve their performance.

Results obtained under slacked-based model (SBM) indicated nine out of seventeen countries (France, Hungary, Greece, Italy, Netherland, Poland, Portugal, Switzerland and United Kingdom) were efficient in terms of energy during 2013-2017 with corresponding energy-efficiency score of 1 for all 5 observation years. On other hand, eight countries (Australia, Belgium, Czech Republic, Finland, Germany, Norway, Spain and Sweden) have a very poor performance with the average efficiency scores are far from the efficiency frontier. Additionally, the results of this study indicated the big variation between efficient countries and inefficient countries. Particularly, efficient countries showed to have efficiency scores of 1 for all observation year while the average efficiency score of the inefficient countries range from 0.559 to 0.704, denoting a big gap.
Regards the efficiency improvement obtained from MPI, results of MPI indicated that during 2013-2017, there was only one country (Switzerland) which roughly accounted 5.9% of total sample size that has proof of efficiency improvement while other sixteen countries suffered from the regress.

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Causes and types of conflicts during electioneering process in Kenya with reference to Kisumu County

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Abstract-The causes and types of conflicts are multifaceted as they are deeply embedded in ethno-political and cultural issues of the community. The study was guided by Galtung's theories of structural violence and structural peace-building and Agenda Setting theory. The study employed qualitative and quantitative methods. The data were collected through questionnaires, interviews schedule, FGDs guides and review of literature through document analysis. The data were analyzed using Statistical Packages for Social Scientists (SPSS 21). The data were presented in tables, pie charts and bar graphs. The findings of the study revealed that conflicts in Kisumu County are attributed to historical injustices, socio-economic factors and political issues. The findings of the study further revealed that Kisumu County experienced electoral and politically instigated ethnic conflicts recurrent largely during electioneering process with the major architects as youths and political class. These conflicts have had greater impacts on socio-economic, psychological and health aspects of people. The study concluded that historical injustices, election rigging claims and ethnicity are the major causes of conflicts while electoral and political conflicts are the key types of conflicts and as such community members and political class are the key players in averting the conflicts for a long term development.

Keywords: Causes of conflicts, Electioneering process, Ethnicity, Media, Types of conflicts

1. Introduction

Today, intra-state conflict is the major type of conflict in the world in general, and especially in Africa (Rupesinghe *et al*., 1996:26; Sandole, 1999:136; Lund 2006:3; Dokken 2008:3). Walter (2009:3) argues that exceeding half of all civil wars in 2008 were fought between ethnic minorities and their central governments over superior autonomy or independence. According to Lund (2006:3), the vast majority of conflicts are national in nature, dealing with secessionist, ethnic, or ideological issues. Dokken (2008:3), writing at the time, observed that 56.6% of African states were experiencing some form of intrastate conflict.

Sisk (2003:1) contends that democracy as a structure of political determination is in many ways a technique of conflict management in which the aftermaths are anonymous but the ultimate rules of the game provide a benign ground in which to contest. For this motive, many profoundly divided postwar cultures in the 1990s have curved to democracy as a system to depart from intractable conflicts (Sisk 2003:1). Along these lines, Brahm (2005: 3) and Lyons (2009:91-92) assert that elections have been a portion of almost all bargained settlements of civil warfare in the post-Cold War epoch. Where secession or division is not an alternative (and it seldom given customs of sovereignty), unadventurous wisdom is that uncensored elections are the truly efficient means of channeling competition to peaceful means. In a different perspective, Deng (1996:226) maintains that Western-Style consensus of the vote, with the 'winner take all' effect, runs pawn to the African native principle of power- allotment and conciliation, and consequently, cannot be a core for dispute resolution in the African traditional milieu.

The continent of Africa has agonized several armed conflicts, some of which the media played a key role. Media has been accused as one of the gears for stimulating conflict. Researches have shown that contribution of mass media on conflicts were by inflaming violence, failing to focus on emerging wars and procrastinating to report struggles. For instance, the Rwandese Radio- Television Libre des Milles Collines (RTLM) is a unique examples of media that abetted stimulate conflict by encouraging the Hutu population to exterminate the Tutsi terming them as "cockroaches" that must be eliminated to ensure peace in Rwanda (Mutua 2001). This resulted in the massacre of almost 1,000,000 Tutsi and displacement of many others.

The widespread community clashes in African continent has repeatedly frolicked contrarily to milieu of high ignorance, dearth, and feeble administrative structures diluted by unfavorable indebtedness and leadership botches (Zartman, 1995). It is contended that amalgamation of resource struggle, ethnicity, socioeconomic and politics triggered several electioneering violence in African continent. Kenya has never been immune from armed conflict. More specifically, Kenya has experienced both intra and inter conflicts. These clashes

mostly display themselves as economic, political, environmental as well as natural resources conflicts, land and ethnic conflicts and recently terrorism (Wotzka *et al.*, 2003). The inception of multi-party politics in Kenya generated new aspects of election conflicts. Election-related violence has been experienced during every election period starting 1992, with the 2007/2008 election ensuing as the severest bloodshed ever in the history of the nation.

Kenya as a nation-state has been regarded as a representative democracy in Africa and has on several instances been depicted as an isle of peacetime in Africa (Wolfsfeld, 2004). In as much as expected, traditionally the media is a tool for peace and peace-building. In rare situations the media has triggered conflict. The research question, therefore, was why has the media served to trigger conflict rather than the expected and anticipated peace-building in Kisumu County, Kenya?

Despite having many studies done on media and election violence, hardly any of these studies substantially identified the influence of media on the peaceful conduct of electioneering process, more so in Kenya and Kisumu in particular where the relationship has not received interest by researchers in any of the accessed studies despite the country having experienced both pre- and post-election violence. The study, therefore, pursued to assess the association between media and conduct of electioneering process and more so the extent to which it contributed to either conflict/violence or peace-building in Kenya with reference to Kisumu County.

2. Theoretical framework and conceptual framework

According to Galtung (1969) structural violence stems from violence in the structure of society, rather than actor-generated personal and direct violence. By relating violence to the structure of society, Galtung created a connection between peace, conflict and development research. Galtung goes further to state that, since personal and direct violence are often built into social structure, it is much better to focus on the bigger picture revealed by structural violence as this would reveal the causes and effects of violence and conditions for peace. Galtung (1969) went on to introduce the concept of cultural violence as those aspects of culture that can be used to legitimize and justify violence. The flow of violence was from cultural via structural to direct violence. To understand the direct structural and cultural violence triangle, Galtung (2000) employs the concept of power and identified four dimensions of power impacting positive and negative peace: cultural, economic, military and political. Galtung (2000) maintains that the vicious spiral of violence can be broken with the virtuous spiral of peace flowing from cultural peace through structural peace to direct peace. This process would bring about positive peace.

Agenda-setting theory explains how audiences can perceive a given news item depending on the significance that media give to the news story in terms of the coverage and position (McCombs and Reynolds, 2002). . In this way, the agenda-setting function may have been altered, either by diminishing the ability of mainstream media to set the political agenda or by reversing the flow of information (Sawers, 1996). Rwanda's radio RTLM urged listeners to pick up machetes to take to streets to kill what they called cockroaches. Broadcasters in the Balkans polarized local communities to the where violence became an acceptable tool for addressing grievances. Media involvement in electioneering violence has been widely criticized to having been part of conflict, being used by government or politicians to cultivate public support. It has been alleged that media framing of stories distorted the reality of the war.

3. Materials and Methods

This study adopted descriptive study designs as recommended by Kumar (2011) whose thrust was to examine causes and types of conflicts electioneering process and how it affects the human factors during conflicts. This study was conducted in Kisumu County nicknamed as "*kisumo"*. The county is viewed as the epicenter of 1992, 1997, 2007/08 and 2013 election violence in the former Nyanza Province (KNCHR, 2008). Kisumu County has experienced heightened political violence since the resuscitation of multi-party system thus it is imperative for this study to analyze this situation. The rationale for choosing Kisumu County and especially the two sub-counties was that those regions have experienced violent conflicts since the resuscitation of multi-party democracy coupled with multi-ethnic groupings. According to Singleton (1993), the perfect location for the research is one that is unequivocally connected to the interest of the researcher. Additionally, he notes that the study area must be simply reachable by the researcher and that it must permit faster relationship with the participants. The researcher adopted both probability and non-probability methods in selecting a representative sample for the study. Throughout the study, both quantitative and qualitative data were gathered. The questionnaires were hand delivered to the target population including local community, businesspersons, journalists, registered voters, CSOs, security officials and survivors. Four hundred and fifty (450) questionnaires were administered to some members of the community residing in Kisumu County. The dependability factor was calculated based on the accepted 95% coefficient/index of reliability (Norland, 2010). The study found a reliability coefficient of 0.8551 showing high reliability. Content and construct validity were examined by the supervisors as well as scholars at the Department of Peace and Conflict studies.

Quantitative data were coded and analyzed descriptively and inferential statistics using Chi-Square goodness of fit in order to establish the level of significance of correlation between study variables. The quantitative data were analyzed using SPSS 21 and presented in tables, pie charts and bar charts. Qualitative data were analyzed using thematic techniques analysis to support quantitative data and presented in form of verbatim reports.

4. Study Findings and Discussions

To examine the causes and types of conflicts during electioneering process in Kenya, a total of 450 questionnaires were administered and 400 were filled and returned.

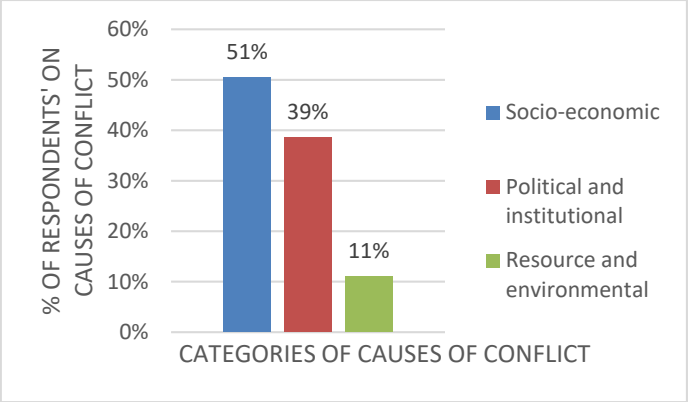

Figure 1: Causes of conflict during electioneering process in Kisumu County

Source: Field Data (2019)

The findings in Figure 1, reveals that the major causes of conflict in Kisumu County is socio-economic factors 51%, political and institutional factors 39% while resource and environmental factor 11%. The study, therefore, shows that socio-economic dynamics are the major instigate of clashes as majority of people are unemployed and poor thus could be easily manipulated. Majority of respondents (67%) mentioned historical injustices and electoral issues as the major cause of conflicts. The study also reveals that political conflicts only occur during electioneering process as people have mentality of win and support of one dominant political party. The study further found out that the political culture of the community lead to conflict.

Culture was mentioned as a cause of conflict as alluded by most respondents to be the order of political wrangles in Kenya. Consequently, leaders are elected based on their culture and where they come from. This was supported by an interview with former South West Nyakach MCA who stated that:

For instance, Kikuyu political leaders barely be voted for in this region that Luos occupy, dominant and so on. We only elect our members of the Luo community. (Interview with MCA Nyakach held at Travellers Hotel, Katito. 7/04/2019).

Several conflicts have risen in Kenya with their main cause as ethnic disagreements or ethnic inclination. The concept of ethnicity occurs when people's needs and interests are solved or addressed based on tribal inclinations. When conflicts arise from ethnic differences they are driven by non-fulfillment or threats to the fulfillment of basic needs (Kamoet, 2011). In Kenya, ethnicity is being used by many people as their form of identity and influences a lot of things like politics. It is a cause of distrust and mistrust between communities. Many stereotypes have come out of ethnicity leading to different strains of conflicts. An interview with Luo council of Elders at West Nyakach on 4/04/2019 confirmed that:

Political conflicts in Nyanza started way back in the 1970s when Jaramogi Oginga differed and drifted with Kenyatta. When Kenyatta came to Kisumu to open Nyanza General Hospital and a rotten eggs was thrown to him, this led to shooting and killing of many people (Interview with Luo council of Elders held at Kabondo on 4/04/2019).

This finding was supported by Nyukuri (2008) who claimed that; "At this point the hatred between Luos and Kikuyus heightened and aggravated till now". From the findings, it could be debated that amalgamation of factors such as culture, political and socioeconomic "Factors such as culture, politics, external intervention, socio-economic, and dysfunctional governance would also explain the inter-state conflict between Eritrea and Ethiopia that occurred in 1998 (Jhazbhay, 2008: 15)". The findings of the study reveals that Kisumu County has had a long history of conflicts as supported by Oucho (2002), who traces the Luo and Agikuyu ethnic rivalry to 5th July 1969, when Tom Mboya, Kenya's illustrious politician was shot dead on a Nairobi street. The findings revealed that electoral injustices and rejection of results lead to conflicts. Ethnicity is also another factor that could lead to ethnic conflict. Dominant ethnic communities that seek to impose their rule over the weaker ethnic communities could lead to ethnic conflict where the smaller ethnic groups seek equal distribution of resources and power. Power of wherewithal is also a key cause of clash in Kisumu County.

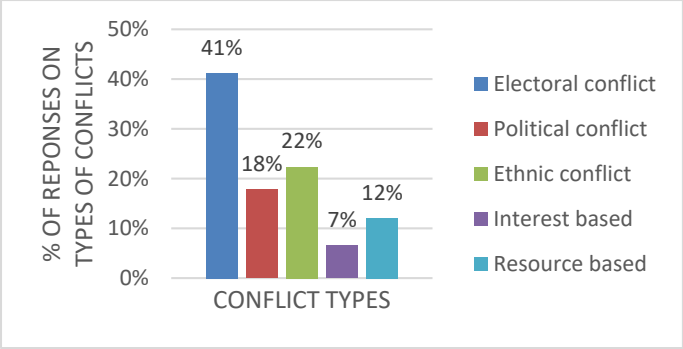

Figure 2: Types of conflicts experienced in Kisumu County since 1992
Source: Field Data (2019)

From Figure 2, it is evident that electoral conflict constituted (41%), political conflict (18%), ethnic conflict (22%), resource based conflict (12%) while interest based conflict constituted 7%. These findings show that Kisumu County is prone to electoral conflict mostly followed closely by ethnic conflict. Ethnic conflict is attributed to the borders of Kisumu and Kericho and Nandi. This is due to the high rates of cattle rustling and natural resources like boundaries and water. The findings reveal that electoral conflicts are mostly associated with the claims of rigging, poor electoral management and unfair coverage of events during casting and counting of ballots. Political conflicts was found to be associated with who belongs to which party and how ethnicity is driven based on issues affecting them.

Table 1: Types of conflicts having widespread impact on Kisumu County

Descriptive Statistics

Types of conflicts	N	Sum	Mean	Std. Deviation	Variance	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Resource based	400	152	.38	.486	.236	-1.763	.243
Ethnic conflict	400	245	.61	.488	.238	-1.794	.243
Electoral conflict	400	330	.82	.387	.150	.960	.243
Political Conflict	400	250	.63	.485	.235	-1.740	.243
Interest based conflict	400	106	.27	.442	.195	-.862	.243
Valid N (listwise)	400						

Source: Field Data (2019)

The results in Table 1, reveal that electoral conflict constituted 330 (82.5%), resource based 152 (38%), ethnic conflict 245 (61.5%), political conflict 250 (62.5% while interest based 106 (26.5%). These findings show that electoral conflicts have had a wider impact on the residents of Kisumu County. The study further shows that electoral conflicts have been felt during every electioneering process since 1992. Electoral conflict is followed closely by ethnic conflict. The study reveals that ethnic conflicts are rampant and recurring along the borders of Nyakach and Nandi or Kericho. These results were in agreement with findings from FGDs and Key informant interviews. During the interview with Women Group Leaders and council of Elders in an FGD conducted at East Nyakach and Kondele respectively, eight (8) out of the ten respondents in an FGD agreed that politics have a lot to do with ethnic and electoral conflicts in the study area. The respondents from the FGDs itemized that the election periods, were the times of highest conflicts in the area with Sondu and Kondele leading in creating tension and putting up fires on the road.

The results are in tandem with the assertion by Peters (2009), who claimed that, in Kenya each electioneer time is tarnished incidents of political provocation, land issues, ethnic clashes and ethnic divisions which ultimately lead to dangerous conflicts among ethnic groupings during electioneers and after elections. Additionally, Oyugi (2002) indicated that clashes in Nyakach and Kisumu areas during and after 1992, 1997 and 2002 elections were as a product of ethnic balkanization constructed on political attachments.

The findings further are supported by Adar (2001) who argues that elect alteration of ethnicity as the central point for political authority is a usual experience in Kenya's post-independence history, with the 1992 and 1997 multiparty elections evidently validating this pattern. At the heart of this tendency of electoral process is the issue of state control, the center of political power and wealth accrual. Exactly, ethnic purgative is aftermath of elect osteopathy.

On the other hand, media has the ability of presenting and analyzing the history of the conflicts as observed from different parties' involvement and creating awareness on the historical and recognized injustices. This was in agreement with the interview findings at Nyakach;

The 2002 General elections marked the end of Daniel's Moi 26 year political regime after being ousted by a united front mounted by opposition leaders who the first time in their political careers put their personal differences aside. The end of Moi era was perceived as a positive move for democracy and media houses pushed the democratic transformation agenda most. The key message from the media was urging people to "vote wisely" (Interview with the former MP of Nyakach, Sondu Hall, 02/04/2019).

To the contrary, the interview with MCA of South Nyakach claimed that;

Kenyans went to the ballot on the 27th December 2007. The media portrayed an atmosphere marred with violence and antagonism between Mwai Kibaki of PNU and Raila Odinga of ODM. All the news and polls evidently declared our own was winning but "wakia gimanotimore" meaning we don't know what happened. The power just went off and when it came back, Kibaki was leading. "Wan joluo imayowa to waneno, ne litnwa marach" Meaning we Luos we are stolen from while seeing, it was very painful. (Interview with MCA, South Nyakach held at ward Office, 03/04/2019).

From the FGD one participant stated that:

The blackout of media and power could aggravated further the fueling of violence. It was evident something was going thus the government didn't want people to see. They had ample time to manipulate the votes on their favor. Many local stations incited

their members to fight for their rights, politicians used local radios to incite hatred and hate speech and propaganda (One of the discussants in FGD, held at Kondele Market, 7/04/2019).

This was supported by the findings of the National Communication on Human Rights report claimed that, the entire electioneering period was characterized by hate speech and incitement to violence. One thing that is memorable about 2007 elections is the role played by all manner of information from all sources, unsolicited and solicited-SMS, blogs, newsletter, leaflets, TV and radio sources.

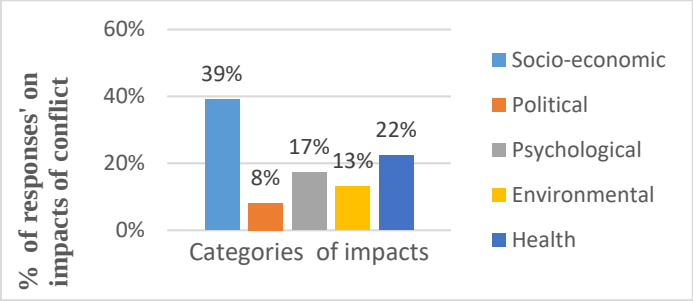

Figure 3: Impacts of conflicts on Kisumu County

Source: Field Data (2019)

The results in Figure 3 indicate that 39% of the respondents experienced socio-economic impacts, health impacts were 22%, political 8%, psychological impact 17% and environmental impact 13%. These findings indicate that conflicts have greater impact on the socio-economic aspects of the study area. The majority of the respondents had experienced the impacts of the conflicts in study. These findings agree with a study by Akinyi *et al*., (2011) "which opined that communities from the two sub-counties had been affected by recurrent conflicts for many years, these conflicts have been more common since 1992 and have since then recurred over the years and thus justifying why majority of the respondents have been affected by conflicts". In an interview, the chief of North Nyakach location indicated that:

The recurrence of conflicts in the border areas of Nyakach led to the deployment of police and establishment of police post thus reducing the incidences of conflicts (Interview with Chief of North Nyakach, 04/04/2019).

All the chiefs, security officers who were interviewed indicated that Kenyan armed forces had really assisted in reducing the conflicts. It also emerged from the Luo council of elders FGD in Sondu construction and camping of armed forces helped. KNHCR (2008) indicated that among the challenges the police face are hostility, bad weather and unfavorable working conditions. An official from Kenya Red Cross Kisumu Central also opined that conflicts are not common within Kisumu central sub-county unless and only during electioneering period. The sentiments of the Red Cross official were in agreement with those of the MCAs, chiefs and security officers interviewed in Nyakach. One of the participants in the FGD, a member of the council of elders from Nyakach opined that:

Most of the areas prone to conflicts are borders and Sondu town. These places are hotspots due to the cattle raiding which goes on in these areas and electioneering period. During 2007/2008, nobody could easily pass Sondu. There was fire lit everywhere mostly on the main roads. (Sondu FGD participant, 5/04/2019).

An interview with women group leaders FGDs, Kisumu Central indicated that:

During electioneering period any results that goes against Luos will escalate conflicts. The starting point for all conflicts in Kisumu is Kondele. It has remained hotspot for a long period. The worst area again is Nyalenda, the gangsters takes advantage of the electoral conflicts to loot, murder and threaten people (Luo Women group leaders FGD in Kondele Market, 27/03/2019).

The findings show that post-election violence had an impact on the country in different ways. For example, it had an impact on the economy, displacement of people, looting and burning of property, re-awakening of latent ethnic hatred among other impacts. The findings of the study indicate that journalists seemed to condemn violence.

The study found that conflicts also had serious implications on the economy and livelihoods of the people living in Kisumu County. According to the results, majority of respondents agreed that conflicts led to lack of market for farm produce and businesses. While only a few of the respondents had contrary opinion. This was attributed to the fact that during these conflicts, movement is limited and traders would not go to the market to their goods. This finding was in line with a key informant interview at Nyalenda:

During conflicts mostly election violence, all roads leading to Kondele market are closed. None is allowed to pass unless you are carrying twigs and accompanying the demonstrators. Nyalenda is usually worst during election times. (Interview with Pastor of Anglican Church, Nyalenda, 08/04/2019).

The results from the FGDs and interviews concurred with findings from the council of elders. Participants in the council of elders FGD in West Nyakach opined that conflicts greatly affected important economic activities in the area, mainly agriculture and trade. Kibuye market is the major market situated within the town. The findings were consistent with a study by Masaka *et al*. (2017), in which cross-border conflicts in Kenyanya and Rongo Sub-counties have a great implication on the economic activities of the communities living in the area. According to the study frequent inter-ethnic violence affects the livelihood of the border residents in many ways. It affects the livelihoods of small-holder farmers in the sense that when clashes break out most of them are unable to access their farms

to cultivate, plant or harvest crops. The conflicts also cause inaccessibility to nearby Rongo.

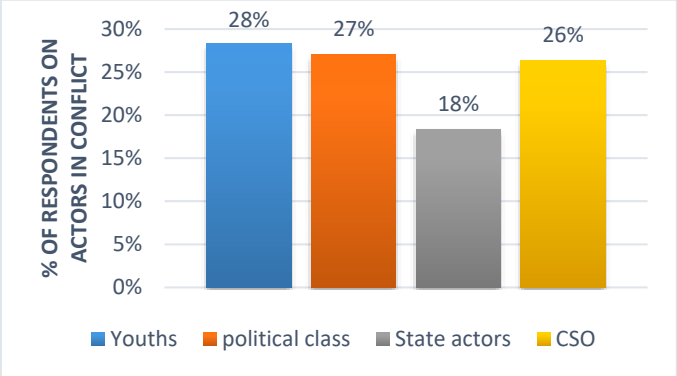

Figure 4: Actors involved in conflicts, Field Data (2019)

From figure 4, it is evident that most actors involved in conflicts are youths (28%), political class (27%), CSO were 26% and state actors 18%. In this sense, therefore, majority were of the opinion that youths are actively involved in conflicts. This can be a result of joblessness which leads to idleness. The findings also reveal that youths can be easily manipulated by the political class as they mostly need hand-outs. In an interview with the chief of Manyatta location it emerged that the youths are the most active participants in electoral and political conflicts. Similar claims were made by the Women Group FGD and victims of PEV at Nyakach South.

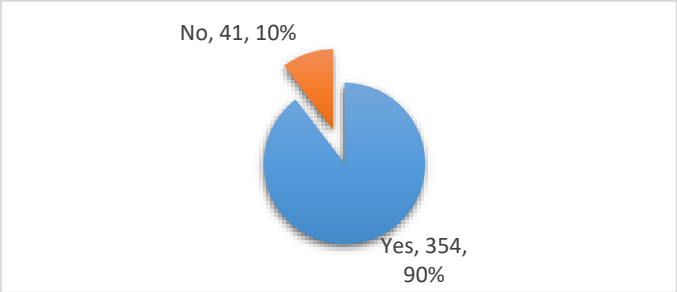

Figure 6: Media playing a role in conflict
Source: Field Data (2019)

The results in figure 6, shows that 90% of respondents said yes while 10% disagreed. Majority of respondents agreed that actually media have played a role in conflict. The findings reveal that media played many roles both positive and negative. Some of the positive roles suggested by the respondents were; education of the public, training of the journalists, calling for peace and advocating for human rights. On the contrary, the negative roles were incitement of groups, hate speech, propaganda, corruption by media houses and withholding information. These findings are in agreement with the findings of Thompson (2007) who opine that, in the Balkans broadcaster's polarized local communities to the point where, violence became an acceptable tool for addressing grievances. In the case of Rwanda, the media was also used to guide the perpetrators of the genocide towards their victims. The media may also incite violence through manipulative, negative presentation of facts that create the impression that the situation is worsening.

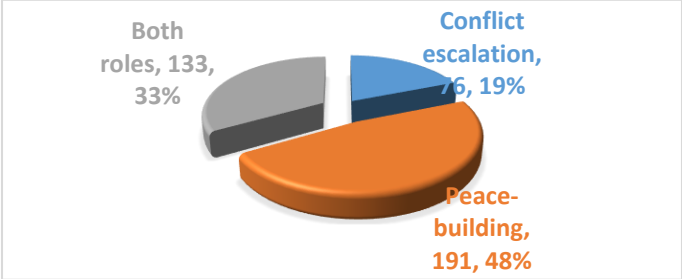

Figure 5: Roles played by the media during electioneering process

Source: Field Data (2019)

The results in figure 5, shows that 76(19%) of respondents were of conflict escalation, 191(48%) of respondents were of peace-building while 133(33%) were of both roles. This study, therefore, found that media played a greater role in peace-building than conflict escalation. While those who said both roles show that media remains a powerful tool and a double edge sword on both sides. Only minority said media played conflict escalation role. The study therefore found that Media is used to send messages between conflicting sides. In this case media acts as the diplomats by sending messages to test reactions on negotiations. Messages and signals may be sent to other groups through the media. This was in line by Gilboa (2002) who opined that the news media also invites leaders from the opposing sides to TV or Radio to discuss matters openly hence creating a bridge among enemies and building confidence that is needed to negotiate and bring the conflict to an end.

These results are in tandem with findings of Gopin (2001) who opined that, media used the special opportunities to work towards peace and reconciliation in Colombia so that people could obtain truth and reparation in relation to violations. The findings are in agreement with Williams and Gulati (2007) who claimed that observers provide physical presence that is intended to discourage violence, corruption and human rights violations in Sudan. Smith (2010) also supported this study finding by observing that media with willingness have gone beyond responding to effects of conflicts and have advocated and agitated for peace. Given the need for peace-building in Kenya after 2007, Nasongo *et al., (2009)*, raised the question, "Are forgiveness and amnesty a panacea to Kenya's post conflict crisis?"

The findings of this study were further supported Viggo (2011), who opined that a conflict- galloped states, media often play an important role in generating and advancing both accelerating factors and activating factors linked to internal and external issues or threats facing the nation. According to Terzis & Melone (2002), media can create divisions by not revealing diversity in the social and political constructs. Summary of the correlation are shown in the table below.

Table 2: Correlation Analysis between influence of media based age and gender

Correlations[b]

		Gender	What role did media play	Age	Do you think media played a role in conflict situation
Gender	Pearson Correlation	1	-.056	-.283**	-.038
	Sig. (2-tailed)		.326	.000	.504
What role did media play	Pearson Correlation	-.056	1	.084	-.043
	Sig. (2-tailed)	.326		.139	.442
Age	Pearson Correlation	-.283**	.084	1	.025
	Sig. (2-tailed)	.000	.139		.652
Do you think media played a role in conflict situation	Pearson Correlation	-.038	-.043	.025	1
	Sig. (2-tailed)	.504	.442	.652	

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Field Data (2019)

The findings in table 2, reveal that the coefficient of age is 0.652 showing a strong positive correlation that age has an effect on the media role in conflict. The finding also reveals there is a weak negative correlation between gender and media role in conflict. Therefore, the study confirms a strong positive correlation between age and media role in conflict. This study shows that there is statistical significance between age and media influence. Most respondents are influenced based on their age. While there is no significant difference between gender. This shows that both gender are influenced on same degree.

5. Conclusion

The study concludes that historical injustices, election rigging claims and ethnicity were the major causes of conflicts within Kisumu County. Youths are actively involved in conflicts due to high level of unemployment. People are always prepared that their own will win and address the historical injustices. People were prepared for violence as media reported an atmosphere of rigging or volatile for conflicts. A win mentality in Kisumu County where there are only winners and no losers also precipitated conflicts. The study also concludes that the major types of conflicts in Kisumu County are electoral and political conflicts. Most conflicts in Kisumu occur during electioneering process. However, ethnicity was also alluded to as a major type of conflict that affects mostly the border of Nyakach and Nandi. Negative ethnicity has influenced the recurrence of conflicts along the Nyakach and Nandi border.

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Relationship Between Financial Literacy of Individual Investors and Stock Market Participation Decision Among Secondary School Teachers from Nakuru County, Kenya

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Abstract
The market for stocks plays a crucial role in the lives of many individual households. They stand to gain from higher returns that they earn from participating in the stock market. In reality, few individual households participate in the stock market. *Many researches have tried to provide explanation for the limited individual investor participation in the stock market.* This study sought to explain whether financial literacy could also provide explanation for the stock holding puzzle by *assessing the relationship between financial wealth and individual investor stock market participation decision among secondary school teachers in Nakuru County. Cross sectional survey research design was employed for the study. Stratified proportionate random sampling was applied and data was collected from 231 secondary school teachers using structured questionnaires. Data was analyzed using inferential statistics with the aid of SPSS. The research findings indicate that financial literacy has a significant positive relationship with stock market participation of secondary school teachers in Nakuru County. The study concludes that that financial literacy of individual investors has a significant relationship with stock market participation among secondary school teachers from Nakuru County. The study recommends that the Capital Markets Authority which is tasked with supervision, licensing and monitoring the activities of financial markets should implement comprehensive awareness and public education programs that targets the wider non-stock market participating public. This will increase participation which is an indicator of well-functioning financial market in any country.*

Keywords: Financial literacy, stock market participation, teachers

INTRODUCTION

The market for stocks plays a crucial role in the lives of many individual households. They stand to gain from higher returns that they earn from participating in the stock market. In reality, few individual households participate in the stock market. In Kenya for instance, a study by the Oxford Group (2015) revealed that individual investors in the Kenya stock market were only 4% out of the

total investors. Constantinides, Donaldson and Mehra (2002) sought to establish the reasons why few individuals participated in the stock market. The study noted that financial theory was yet to provide explanations for the participation puzzle. A number of factors have been identified that contribute to stock market participation and this study sought to explain whether financial literacy could also provide explanation for the stock holding puzzle.

Several previous studies have attempted to explain the behavior of individual investors in the financial markets (Aduda, Masila and Osongo, 2012; Wendo, 2015; Brown & Graff, 2013). Aduda, *et al.,* (2012) conducted a study that sought to evaluate the behavior and the performance of individual investors for companies listed at the Nairobi Securities Exchange. The study found that individual investors behave differently when making the investment decision with some making decisions rationally while others make irrational decisions in their investment. The investors can also be speculative meaning that they invest in the short run or they can be long term investors or both. Barber and Odean (2013) examined the behavior of individual investors. Their main focus was on the trading of these investors in individual stocks. The study's findings reveal that individual investors tend to hold portfolios that are not well diversified because they do not have sufficient information about the securities resulting in low returns even before considering transaction costs. The study further reveals that individual investors prefer to take up investments in the stocks of companies close to where they stay or close to their work place. The study further observed that the media also influenced the behavior of individual investors and that investors purchased the stocks that were given attention in the news. This suggests that investors lack information about the securities traded and hence have inadequate ability to select the securities they can use to form portfolios leading to poor returns.

Another study by Barber, Lee, Liu and Odean (2008) sought to estimate the amount of loses incurred by individual investors as a result of their trading activities in Taiwan. The study showed that the economic losses incurred were significant accounting for 2.2% of the Country's Gross Domestic Product. This was also equated to 2.8% of the total annual income of an individual. This further pointed out the behavior of individual investors to make uninformed decisions in their investment activities. The study concluded that individual investors should not engage in trading in the financial markets. Instead they should invest in well diversified portfolios and hold them.

Other studies suggest that individual investors are irrational even in obvious circumstances. Elton, Gruber and Busse (2011) sought to evaluate whether individual investors were rational in their investment decision making in the Standard and Poor's choice of index funds. The study investigated investors' choices of index funds where costs varied across funds with the funds having almost comparable investment strategies which predicted the anticipated differences in performance. Despite this predictability, investors invested in very costly securities with expected poorer performance. This means that individuals need to have proper knowledge and skills if at all they are to benefit from trading in the financial markets. The findings further suggested that the individual investors preferred to make investment in the stocks of companies closer to them because they have information advantage as a result of proximity and familiarity. However, this is not a justification to have too much of one investment in a portfolio. Therefore, individuals should form well diversified portfolios in order to reduce risk and earn high returns from investment in financial securities.

Calvet, Campbell and Sodini (2007) conducted a study to evaluate the efficiency of investment decisions by Swedish households. The study focused on the welfare costs of household investment mistakes and reported that individuals who were retired and those that invested mostly in pension plans were most likely to participate. This participation was also found to be positively correlated to higher income, greater wealth, and education of individuals. The study also found that participation was adversely affected by unemployment and age. Thus in relation to the study the terms of employment for teachers was always permanent and pensionable especially under Teachers Service Commission and therefore they were likely to invest in the stock market.

Previously reviewed studies (Calvet, *et al*., 2007; Barber & Odean 2011; Aduda, *et al.,* 2012) have brought out the character of individual investors to make uninformed investment decisions and many researchers have tried to find explanations as to why few individual investors participate in the stock market. The explained literature has not provided a clear role of financial literacy in their decision to participate in the stock market. This study therefore sought to explain the decision to participate in the stock market by assessing financial literacy and the stock market participation of secondary school teachers from selected sub counties in Nakuru County.

In assessing the relationship between financial literacy and stock market participation decision among secondary school teachers the following hypothesis was tested

$H_{o1:}$ There is no significant relationship between financial literacy of individual investors and stock market participation

Figure 1: Conceptual framework

LITERATURE REVIEW

Financial Literacy and Stock Market Participation

Financial literacy has potential of enhancing stock market participation by reducing the cost of obtaining information related to investment vehicles and stock market in general. For instance, Lusardi (2008) in a study revealed that it is more probable for better educated people to hold stocks after controlling for labor income, wealth and unemployment risk. According to the study, education gives individuals ability to understand information about the stock market and the available investment opportunities.

Mouna and Jarboui (2015) sought to determine whether financial literacy could explain investor portfolio selection in the emerging market of Tunisia Stock Market. The study used ordinary least square regression to analyze the data due to the continuous nature of the portfolio diversification variable. The study found that the investor's with greater financial knowledge also held more assets in their portfolios and the higher the diversification, the lesser the risk. The results show that financial literacy has important implications on an investor's investment management. The study recommended that investors should be educated so that they can become well equipped to make rational decisions in their investment choices. The results suggest that investors should make informed decisions regarding their investments in order to maximize their returns from their investments.

Mbabazi and Daniel (2017) investigated the effects of financial literacy on 130 small and medium enterprises participation in the market for stocks among small and medium enterprises in Rwanda. The study found that there is a positive significant association between financial literacy and stock market participation. The regression analysis revealed that financial literacy explained 81% in the stock market participation. The study further recommended that these enterprises should be trained on financial literacy in order to encourage more stock market participation. This implies that financial literacy is the main determinant of stock market participation.

Sindambiwe (2014) conducted a study on financial literacy, stock market awareness and capital market participation of an emerging stock market. The main focus was the Rwandan Stock Exchange. The objective of the study was to investigate the influence of stock market awareness of leaders of 91 selected organizations on the level of stock market participation. The study used descriptive correlative research design and collected data both qualitative and quantitative using interviews and a detailed questionnaire. The study found that directors of organizations were highly financially literate and that they apply this financial literacy in the daily running of their business. However, the study also reveals that despite the directors' high literacy levels, their organizations' level of stock market participation on the Rwandan Market was low. The study further noted that despite the findings that Commercial banks ranked first in stock market awareness, insurance firms reported the highest level of stock market participation with the manufacturing organizations ranking lowest in in both stock market awareness and participation in the stock market. The study found a significant and positive relationship between stock market awareness and stock market participation and recommended that Capital Markets Authority should develop programs aimed at increasing awareness and financial literacy training in order to increase the stock market awareness which in turn increases stock market participation.

Li, Geng, Subrahmanyam and Yu (2014) conducted a study that sought to establish whether the rich individual investors have an advantage over normal investors in terms of information. Data was obtained from a national brokerage firm in China for 1.8 million individual investor's trading and also about their record of holding for the period 2007-2009. The study employed monthly time series regression to measure the return of the portfolios held by each individual investor sampled for the study. The investors were categorized into four groups the super investors, small, middle and big investors. The study found that although generally individual investors perform poorly, the super investors were able to earn positive significant returns and that the more these super investors traded, the greater the returns they earned from their investment activities. The study concluded that these super investors were able to get positive returns because they have informational advantage over the other groups of investors. The study further suggested that investor with high value portfolios also became wealthy due to their higher cognitive abilities. This means that smart investors those who have information about financial securities are in a better position to make greater gains as they are able make informed investment decisions.

Lodhi (2014) sought to investigate the influence that financial literacy on individual investors decision making. Primary data was collected from 60 individual investors drawn from Karachi population. Probability sampling method was used to identify the final sample. The study targeted entrepreneurs, teachers, executives, officers, housewives, and students from different religious and cultural backgrounds. The study reported that financial literacy lowers information asymmetry thereby allowing investors to invest in risky securities.

Marobe (2013) conducted a study on the determinants of stock market participation by individuals in Dares-Salaam Stock Exchange (DSE) Tanzania. The objective of the study was to examine factors that influence stock market participation in Tanzania. The study specifically investigated the effects of economic, social and financial literacy factors on stock market participation. The study applied a survey approach using both purposive and incidental data collection techniques to administer the questionnaires. The study found that income, occupation, education and age significantly explained stock market participation in Tanzania. The study also found financial literacy and gender to be insignificant to the stock market participation decision. The study emphasized the need for the DSE to provide training and education to people in order to increase awareness on stock issues in order to attract more participants to trade in stock market. Following the recommendation, it was therefore important to investigate whether the lack of awareness could be the reason why we have few individual investors in the Nairobi Stock Exchange.

Brown and Graf (2013) conducted a survey that sought to evaluate how investment and borrowing is influenced by financial literacy among Swiss households. Data was collected through the use of telephone interviews from 1500 individuals aged between 20-74 years. Regression analysis was used to analyze the data. The study found that the Swiss population was relatively financially knowledgeable as they understood knowledge in basic financial concepts. The study's results reported that financial literacy positively influenced investment behavior and that more financially knowledgeable individuals were more likely to participate in the stock market, saving for retirement and mortgage borrowing.

Yoong (2011) investigated the effects of financial literacy on stock market participation. Data was collected from American Life Panel from a sample of 1000 individuals who were 40 years of age and above. The study found that lack of financial knowledge affects the decision to participate in the stock market. The findings reported that lack of knowledge in finance hinders investors from participating in the stock market and the impact is worse for risk averse individuals as the lack of awareness in financial concepts affects their ability to amass wealth. These findings illustrate the importance of financial literacy in influencing the investment decision of individual investors.

In another study, Hastings and Mitchell (2011) sought to explain whether financial literacy has a role to play in the savings for retirement and the investment behavior using data obtained from 14,000 respondents drawn from the Chilean firms' EPS over a ten year period. The results from the study reported that financial literacy is actually related with retirement saving but less associated with to the investment decision making. The study further recommended that policy makers should come in to guide individual investors in making the right investment decisions and especially where long term investment opportunities are being considered especially now that the choice of investment rests on the investors themselves. The study suggests that individual investors especially the less educated ones are incapable of making optimal investment decisions and there is need to provide training on financial literacy.

Grinblatt, Keloharju and Linnainmaa (2011) examined the effects of investor cognitive abilities on participation in the stock market. The study was revolved around the assumption that individuals having limited cognitive abilities tend to lack the ability to process information and act on it. The results reported that IQ plays a significant role in influencing individual investor decision to participate in the stock market. The study further revealed the central role that cognitive abilities played in influencing other variables of wealth and income which have direct effect on the stock market participation. The results suggest that investors with lower cognitive abilities participate less frequently in the market and in turn earn lower returns. This could explain the wealth disparities witnessed between the low and high IQ individuals.

Barber and Odean (2013) in another study examined the behavior of individual investors. The main focus was on the trading of these investors in individual stocks. The study found that individual investors do not behave rationally as they tend to hold portfolios that are not well diversified because they do not have sufficient information about the securities resulting in low returns even before considering transaction costs. The study further reveals that individual investors prefer to invest in the stocks of companies close to where they stay. The study further observed that the media also influenced the behavior of individual investors and that investors purchased the stocks that were given attention in the news. This suggests that since investors lack information about the securities traded, they have inadequate ability to select the securities they use to form portfolios.

Müller and Weber (2010) conducted an online survey on the relationship between financial literacy of retail investors and their investment in mutual funds. Data was collected from a sample of 3,228 participants in investments through an online questionnaire. The results reveal that there are majorly two distinct groups of individual investors. The more knowledgeable who have a better ability to select their investments. These investors select these investments mostly on their own and rely on information obtained from the internet therefore they reduce their overall transaction costs. Unsophisticated investors on the other hand relied heavily on advice from financial advisors who recommend investment in actively managed funds and as a result such investors incur greater costs on commissions. The study revealed that financial literacy improves the investment decisions of individual investors when considering investment in mutual funds as it improves their ability to select investments and helps in their assessment of expected returns and risks and reduces their overall transaction costs.

Hassan Al-Tamimi and Anood Bin Kalii (2009) conducted a study that assessed the relationship between financial literacy and the effects of dynamics that influence the investment decision among United Arab Emirates individual investors. Data was collected through a structured questionnaire from a convenient sample of 290 individual investors who had invested in the stocks of local companies. The study reported that financial literacy among the individual investors was far below the required level. Further, the study revealed that financial literacy was also affected by the level of education and income. With regard to gender, the women were found to be less financially knowledgeable than men. The study concluded that financial literacy influences the investment decisions of retail investors significantly. However, purposive sampling has serious limitations which may impact on reliability of the findings (Mugenda and Mugenda, 2003). There is need to replicate this study using other designs to corroborate the findings.

In a study dedicated to education and financial market participation, Cole and Shastry (2009) carried out a study that sought to examine the association between education and stock market participation. Data was collected from individual households from a large sample of United States Census data through the use of a detailed questionnaire. The study revealed that education was important in boosting individual investor participation and estimated that stock market participation for households would increase by 1.5% with one additional year of schooling.

Calvet, Campbell and Sodini (2009) evaluated the investment mistakes that many investors make in the stock market. Calvet *et al*., identifies these mistakes to include little diversification, risk taking and the inclination of investors to sell well performing stocks too soon and holding poorly performing stocks too long. Data was collected from Swedish panel and was analyzed using regression analysis. The results revealed that households that were more educated committed smaller investment mistakes and that wealth negatively influenced the three investment errors. Finally, the study reported that financial sophistication increased significantly with the affluence and household size of the investors.

Korniotis and Kumar (2010) examined the impact of cognitive abilities on investment decisions of individual investors in US. They collected data from a sample of 62,387 individual households from a US brokerage house for the period1991-1996. The study estimated cognitive abilities together with the demographic characteristics of the retail investors. Using multivariate cross sectional regression analysis, the study found that investors with cognitive abilities perform better than investors without these abilities by 6% when there are significant differences in the securities in their portfolio. The difference in the performance between the high and the low cognitive abilities investors was positive and significant at 0.05. The study suggests that investors having low cognitive abilities would be better off if they invested indirectly in the financial markets as their direct investment in the financial market would result in economic losses.

In another study, Ivkovic, Sialm and Weisbenner (2008) investigated the role of information on the selection of securities that make a portfolio for individual investors. Data was collected from 78,000 household trades from their monthly statements of position for the period 1991-1996 obtained from a discount broker. The main focus was on common stocks traded in various security markets. The households were divided into two groups of concentrated and diversified households. The data collected was analyzed using regression analysis. The study reported that the holdings of concentrated households performed better that the households that held too many stocks in their portfolios. The study revealed that households that held one or two assets in their portfolio performed better than diversified portfolios. The study also showed that these returns were more in situations of greater information asymmetry. The study suggests that the wealthy households are able to earn higher returns because they have better ability to identify and select the stocks of superior performance because they have more information about the securities.

Guisso and Japelli (2008) conducted a survey on the effect of financial literacy on portfolio diversification decision. Data was collected from a sample drawn from the largest Italian Bank from the 2007 Unicredit Customers Survey. The regression results reported a high correlation between financial literacy and portfolio selection. The study also revealed that the investors with limited financial literacy held undiversified portfolios. The study also found those investors that were risk averse, older investors, little income and less educated investors were less sophisticated financially. The study further recommended that more training should be done to improve investors' financial literacy and ultimately their investment decision making.

Lusardi (2008) sought to establish the influence of financial literacy on financial decision making. The study data was obtained from the US population and the respondents were between the ages of 40 and 60 years. The findings of the study showed that there was widespread financial illiteracy among many households in the US and particularly among individuals with little education. The study found that there was a direct relationship between financial literacy and financial decision making on matters such as savings, investing and the decision to participate in the stock market. The study further recommended that individuals should be trained on financial concepts to enable them make wise investment decisions. This shows that financial literacy is important in the decision to participate in the stock market.

Rooij, Lusardi and Alessie (2011) conducted a study to investigate the effect of financial knowledge on stock market participation. The study found that knowledge in the field of finance increases the efficiency of processing financial information and in this way result in a more individuals participating in the stock market. Data was collected through questionnaires having wide ranging questions for measuring various levels of financial literacy. The study revealed that many individuals had adequate knowledge of basic financial concepts but lacked knowledge in complex financial matters. For instance, the study observed that investors did not have adequate knowledge on financial securities like stocks and bonds and their relationship with interest rates nor were they aware about the importance of diversification. Upon including risk aversion in their empirical specification, financial literacy did not change appreciably in magnitude. It remained positively and statistically significant in explaining stock market participation.

Beckmann, Menkhoff and Suto (2007) conducted comparative study on asset managers' behavior in the United States, Germany, Japan and Thailand reveal that fund managers with a lesser learning degree were prone to herding behavior. Elton, *et al*. (2004) investigated investors' choices of index funds where costs varied across funds with the funds having almost comparable investment strategies; the variations drove anticipated differences in performance. Despite this predictability, investors invested in very costly securities with expected poorer performance. This means that individuals need to have proper knowledge and skills if at all they are to benefit from trading in the financial markets.

The studies reviewed reveal that there are mixed results on whether or not financial literacy contributes to stock market participation. The studies that have found a positive relationship between financial literacy and stock market participation decision show that the estimated effects differ. Further, many of the studies reviewed have been conducted in developed countries and therefore their findings may not be similar as those of stock markets of developing countries like Kenya. Many of these studies have also focused on other populations and none has looked at civil servants and specifically teachers who can also invest in the stock market. Therefore there was need to investigate how individuals' stock market participation can be affected by financial literacy and awareness in Kenya and specifically for secondary school teachers in Nakuru County, Kenya.

Dual Process Theory

Dual-process theory was developed by William James in 1980. He proposed that decisions are normally as a result of two processes. An implicit process that remains unchanged for long and an explicit process that can be varied through education and persuasion. This theory is relevant for the study in that financial literacy is a variable that is presumed to influence the stock market participation decision by individual investors. Hilgert, Hogarth and Beverly (2003) found a strong relationship between knowledge and behavior in their investigation of different groupings of financial activities. Evans (2008) in his study concluded that the dual process theories agree that decisions are driven by both intuitive and cognitive processes. Siekei, Wakoki, and Kalio, (2013) in a study supported that financial literacy expedites the decision making processes. Financial literacy facilitates the making of decisions related to investment and particularly individual stock market participation decision. The theory guided the investigation on the relationship between financial literacy and individual investors' decision to participate in the stock market.

RESEARCH METHODOLOGY

This study employed cross sectional survey research design**.**

Polulation and Sample

The target population was 1,609 secondary school teachers from the Nakuru, Molo, Njoro, Naivasha and Gilgil sub counties of Nakuru County as per the Teachers Service Commission Report (2018). Stratified proportionate random sampling was used in this study where the Sub Counties represented the strata. The representative sample from each stratum was determined using simple random sampling. The sample size was 320 secondary school teachers. Out of the 320 questionnaires that were distributed to the respondents, 231 were returned fully filled. This represented a response rate 72%. This is considered sufficient for analysis according to Babbie (1990) who asserts that a response rate of 60% is good for analysis.

Primary data was used and was collected through the use of structured questionnaires. Pilot testing was used to check the instruments reliability. Cronbach alpha was used to test reliability of items measuring financial literacy. The results obtained an overall Cronbach Alpha correlation coefficient of 0.845 on financial literacy and a coefficient of 0.853 on stock market participation. Factor analysis was used to check construct validity and all the items that met the loading cut off of 0.4 were retained for analysis. Hair, Babin, Anderson and Tatham (2011) assert that factor loadings greater than 0.4 should be accepted.

Inferential statistics such as correlation coefficient, ANOVA and regression analysis were used to analyze the data with the aid of Statistical Package for Social Scientists (SPSS) version 25. Regression analysis was used to establish the relationship between

financial literacy and stock market participation. Research hypothesis was tested at 5% significance level using the regression while F-statistic was used to measure whether the model fits the data significantly.
The study employed the following regression model

$$\mathbf{Y = \beta_0 + \beta_i X_i + \varepsilon}$$

Where;
Y - Stock market participation
X_i - Financial literacy of individual investors
B_i - Regression coefficients for the independent variable
β_0 - Regression Constant
ε - Stochastic error term assumed to be normally distributed

ANALYSIS AND FINDINGS

Financial Literacy of Individual Investors

The study found that the correlation between financial literacy and stock market participation was positive and statistically significant (r =0.313, p <0.05)

As shown on Table 1, the R square is 0.098 which implies that 9.8% variation in stock market participation can be explained by financial literacy of individual investors. This means that 90.2% variation in stock market participation decision can be explained by other factors other than financial literacy.

Table 1
Model Summary for Financial Literacy and Stock Market Participation

						Change Statistics			
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.313[a]	.098	.094	.81566	.098	24.835	1	229	.000

Source: Research Data, 2019

The results on Table 2 indicate that the model was statistically significant. The model had F-statistics of the regression ($F_{(1, 229)}$ = 24.835) which was statistically significant (p<0.05). This indicates that the model applied significantly predicted the change of the dependent variable as result of the predictor variable included in the model suggesting that the model significantly fits the data.

Table 2
ANOVA Results for Financial Literacy and Stock Market Participation

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	16.523	1	16.523	24.835	.000[b]
	Residual	152.353	229	.665		
	Total	168.876	230			

Source: Research Data, 2019

As presented on Table 3 show that there exists a statistically significant positive relationship between financial literacy of individual investors and stock market participation among secondary school teachers from selected sub counties in Nakuru County (β = 0.378, p<0.05). A beta coefficient of 0.378 implies that when financial literacy of individual investors increases by an additional unit, stock market participation increases by 0.378. This means that the null hypothesis (**Ho_1**) was rejected by implying that "Financial literacy of the individual investors has significant effect on stock market participation".

The following regression equation was obtained

$$Y = 2.009 + 0.378\ X_1$$

Where;
Y – Stock market participation
X_1 – Financial Literacy of individual investors

Table 3
Coefficients for Financial Literacy and Stock Market Participation

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	T	Sig.
1	(Constant)	2.009	.266		7.555	.000
	Financial Literacy	.378	.076	.313	4.984	.000

Source: Research Data, 2019

The results support the observed responses of the respondents where majority of the respondents agreed that they consider the ability to access financial market information from print media sources while making the investment decision. Further, most of the respondents agreed that they consider the knowledge acquired from investment workshops attended while making the investment decision.

The findings concur with those of Mbabazi and Daniel (2014) who found a positive significant association between financial literacy and stock market participation. The study concur with those of Lusardi, *et al.* (2007) in another study done in Dutch concluded that knowledge in the field of finance increases the efficiency of processing financial information and in this way result in a more individuals participating in the stock market. The study reported that financial literacy was positively and statistically significant in explaining stock market participation. The results concur with those of Hassan Al-Tamimi and Anood Bin Kalii (2009) who conducted a study that assessed the relationship between financial literacy and the effects of dynamics that influence the investment decision among United Arab Emirates individual investors. The study concluded that financial literacy influences the investment decisions of retail investors significantly.

The findings are inconsistent to those of Marobe (2013) who examined factors that influence stock market participation in Tanzania. The study reported that financial literacy was insignificant to the stock market participation decision. A theoretical explanation that could account for this is the differences in the questions that measured financial literacy. The results also support those of Brown and Graf (2013) who conducted a survey that sought to evaluate how investment and borrowing is influenced by financial literacy among Swiss households. The study's results reported that financial literacy positively influenced investment behavior and that more financially knowledgeable individuals were more likely to participate in the stock market.

CONCLUSIONS AND RECOMMENDATIONS

It can be concluded that financial literacy of individual investors has positive significant relationship with stock market participation decision among secondary school teachers from selected Sub Counties in Nakuru County, Kenya.
Secondary school teachers focusing on stocks investment have limited access to financial market information. Although they are aware of the investment opportunities available they lack the ability to understand financial markets information. It can be concluded that secondary school teachers consider their ability to access financial markets information from print media resources when making the investment decision. Further, it can be concluded that there is low understanding of market processes and fundamental stock analysis among secondary school teachers who participate in investment in the stock market.
Based on the conclusions, the study recommends that the Capital Markets Authority, which is tasked with supervision, licensing and monitoring the activities of financial markets should implement comprehensive awareness and public education programs that targets the wider non-stock market participating public. This will increase participation which is an indicator of well-functioning financial market in any country.

The study further recommends that other factors that could explain stock market participation should be investigated since financial literacy could only explain 9.8% of variation in the stock market participation of teachers. This means that 90.2% of variation in stock market participation could be explained by other factors other than financial literacy.

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Validation of Learning Media Using Argument Driven Inquiry (ADI) Learning Model

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Abstract -The subjects in this study are the development of learning media using the ADI (Argument Driven Inquiry) learning model on electrolyte and non-electrolyte material. Learning media developed aim to improve self-efficacy and student learning outcomes. Development of learning media is carried out using the 4D development model. Data validity is obtained based on the results of the assessment by three validators from the chemistry lecturer, where the assessment is carried out using a validity test sheet in the form of questionnaire. This study aims to describe the validity of the learning media developed consisting of Lesson Plan, Student Worksheets, knowledge assessment sheets, student response questionnaires, student activity sheets, motivational questionnaire sheets, self-efficacy questionnaire sheets, and student response questionnaire. The results of the assessment of the three validators were found that the learning device developed got the value of modus 4 with a very valid category.

Keywords- Validation, learning instruments, Argument Driven Inquiry, self-efficacy

I. INTRODUCTION

Curriculum 2013 which has been implemented in Indonesia in its implementation has always undergone improvements in accordance with the development of science and technology. The 2013 curriculum applied at this time emphasizes more on character and competency education, so students are expected to be able to have a strengthening of spiritual attitudes, and social attitudes, and be able to increase curiosity, creativity, psychomotor, and intellectual knowledge [1].

One of the expected achievements can be achieved by creating a more innovative learning process, and learning is more student-centered so that students are more active in learning activities. Teacher-centered learning will focus on learning where the teacher is the source of information so students will be more passive in learning activities. Another case when learning is student-centered, students who were previously accustomed to receiving information (notified) from the teacher will actively find out.

Self-efficacy is very important in learning activities because it can affect cognition, motivation, affective process which will affect one's behavior and can have an impact on someone's perseverance in learning [2]. Hairida (2012) In his research also suggests that the higher self-efficacy, student achievement in learning chemistry will get higher. Conversely, if students' self-efficacy is low, their learning achievement will also be low **[**5].

To support the educational objectives described above, one of them is the availability of learning that corresponds with the demands of education both nationally and internationally. Learning media are a set of materials used for the learning process, for example lesson plan, student worksheets, and assessment sheets. This learning media is made so that the learning conducted in the classroom can run well in accordance with the learning objectives and competencies to be achieved. Learning media determine so much on the achievement of the desired learning objectives, so that a valid learning instrument is needed to get the learning objectives which correspond with the competencies to be achieved.

II. RESEARCH METHODH

The development model used in this study is the 4-D (four-D Model) [7]. Which consists of four stages, namely definition, design, development and dissemination.

First, the definition phase is carried out need-analysis which includes curriculum analysis, student analysis, task analysis, concept analysis, and formulation of learning objectives. Second, the design phase aims to produce learning media based on the ADI learning model. The results at this design stage are called draft I. Learning media developed include learning lesson plans, student activity sheets, and assessment sheets, motivational questionnaires, self-efficacy questionnaires, student response questionnaires. Third, the development phase is carried out to study and evaluate the learning media developed, especially on aspects of concepts, novelty, language, and ease of use by students, teachers or education experts.

At the development stage, validation of learning instruments was carried out. It was carried out by experts to get an assessment and input in the form of suggestions and criticisms of the draft learning instrument I. The instrument validation is content

validation, language, format, and corresponds with the ADI learning model. Suggestions and criticisms from the validator are used to improve learning media that have been developed by researchers before learning media are tested on the subject of research. The revised learning media based on the validation results is called draft II.

Data from the validation results were analyzed using quantitative descriptive analysis by calculating the average value given by the validator. This score is then adjusted to the assessment criteria shown in Table 1 [8].

Table 1. Criteria for assessment of learning instrument

Score	Category
$3{,}6 \leq P \leq 4$	Very Valid
$2{,}6 \leq P \leq 3{,}5$	Valid
$1{,}6 \leq P \leq 2{,}5$	Less valid
$1 \leq P \leq 1{,}5$	Not valid

The validation agreement was calculated based the formula:

$$Percentage\ of\ Agreement = (1 - \left[\frac{A-B}{A+B}\right] x100\%$$

that
A = the highest score given by the assessor
B = the lowest score given by the assessor

An instrument is satisfied to valuation agreement if the percentage of agreement is ≥ 75%. Based on the criteria in Table 1, the learning instrument developed in this study are said to be valid if they get a score ≥ 2.6.

III. RESEARCH FINDING

The results of the validation of the learning instruments include the plan for implementing the lesson, student worksheets, motivation armature sheets, student activity sheets, self-efficacy questionnaires, and knowledge assessment sheets which will be explained as follows:

1. Results of the Lesson Plan Validation

The lesson plan developed by using the learning model ADI where using the learning model is expected to be able to improve self-efficacy and student learning outcomes in electrolyte and non-electrolyte material in class X of SMAN 7 Surabaya. The developed lesson plan is arranged for 3 meetings, in which each meeting consists of 2 lesson hours consisting of 45 minutes for each lesson. The following is the result of lesson plan validation which has been validated by 3 validators from chemistry department in UNESA.

Tabel 2. Validation of Lesson Plan

No	Diskription	Modus	Category	PoA (Average) (%)
1.	Lesson plan format	4	VV	87,38
2.	Learning activities	4	VV	100
3.	Supporting Learning activities	4	VV	100
4.	Language	4	VV	86

V = Valid; VV = Very Valid; PoA = Percentage of Agreement

Based on the results of the validation by the three validators in table 2 shows the data that in general the results of the validation of the Lesson Plan are arranged to have very valid categories and can be used with a slight revision. In addition, there is also a modus 4 with very valid criteria and an average reliability of 91.8% so that it can be categorized as reliable. The developed lesson plan can be used with a little revision. Followings are some suggestions for improvement from 3 validators.

Table 3. Suggestion and Enhancement Lesson Plan

No.	Suggestion	Enhancement
1.	Destination numbering is adjusted by indicator numbering	Numbering has been adjusted to the learning indicator
2.	Learning objectives must be ABCD	Learning objectives have been adjusted for ADCD
3.	The introduction and closing of the learning step are corrected	The introduction and closing of the learning steps have been corrected

3.2 Results of Student Worksheet Validation

Student Activity Sheet by using the Argument Driven Inquiry learning model developed to improve learning outcomes and also student's self-efficacy consists of 3 Student Activity Sheet which is used for 3 times. The developed worksheet is used to guide students to make it easier to understand the concepts of electrolyte and non-electrolyte solutions. The following are the results of the Student Activity Sheet Validation validated by 3 Validators

Table 4. Validation of Student's Worksheet

No	Diskription	Modus	Category	PoA (Average) (%)
1.	Student's Worksheet format	4	VV	95
2.	Eligibility	4	VV	93
3.	Language	4	VV	86

V = Valid; VV = Very Valid; PoA = Percentage of Agreement

Based on the results of validation by the three validators in table 4, it shows data that in general the results of validation of Student Worksheets compiled get modus 4 with a very valid category and can be used with a slight revision. In addition, the reliability data of an average of 93.3% was also obtained, giving the meaning that Student Worksheets can be categorized as reliable. The followings are some suggestions for improvement from 3 validators.

Table 5. Suggestion and Enhancement Student's Worksheet

No.	Suggestion	Enhancement
1.	Some writing procedures need to be fixed	The writing system has been fixed
2.	The answer key is incorrect	The wrong answer key has been corrected

3.3 Self efficacy Questionnaire

The self-efficacy questionnaire is one of the instruments developed in this study. The self-efficacy questionnaire that has been developed is used to measure the increase in student self-efficacy, where self-efficacy questionnaires are developed based on the dimensions of self-efficacy including magnitude, strength, and generality. The following is the result of student self-efficacy questionnaire validation which has been assessed by three validators.

Tabel 6. Self efficacy Questionnaire

No	Diskription	Modus	Category	PoA (Average) (%)
1.	Format	4	VV	100
2.	Language	4	VV	96,5
3.	Contents	4	VV	100

V = Valid; VV = Very Valid; PoA = Percentage of Agreement

Based on the results of validation by three validators in table 6, the data show that in general the results of the self-efficacy questionnaire validation compiled have modus 4 with a very valid category and can be used with a slight revision. Besides, the reliability data of 98.6% also gives the meaning that the results of the validation of the self-efficacy questionnaire are included in the reliable category. The following are some suggestions for improvement from 3 validators.

Table 7. Suggestion and Enhancement Self efficacy Questionnaire

No.	Suggestion	Enhancement
1.	Some statements are made in negative statements.	Some statements have been made in negative statements.
2.	A goal is given for each point.	At each point added to the goal

3.4 Learning outcomes test instrument

The learning outcomes test instrument developed consisted of the pretest and post-test questions. Each test instrument consists of 10 multiple choice questions which are arranged based on learning indicators on electrolyte and nonelectrolyte material. The following is the result of the validation of the learning outcomes test instrument from three validators.

Table 12. Learning outcomes test instrument

No	Diskription	Modus	Category	PoA (Average) (%)
1.	Concept	4	VV	86
2.	Construction	4	VV	100
3.	Language	4	VV	93

V = Valid; VV = Very Valid; PoA = Percentage of Agreement

Based on the results of validation by three validators in table 12, the data shows that in general the results of the learning outcome test validation are compiled with modus 4 with a very valid category and can be used with little revision. In addition, the reliability data of 90.6% also gives the meaning that the results of the validation tests of student learning outcomes are included in the category of reliability. Here are some suggestions for improvement of 3 validators.

Table 13. Suggestion and Enhancement Learning outcomes test instrument

No.	Suggestion	Enhancement
1.	There are several keys and cognitive domains that are not appropriate.	The answer key and cognitive domain have been adjusted
2.	The cognitive domain used is at least C4.	The problem used uses a minimum of C4 cognitive domains

IV. DISCUSSION

1. The Lesson Plan

The lesson plan is a very important guide prepared by the teacher in the implementation of learning activities. The implementation plan is prepared based on the basic competency that has been set, so that it is expected that the learning objectives can be achieved thoroughly. The lesson plan which was developed by using the ADI learning model (Argument Driven Inquiry), with the applied learning model expected to be able to improve students' self-efficacy. Teachers who have high self-efficacy are teachers who successfully teach their students and even naughty students [9]. The developed lesson plan was arranged for 3 times face-to-face applied to electrolyte and non-electrolyte material. In the first meeting discussed the electrical conductivity of electrolyte olutions, the nature and type of electrolyte solution, electrolyte strength and electrolyte properties.

2. Student Worksheets

Student Worksheets is teaching material that is packaged in such a way that students are able to learn material taught independently [10]. Good learning is learning that emphasizes the participation of students who are active in learning, and the teacher only functions as a facilitator [8]. With the opinion above, in this study the researcher facilitates students to learn by using LKS for guidance in conducting practical work, thus students are expected to be able to gain an understanding of the concepts learned. The results of Student Worksheets validation are good if the worksheets compiled by the researcher pay attention to the following: (1) The titles on the Student Worksheets must be in accordance with the material, (2) the material presented is in accordance with the level of student development, (3) the material presented is simple, logical, clear, and systematic (4) able to make students actively involved in learning activities, (5) the appearance of student worksheets is simple, clear and easily understood by students, (6) images and graphics in accordance with concepts (7) location of images, tables, and questions must be appropriate, and (8) develop interest and be able to invite students to think.

a. Self-Efficacy Questionnaire

The self-efficacy questionnaire is used to measure the increase in self-efficacy of students. The self-efficacy questionnaire assessment includes the suitability of the format, language, and content. Based on the results of the assessment of 3 validators, the format conformity data obtained modus 4 with a very valid category and reliability of 100% with the reliable category. Language points in the self-efficacy questionnaire get modus 4 values with very valid categories and reliability of 96.5% with the reliable category. For the content format, get the modus value of 4 with a very valid category and 100% reliability with the reliable category. Thus the self-efficacy questionnaire developed was declared very valid and reliable.

b. Test of learning outcomes

The student learning outcomes test instruments are composed consisting of 10 questions for the *pretest* and 10 questions for the *posttest.* Questions are arranged based on learning indicators, namely on electrolyte and non-electrolyte material. With the existence of cognitive processes *self-efficacy* students will appear to apply the various knowledge they have as well as to overcome the existing problems. In working on the problem, it takes strong *self-efficacy* in dealing with problems when working on questions and other demands. With high *self-efficacy*, a person will be able to set themselves to achieve the goals of the challenges that exist, and by using good analytical thinking able to show good performance when conducting tests [11]. S*elf-efficacy* possessed by students is able to have an impact on student achievement in accordance with the objectives to be achieved [12].

V. CONCLUSION

Based on the results of the research conducted, it can be concluded that the learning device developed using the ADI learning model on electrolyte and non-electrolyte material is declared valid with a modus value of 4, and a reliability of 80% -100% with a reliable category.

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Influence of Selected Televised Music Programs On the Sexual Behaviour of Students in Secondary Schools, Nairobi County, Kenya

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Abstract

This study sought to establish the influence of televised music programs on the sexual behaviour of students in secondary schools, Nairobi County, Kenya. More precisely, the study evaluated the influence of nature of televised music programs, the influence of programs watching environment, the influence of frequency of watching televised music programs and the influence of program gratifications on the sexual behavior of secondary school's students in Nairobi County, Kenya. The findings revealed that the students mostly watched the music programmes during the weekends, and during holidays, the major gratification that the student get from the music programmes is entertainment and socializing aspects where the students seek for companionship and self-belonging. The study further showed that the probability of negative sexual behaviour increases for those students who watch these televised music programs because of entertainment and socializing compared to those who watch them because of education. However, the potential for the rise of the prevalence stands at a risk if the relevant stakeholders including the parents, teachers, the media practitioners and the government at large do not take into consideration the risk of selected televised music programs on the sexual behavior of secondary school students.

Key words

Nairobi County Kenya, Selected Televised Music Programs, Students in Secondary Schools, Sexual Behavior of Students.

I INTRODUCTION

In Kenya, there are many televised music programs owing to the popular TV channels being aired every day. The creative industry is growing speedily with the aim of targeting the gratification needs of the general public. The entertainment business has thus been able to capture the interest of the public especially the young people through the music programmes being aired on national TV. Apart from, Digital music offering the advantage of being able to be downloaded, streamed online, set as a ringtone or video watch, young people have preferred to experience the show live with the local artists being present to entertain them. Teenagers especially tend to emulate the habits that are represented in the media by popular individuals. Children and adolescents have been found to be highly devoted television viewers, regardless of whether the programmes are designed for them or not. To some people the television is a waste of viewers' time and it is corruptive. However, to others, television is a great tool of effective education to the people especially children. Teenagers may not be immediately affected by TV programmes, however, they may develop false ideals and socially unacceptable behaviors especially portrayed in their verbal expressions. The more they watch these televised programmes in the name of entertainment, the higher their chances of developing views and perceptions of reality that are similar to those on television programmes, considering that the amount of time spent watching them is also a lot.

The paper therefore examined the Influence of selected music programmes on the sexual behavior of Secondary School Students in Nairobi, Kenya.

1.1 STATEMENT OF THE PROBLEM

Sexual misconduct has been on the rise in students within their period puberty, which has resulted in higher rates of premarital sexual activity, pregnancies and contraction of STIs. In Kenya, parents and teachers have raised an alarm towards TV programmes especially music and soap operas which have been

attributed to influence adolescents' sexual misconduct. As indicated by Mumah *et al.* (2014) over 40% of pregnancies in Kenya are unintended with about 18% of teenage girls ranging from 15 to 19 years becoming early mothers and thus their opportunities for economic and educational growth become limited. In Kenya, nearly half of all new HIV infections is reported in young people aged 15 to 24 years (Avert, 2018). In 2017, a report by the Ministry of Health indicated that the number of new infections stood at 52,800 with 44,800 reported among persons aged 15 and above with the rest being children below the aforementioned age. Of this findings, Nairobi accounted for 2,587 new infections of people aged 15 to 24 years (MoH, 2018). This is an indication of negative sexual behavior among adolescents. Thus the study sought to shed more light on how televised music programs have contributed to the sexual activities amongst secondary school students in Nairobi, Kenya.

1.2 OBJECTIVES

Generally the paper sought to establish the effects of selected televised music programs on the sexual behavior of secondary school students in Nairobi County, Kenya. In particular, the paper sought to determine the influence of nature of televised music programs on the sexual behaviour of secondary school students within Nairobi.

II. THEORETICAL BACKGROUND AND LITERATURE REVIEW

In this section of the paper, the literature review of the objective informing this paper as well as the theory informing the particular objective were discussed as seen below.

2.1 Nature of Televised Music Programs and Sexual Behaviour of Secondary Schools Students

Kidenda (2018) also purposed to investigate the nature of televised animated cartoons watched by children in Kenya. She was able to show a significant relation between the type of films and cartoon children watch and the impact that is brought about in the children. From the study, it was discovered that animated cartoons have discernible impacts on children in Nairobi in that they influence the children to construct their worldview and create perceptions that are alien to Kenya. In that case, since children are excellent at imitating but rather poor at evaluating, the non-African ideals and values portrayed in the animated cartoons are increasingly defining the perception toward sexuality, gender roles and body images for children who regularly view animated content in Kenya.

By adopting a survey design in the research, Njoku (2016) analysed how the movie industry influences the behaviors of students in high school in Ebonyi, Nigeria. The findings showed that the movie industry in Nigeria negatively affects the moral behavior of school-going children. Furthermore, teaching the children on Christian values was found to go some way to mitigating those effects. However, the research advised on the need to direct the in public secondary school Nigeria likewise, Fehintola and Audu (2012) sought to find how watching such videos affect the academic performances of the high school students. The study observed five public schools in the region. And the results from revealed a significant association between the type of content watched, the reason for watching, the amount of time spent, the reactions of the reactions of parents and the students' performances.

Odeleye and Ajuwon (2015) took a keen interest in the sexually explicit films and how high school students in Ibadan behave as a result. The research found that young people who spent considerable time watching TV were more likely to engage in sexual practices. These scenes were found to motivate them to engage in negative sexual behaviors. Generally, the study showed that many students at some point of their watching had come across sex scenes. In addition, the students acknowledged that they were able to access the media from secondary storage devices. Therefore, the study was able to affirm that watching TV had affected their sexual behavior.

Ku, Kwak, Yurov and Yurova (2014) sought to find out how gaming culture among college IT students affects their academic performance. Results from multiple regression analysis showed that social interactions through mobile phones or face-to-face, capacity for self-control and playing video games significantly affect their academic performances. This replicates to the performance of the students due to their ability to manage the addiction to video games and focus on academics.

Mullings (2012) explored the use of Cultivation Theory by Gerbner (1998) to assess the effect of reality television on the academic performance of high school students. Mullings indicated students maintained a healthy attitude toward education regardless of how much TV they consume. Students who spent less hours watching reality TV shows were less influenced by what they saw and instead used their indifference toward it as a source of motivation for their studies. Further, underachieving students placed little value toward their education.

2.2 Social Learning Theory

Albert Bandura (1977) developed this theory. The theory conforms with behaviorist learning theories such as operant conditioning and classical conditioning. Further, he added two more ideas: the environment shapes an individual's behavior through learning by observation and the process of mediation occurs between a stimulus and a response. Individuals that are observed are called model**.** This theory suggests that knowledge is best formed when there is a collaboration between learners. As a result of students supporting each other, they develop better ways to construct and reflect on any fresh material.

The theory puts an emphasis on observation, behavior modelling, emotional reactions and attitudes of others. Further, Bangura admits that learning would involve a lot of effort if everybody relied solely on their own to determine the effects of their actions. One aspect of this theory is that of modelling where we model our behaviour from observing others. The effects of modelling can be particularly apparent when children observe televised cartoons without adult supervision. This may lead the students develop totally new behaviour ranging from dressing style, speech, moral stances and table etiquette (Zimmerman, 2013).

In society, influential figures surround students. They include family members, TV characters' friends within their age groups and school teachers. Students observe and imitate these models and behave appropriately as per their observations, e.g. pro-social, anti-social, feminine, masculine etc. (Bandura, 1974). Social learning theory is much more than just observing behaviour and modelling our own after it. An individual need to be motivated to conform to modelled behavior, and memorize those behaviors (e.g. Rehearsing it) and to later retrieve it when opportunity arises to put it to use. This theory has directly benefited studies related to human development. Researchers have been led to conclude that behavior stems directly from the immediate environment, even those that seem inborn. (Berger, 1995). This theory therefore is instrumental in explaining the influence of nature of televised music programs on the behaviour of secondary school's students.

III. METHODOLOGY

This paper was based on literature review in line to the following objective, To determine the influence of nature of televised music programs on the sexual behaviour of secondary school students within Nairobi County. In addition, literature of journals were widely reviewed.

IV.CONCLUSION

The research came up with the following conclusions in line with the subject of study. Based on the findings of the study, parents have a part to play in shaping their children's TV viewing. In addition sexual music on TV has the same effect on teens as depictions of sex and it likewise interferes with the students' mentally and triggers their need to engage in premature sex Thus, sexually explicit content may contribute greatly to teen pregnancy, sexual assault and substance abuse. The study likewise concluded that schools in Nairobi

The study also noted that parents do not talk about sexuality with their children which consequently create a knowledge gap making the teenagers learn about sexuality from other avenues, mainly media which may be misleading. In addition, The study also concluded that televised music programs influence sexual behavior among secondary school going students in Nairobi County and therefore the potential for the rise of the prevalence stands at a risk if the relevant stakeholders including the parents, teachers, the media practitioners and the government at large do not take the keenly evaluate the TV content. This means, depending on what these students are exposed to, their choices in life are in extreme danger if not closely monitored at an early stage. The role of mainstream media comprised of television, magazines, movies, music and even the internet is to ensure the information relayed does not frequently portray sexuality (Ngula, Mberia, & Miller, 2016). Since every piece of information has its influence of the audience in terms of their beliefs and behavior, it is hence the objective of the responsible stakeholders to ensure the public and personal agendas of the media adhere to the norms and responsible models within society.

V. RECOMMENDATIONS

- Parents need not to assume that there is no behavioral harm regarding the content being broadcasted on Television. The spread of televised music programmes is at a ravaging pace and the youth are at a risk of being consumed by the wave if not monitored. Thus, the parents need to be good role models and impact sensible and applicable knowledge in the children from the very beginning at infancy. This will help the students to be

better placed at developing sound mind and making informed decisions about their career choices rather than relying on televised programme models.

- Media Practitioners likewise need to be concerned about the future generation and its roots right in the adolescents' hands. They need not to focus on money making aspects alone but also need to be aware of the intellectual shaping of the youth which will boost the work force of the nation to the future. Thus, they need to minimize the airing of sexually explicit programmes on national television. This is because the youth are not only the majority consumers of the content but they are also at a tender age of being misled by such pervasive content.
- The Government likewise needs to come out clearly and strictly about the policies that govern the media in Kenya. It needs to set policies governing the content in televised music programmes aired by the local and international media houses. The music society of Kenya likewise needs to train collaborate with the government regarding the content being produced by the local producers and artists.

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Histopathological Spectrum of Heart Diseases in Autopsy Specimens

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***Abstract*- Background:** Objective of the study was to analyze the histopathological spectrum of heart diseases in autopsy specimens that play a major role as cause of death.

Methods: During the period from January 2018 to December 2018, 400 autopsy specimens were received in Department of Pathology at Government Medical College Jammu. Out of 400 Autopsy specimens 350 specimens of heart were received. Out of these specimens of heart, 36 specimens were autolysed and eight specimens had only small pieces of heart, which were not included in the study. Study was conducted for 308 specimens of heart. Gross and microscopic findings on H&E stained sections were studied.

Results : Out of 308 cases, 219 cases showed atherosclerosis, 14 Cases showed features of myocardial infarction, 12 cases showed myocardial hypertrophy, 2 cases showed myocarditis .There was one case showing cysticercosis in the lumen of anterior descending artery.

Conclusion : Atherosclerosis is the leading cause of cardiovascular related deaths in cases subjected to medico legal autopsies.

***Index Terms*-** Coronaries, Heart, Postmortem.

I. Introduction

Incidence of cardiac deaths has been increasing all over the world particularly in urban population during last five decades. In India incidence of ischemic heart diseases has increased to about 10% [**1**].

Autopsies can be valuable source for epidemiological information in addition to providing valuable information to deceased family [**2**].

Autopsy is therefore a tool of real value for assessment of pathologies that are difficult to access in living [**3**]

Many a times it has been found that when gross pathology could not help to evaluate the cause of death, histopathology can conclusively opine the involved cardiac pathology.

The aim of the present study is to identify the various histopathological lesions of the heart found incidentally which play a major role as a cause of death.

II. METHODS

The present study was carried out at the Department of Pathology Government Medical College Jammu from January 2018 to December 2018. Total of 400 Medico legal autopsies were received during this period .Out of 400 autopsy specimens 350 autopsy specimens included heart .There were 36 autolysed specimens of heart and 6 specimen comprised of only pieces of heart which were not included in the study. Total 308 specimen of heart were included in the study. Epidemiological data and postmortem findings were collected from the postmortem papers and police papers.

Gross Examination of the heart, weight and dimensions of whole heart were recorded .The external surface was looked for any pericardial pathology and for any evidence of recent or old infarct .The heart was dissected /opened by inflow outflow technique. Measurement of thickness of ventricular ,atrial walls and interventricular septum was measured. The valves were checked for their number, stenosis and calcification. All the coronary arteries were examined using regular sections every 4 to 5 mm. The ascending aorta was checked for dilatation, thickening or atheromas.

Microscopic Examination:

Sections were taken from Aorta, Pulmonary artery ,both the Atria and both the ventricles and coronary arteries. In addition sections were taken from inspected pathological lesions.

III. RESULTS

Age in years	No. of Patients	Percentage
0 -10	-	
11- 20	2	1%
21- 30	40	12.5%
31- 40	56	18%
41- 50	86	28%
51-60	90	29%
61 – 70	33	11%
71- 80	1	0.5%

Table1: Agewise distribution of cases

Sex	Number	Percentage
male	215	70%
female	93	30%

Table 2: Sexwise distribution.

Findings	No. of cases	Percentage
Atherosclerosis	219	71.0%
No specific findings	60	19.5%
Myocardial infarction	14	4.5%
Myocardial hypertrophy	12	4.0%
Myocarditis	2	0.75%
Cistecercosis	1	0.25%

Table 3: Histopathological findings.

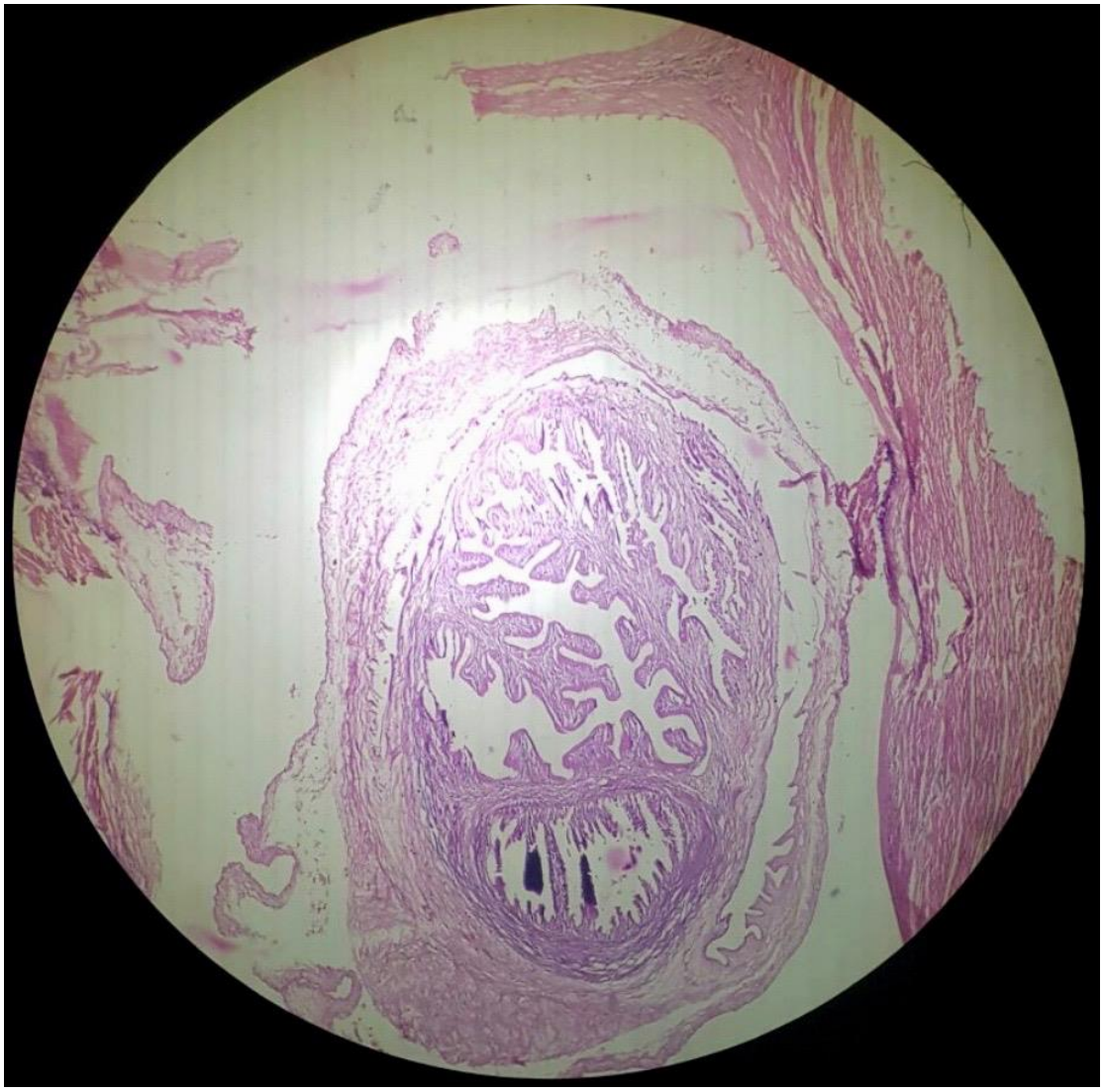

Figure 1: Microphotograph depicting cysticercosis in the lumen of anterior descending artery of an unidentified male.

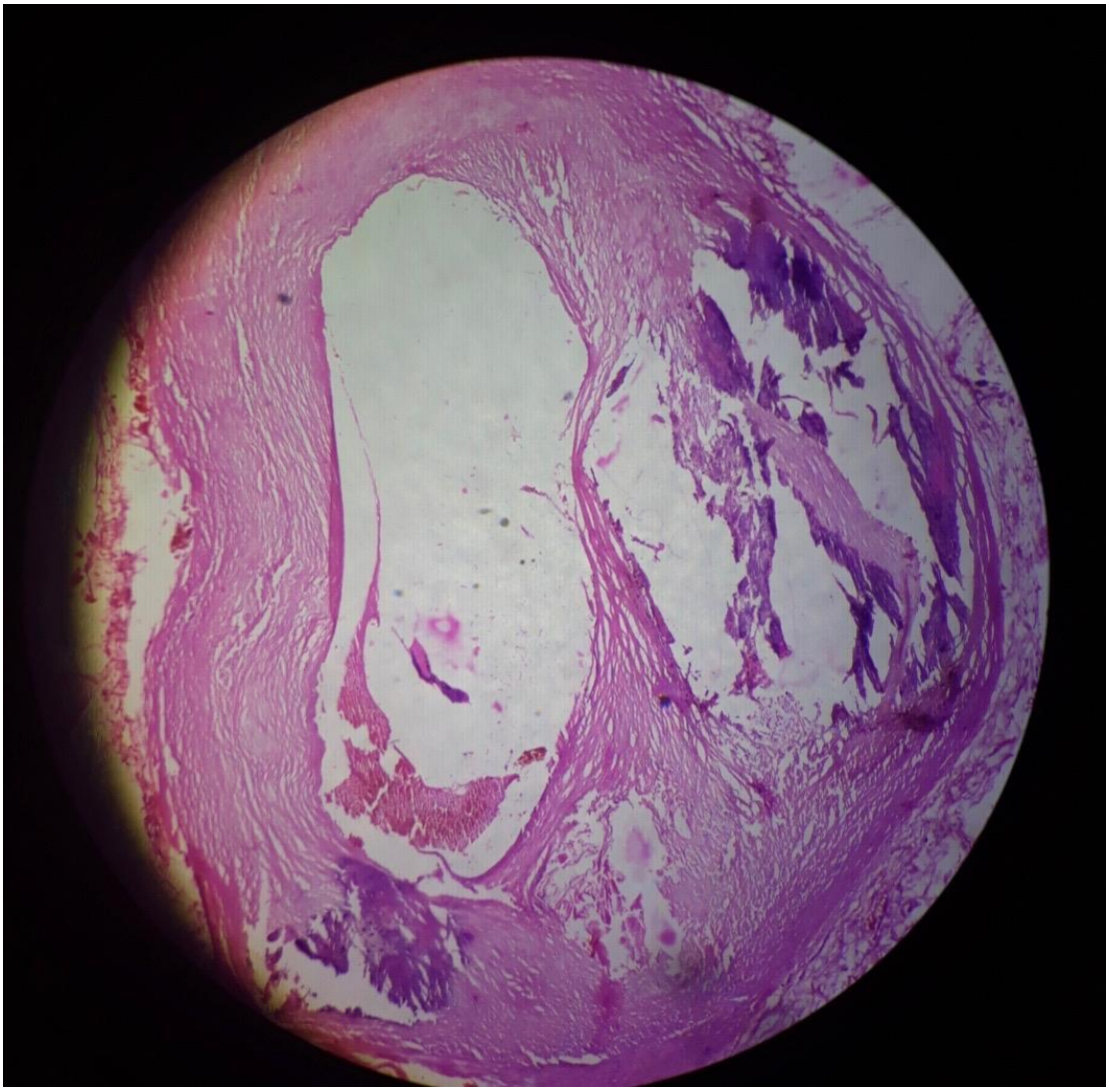

Figure 2: Atherosclerosis with medial calcification.(H&E x20)

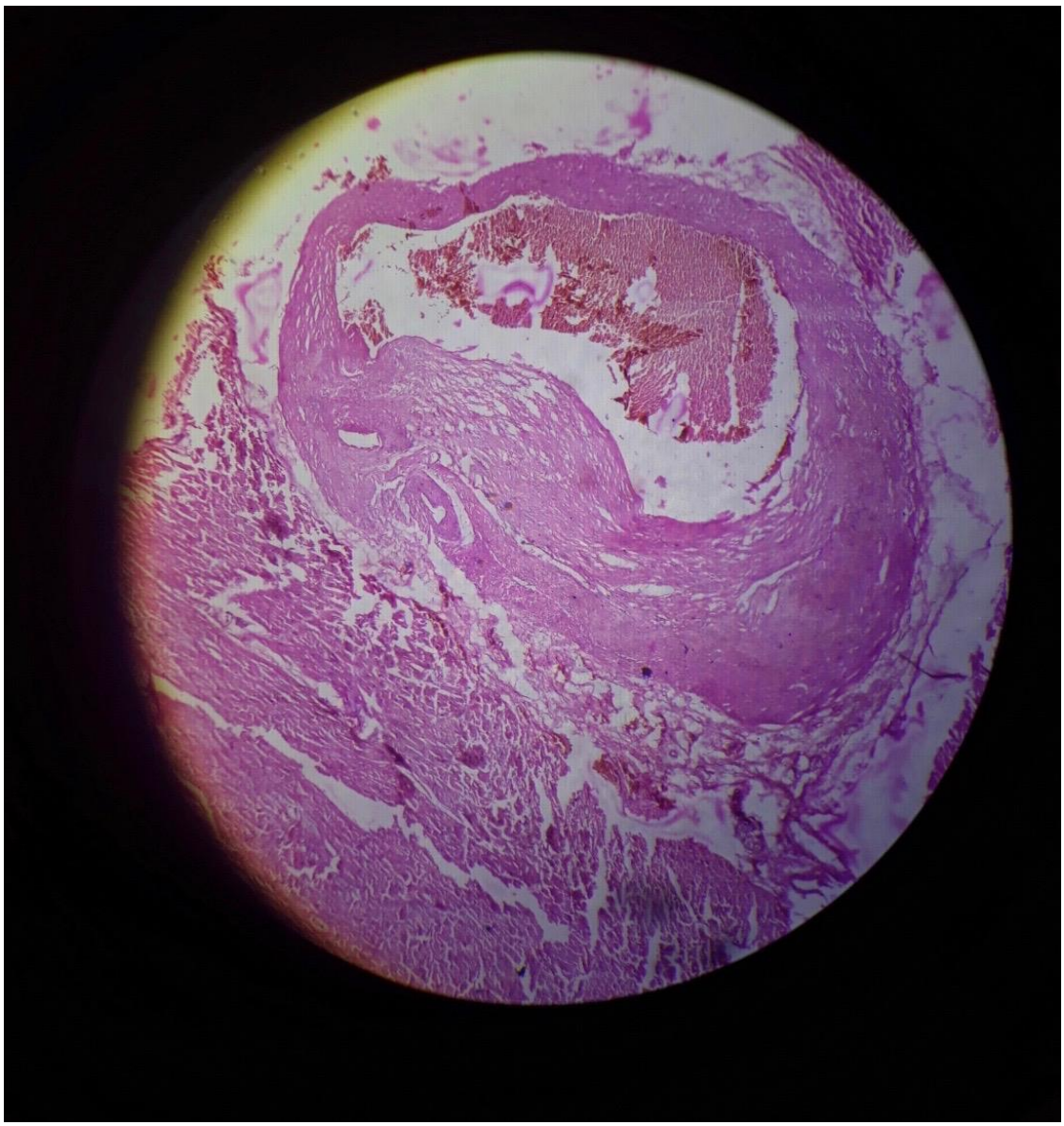

Figure 3: Atheromatous plaque .

Findings	No. of cases	percentage
Atherosclerosis	114	52%
Atherosclerosis with calcification	97	44%
Atherosclerosis with thrombus	8	4%

Table 4: out of 219 cases

In this study 308 specimens of heart were included. This study included cases between 11 to 80 years. Maximum number of cases were present between the age group of 51 to 60 years . Out of 308 cases 215 were males and 93 were females. There was remarkable male dominance [Table 2].

In histopathological evaluation most common finding was atherosclerosis [Table 3] followed by Myocardial infarction and myocardial hypertrophy.

In 60 cases no specific pathological findings were identified during gross and microscopic examination [Table 3].

Among 308 Case 219 revealed atherosclerotic changes .97cases had calcification with plaque and 8 cases had superimposed thrombus formation.

IV. DISCUSSION

The autopsy study provides a means of understanding, the basic process that sets a stage for clinically significant atherosclerotic cardiovascular diseases. There is no valid method of sampling of living population .It was therefore considered that death suspected due to cardiovascular pathology, probably provide

the best sample of living population for studying the cardiovascular diseases [**4**].

In this study most of cardiovascular deaths occurred within the age range of 40 to 60 years. Similar findings were reported by Ramazan Karanfil et al (17 – 78 Yrs.) and Chandrakala Joshi ,41 – 60 yrs.[**2,5**].

Similar findings were observed in a study conducted by Garg S et al [**6]**. Who observed most of cardiovascular deaths within age range of 41 to 60 years. This reveals that age is a powerful risk factor for heart disease. The development of atherosclerosis increases markedly with age up to an age of about 65 years.

In the present study males were 215 (70%) and females were 93(30%). This observation was similar to the observation of Garg S et al in which there were 76% males and 24% females. In comparison of histopathological findings in this study coronary atherosclerosis was most common finding present in 219 (71%) cases[6]. Similar findings were reported by Ramazan karanfil et al (75%), Stav roula A et al 77% and Chandrakala Joshi 64%(**2,5,7**). Similar observation was seen in the study conducted by Garg S et al 78(55.3%), [**6**].

Plaque calcification is found more frequently in advanced lesions, it may also occur in small amounts in early lesions, which appear in second and third decade of life. Histopathological investigation had shown that plaques with microscopic evidence of mineralization are larger, however the relation of arterial calcification to the probability of plaque rupture is unknown [**4**].

In this study the evidence of myocardial infarction was present in 14 (6%) cases. Similarly bora Ozdemir et al, reported myocardial infarction in 48% cases which is higher than this study [**8**]. Wang H Y et al reported ischemic heart disease in 7% cases and is lower than the present study [**5,9**]. In the study conducted by Garg S et al myocardial infarction was observed in 20(14.15)% cases [**6**].

The difference may be due to time variability between onset of ischemia and time of death. Because microscopic features depend upon the time period between onset of ischemia and death.

Next common lesion was myocardial hypertrophy which was present in 12(4%)cases in this study .In the literature similar incidence that is 7% was reported by CristinoBasso et al and Wang H Y et al [**9,10**].Ramazan Kanafil et al Chandrakala et al ,reported much higher incidence of cardiac hypertrophy in 66% and 52% cases respectively[**2,5**]. In the study conducted by Garg S et al there were 10 cases 7.09% reported as myocardial hypertrophy [**6**].

There was only one case of cysticercosis seen in an 35 years old unidentified male in the lumen of anterior descending artery. Review of literature revealed case reports of rare cases of cardiac and disseminated cysticercosis as reported by Sanjay k et al [**11**].

Cardiovascular diseases contribute the most common cause of sudden death .It is well known that lifestyle modifications and drug therapy in selected individuals can reduce the risk of cardiac events but current Framingham risk assessment is suboptimal .So in medico legal autopsies it is proposed that every possible organ must be sampled for histopathological examination and must be examined with a multidisciplinary approach (medical history, scene investigations, biochemical, microbiological, toxicological etc.).

Histopathology of various organs is very helpful to the forensic surgeons in arriving to a conclusion regarding cause of death.

V. CONCLUSION

To conclude this study most common cause of death was myocardial ischemia due to atherosclerosis. Histopathological studies provide the most accurate clues to a better understanding of human cardiovascular diseases with better insight into disease pathophysiology, novel interventions could be introduced to improve care and future outcomes for patients undergoing cardiovascular diseases.

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Amino Acid Marshmallow Profile from Grouper Bone Gelatin

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Abstract- Gelatin is a water-soluble protein obtained from animal collagen through a controlled hydrolysis process. Groupers are one of the large pelagic fish that are used as fillet products, while for waste that can be used to make gelatin. Gelatin is then used as a raw material for Marshmallows. Marshmallow is a kind of candy which has a texture like soft foam. The purpose of this study was to study the amino acid profile and the nature of the chemical composition of marshmallows from grouper bone gelatin. The highest amino acid profile of grouper gelatin marshmallow bone is arginine 3360.48 mg / kg and the lowest amino acid is histidine 389.93 mg / kg. While the highest composition of non essential amino acids is glycine 9650.06 mg / kg and the lowest is tyrosine 270.67 mg / kg. The results of the chemical composition of Marshmallow from grouper bone gelatin is content were water content of 26.82%, ash content of 0.05%, protein content of 3.88%, calcium content of 69.02%, and fat content of 0.23 %.

Index Terms- gelatin, marshmallow, amino acid, chemical composition

I. Introduction

Gelatin is a water-soluble protein obtained from animal collagen through a controlled hydrolysis process. Gelatin is a gelling agent or a non-gelling agent. Gelatin is a polymer of amino acids found in collagen in animal skin and bone tissue. Gelatin can be obtained by hydrolysis of skin and bone tissue using acidic or basic solutions, which are then denatured (Siregar and Eddy, 2019).. As an alternative source of halal gelatin, gelatin from fish is now starting to get attention from industry circles. Fish gelatin can be produced from the skin and bones as a by-product of fish fillet processing. The content of collagen in hard fish bones (*teleostei)* ranges from 15-17%, while that in cartilage bones (*elasmobranch*) ranges from 22-24%. Fish bones that can be used as gelatin are grouper bones. Grouper fish (*Ephinephelus* sp.) Is one of the high economical fish species that lives in coral reef waters, and its spread is almost in all Indonesian waters. Besides, grouper fish is one of the most popular types of fish in the local and international markets. Grouper fish belong to the family Serranidae, their bodies covered by small scales (Anggraini *et al*., 2018). Grouper fish have a type of cycloid scales Cycloid scales have two main constituent layers, namely the skin surface and fibrous layer on the inside.

Grouper bone gelatin is then used as raw material for making marshmallows. Marshmallow is a type of candy (including soft candy) based on gelatin and sugar, especially sucrose and several different types of glucose. The origin of the naming of this product is derived from a plant called Marshmallow (Althea officinalis) (McWilliams 1989). Marshmallow is a kind of candy which has a textured texture such as soft foam, light, chewy in various shapes, aromas, flavors and colors so that it is classified in confectionery products. Marshmallow when eaten melts in the mouth because it is the result of a mixture of sugar or corn syrup, egg whites, gelatin and flavorings that are shaken until fluffy (Rochima and Azizah, 2013).

II. MATERIALS AND METHODS

2.1 Material

The main raw materials used are grouper fish bones (*Ephinephelus* sp.) Obtained from the fish processing industry in Surabaya and Tuban, 1% citric acid and aquadest. The ingredients for making marshmallows are gelatin from fish bones from the results of the first phase of research with the best physical and chemical characteristics, glucose syrup, sucrose, strawberry flavor, water and refined sugar. The materials used for analysis include potassium sulfate (K2SO4), NaCl, H2SO4, 3% boric acid, indicators of Methylene Blue and Methylene Red, 0.02 N HCl, hexane, methylated spirits, aquades, physiological solutions and cotton.

The research method used is the experimental method. This research was divided into two stages. The first step is making gelatin from grouper bone (*Ephinephelus* sp.) The second step is making marshmallow by adding grouper bone gelatin. Furthermore, amino acid testing and chemical characteristics testing were carried out.

2.1.1 Making Fish Gelatin

Making gelatin from the bones of grouper fish (Ephinephelus sp.) Using an acid process that is 1% citric acid (C6H8O7) with a soaking time for 24 hours. The steps taken are as follows. The grouper bones (Ephinephelus sp.) each cleaned of dirt in the form of leftover meat, fat layer and outer skin, followed by cutting size to 1 cm x 1 cm and washed with running water. This reduction did to facilitate the dissolution of collagen proteins contained in the skin. The fish skin is then soaked in 1% citric acid (C6H8O7) for 24 hours at a ratio of 1: 3 (w / v). Skin rinsing is carried out with running water to a neutral pH and then an extraction step with aquadest at a ratio of 1: 3 (w / v) at 70 ºC for 6 hours using a water bath. Furthermore, the filtering process is carried out with an calico cloth and followed by drying using an oven at 60 oC for 48 hours. Gelatin is then mashed using a grinder.

2.1.2 Making Marshmallow

The addition of gelatin in marshmallows serves as a gel maker. In this study gelatin was added with a concentration of 6%. The steps taken are as follows. Make gelatin at a concentration of 6%, then add 75 gram sucrose and 150 ml glucose syrup heated to a temperature of 80ºC. The solution is stirred using a mixer until evenly distributed and expands for ± 15 minutes. When the mixing process is added, the flavor is then poured into a container that has been sprinkled with refined sugar and then left for 12 hours. Marshmallow then tested the amino acid profile and chemical characteristics test which included water, ash, protein, fat and carbohydrate content.

III. RESULT AND DISCUSSION

3.1 Composition of Amino Acid Marshmallow

Amino acids are the smallest units that make up proteins. The composition of amino acids is very important in the characteristic properties of gelatin. Gelatin contains 9 of the 10 types of essential amino acids the body needs. One essential amino acid that is almost not contained in gelatin is tryptophan. Determination of amino acids is done by using Ultra Performance Lyquid Chrtography (UPLC) technique. The results of marshmallow amino acid composition with the addition of grouper bone gelatin are presented in Table 1.

Asam Amino	Unit (mg/kg)
Leucine	2073,13
Tyrosine	270,67
Proline	4459,51
Threonine	1371,01
Histidine	389,93
Serin	1847,48
Glutamic Acid	4330,05
Phenylalanine	1048,95
Isoleucine	914,09
Valine	1268,64
Alanin	3627,31
Arginine	3360,48
Glycine	9650,06
Lysine	1544,30
Aspartic acid	2226,01

Marshmallow has 8 essential amino acids out of a total of 10 known essential amino acids. The highest amino acid in marshmallow gelatin grouper bone is arginine 3360.48 mg / kg and the lowest is histidine 389.93 mg / kg. While the highest non-essential amino acid composition is glycine 9650.06 mg / kg and the lowest is tyrosine 270.67 mg / kg. Marshmallow structure is dominated by amino acids which include 14% hydroxyproline, 16% proline and 26% glycine, it depends on the composition of gelatin contained in the raw material. Gelatin contains 35% glycine and about 11% alanine and the proline content is quite high. Gelatin has a range strength, a special structure that contains hydroxilisin and hydroxyproline, which are amino acids that are not present in other proteins.

3.2 Chemical Characteristics of Marshmallow

Marshmallow chemical characteristics include carbohydrate content, protein content, ash content, fat content and water content. The chemical characteristics of Marshmallows are presented in Table 2.

Chemical Characteristics	Content	Unit
Carbohydrate	69,02	%
Protein	3,88	%
Ash content	0,05	%
Energy from fat	2,07	Kcal/100 g
Total fat	0,23	%

Water content	26,82	%
Total energy	293,67	Kcal/100 g

3.2.1 Water Content

The results of marshmallow water content analysis with the addition of grouper bone gelatin of 26.82%. The water analyzed in determining the water content is free water present in the material. This also includes water which is physically bound, that is, water contained in gelatin micelles in marshmallows. The greater the amount of gelatin added, the more water is bound to the gelatin micelles.

3.2.2 Ash Content

Results of marshmallow ash content analysis with grouper bone gelatin levels of 0.05%. Ash content in marshmallows can be obtained from gelatin. At the time of gelatin extraction, the remaining the remaining ash type are associated with reactive groups of gelatin molecules such as OH, COOH and NH2 groups. This means that the more gelatin is added the higher the ash content. In addition ingredients in marshmallows such as flour can also increase values of marshmallow ash. According to the Indonesian National Standard for Soft Jelly Sugar (SNI 01-3547-1994), ash content for sweets has a maximum limit of 3%. Marshmallow ash content with the grouper bones gelatin has a value that meets the standards set by SNI.

3.2.3 Protein Content

The results of the analysis of marshmallow protein levels with the addition of grouper bone gelatin of 3.88%. High levels of protein in marshmallows are caused by the addition of gelatin concentration. The largest constituent component of gelatin is protein. This means that the greater the amount of gelatin added, the higher the protein content produced.

3.2.4 Carbohydrate

Results of marshmallow carbohydrate analysis with the addition of grouper bone gelatin of 69.02%. This shows that the marshmallows from gelatin grouper bones produced have high carbohydrate levels. High levels of carbohydrates are influenced by the basic ingredients in making marshmallows namely sucrose and glucose syrup which are sources of carbohydrates. Coating added to marshmallows in the form of sugar flour can also affect the levels of carbohydrate marshmallows produced.

3.2.5 Fat Content

Hasil analisis kadar lemak marshmallow dengan penambahan gelatin tulang kerapu 0,23%. Ini menunjukkan bahwa marshmallow dari tulang kerapu gelatin memiliki kandungan lemak rendah. Ikan kerapu sebagai bahan utama dalam pembuatan gelatin adalah jenis ikan air laut yang memiliki kadar lemak kecil yaitu sebesar 0,4% (Direktorat Jenderal Perikanan 1990). Jadi kandungan rendah lemaknya berasal dari gelatin tulang kerapu yang ditambahkan ke marshmallow.

IV. CONCLUSION

The highest amino acid profile in marshmallow gelatin grouper bone is arginine 3360.48 mg / kg and the lowest is histidine 389.93 mg / kg. While the highest non-essential amino acid composition is glycine 9650.06 mg / kg and the lowest is tyrosine 270.67 mg / kg. The results of marshmallow chemical composition analysis with the addition of grouper bone gelatin are water content of 26.82%, 0.05% ash content, protein content of 3.88%, carbohydrate content of 69.02%, and fat content of 0.23 %

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Prevalence of Obesity and Dietary Habits of Students at Rai Medical College Sargodha-Punjab Pakistan

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***Abstract*- Background:** Obesity and its associated disorders are a growing epidemic across world. Many genetic, physiological, psychological, environmental and behavioural factors play a role in etiology of obesity. Diet and exercise are known to play a valuable role in treatment and prevention of obesity and associated disorders. Therefore, purpose of this review is to examine, prevalence, etiology, consequences and treatment of obesity.

Objectives:

- To assess the magnitude of obesity among RMCS students.
- To find out relationship among obesity and dietary habits of students RMCS.
- To examine impact of demographic variables on all variables of current study.

Methodology:- Descriptive cross sectional study was conducted at Rai Medical college Sargodha from August 2019 to September 2019. A total of 100 medical students from all batches participated in this study. A self structured questionnaire was administered to the students after taking their onset. Data included socio demographic characteristics, life style, exercise, dietary habits, diabetes mellitus, Hypertension etc. There were strong relationship between unhealthy dietary habits and being obese.

Results: Out of total participants (100). According to BMI 58% students were normal weight 32% were overweight and 10% were obese

Conclusion: Our study concluded that dietary and exercise counseling is necessary as a preventive strategy.

I. Introduction

The rapid increase of overweight obesity especially in younger generation in many low and middle income countries due to appropriate diet and in acts lifestyles. The WHO projected that 2020 non communicable diseases will be cause of great number of deaths in south east asia and western pacific region. Obesity is one of the contributing factors for non communicable diseases. In 2008, 1.5 billion adults were found to be overweight and obese out of this figure nearly 300 million were obase women.

The WHO latest projection indicates that globally in 2005 there were approx 1.6 billion adults overweight and at least 400 million obase. The Europe who contents that rapidly increasing prevalence of obesity will include 150 million adults and 15 million children 2010.

Abnormal or excessive fat accumulation that presents a risk to health is called obesity. It has two types one is central obesity or apple shaped upper body obesity and which is common in males. Second is peripheral obesity or pear shaped lower body obesity which is common in females presence of excess central fat is associated with and increased risk for morbidity and morality independent of BMI.

Obesity is a multifactorial disorder factors contributing to obesity are physical inactivity/sedentary life style, lack of exercise poor dietary habits, socioeconomic status, environmental, behavioural, (overeating) genetic, endourine (hypothio PCOS, cushing's syndrome), psychology (hereditary) (stress) factors and medication such as cartisoteriods, antuperessants, insulin and drugs containing sulfonylucca.

Medical education is stressful through out the course of training and stressful condition leads to irregularity in diet and lack of exercise. The amount of material to be absorbed social isolation pressure of examination, discrepancies between expectation and reality all can be anticipated to bring psychological stress. However stress will remain part and parcel of every medical student which can not be modified as college level. Other modifiable factors such as increased fast food consumption, increased soft drinks watching television and playing games on the computer and lack of outdoor fames are important from prevention point of view.

"Prevention of obesity is always better than its treatment"

Medical colleges can play a significant role in encouraging healthy behavior in students medical students are exposed to various factors known, unknown for overweight/obesity. Therefore this study was under taken with the objective to find the proportion of overweight/obesity among medical students and to identify various correlates associated with it.

Students who have obesity, compared to those with normal or healthy weight all at increased risk for many serious diseases and health conditions including:

All cases of death (morality), infertility high blood pressure, high LDL and tag low HDL type diabetes mellitus, CHD, stroke Gallbladder disease, Osteoarthritis, sleep apnea, Mental illness, body pain and difficulty with physical functioning.

The height/weight index considered to be most popular of all indices in BMI. It is calculated by dividing a person's weight in kg by person's weight in meter square. The who classifies underweight less than 1805, normal weight as having BMI 18.5-24 9kg/m^2 overweight 25-29 kg/m^2 moderately obese as equal to

or greater than 30 kg/m^2 and morbidly obese as equal to or greater than 40kg/m^2.

Dietary Habits:

Food choices preferred by persons in their daily life.

They differ from person to person. There are two types of diet, unhealthy diet and unhealthy diet. Unhealthy diet includes fast food (sandwiches, pizza, French fries, chicken nuggets etc) dairy products rich in fat, highly flavoured food (meat is food group rich in Umaniflacour), pungent food (ginger, garlic, onion, cloves, turmeric and disadvantages of unhealthy diet can be being overweight or obese, tooth decay, high blood pressure, heart diseases and stroke, type II diabetes Osteoprosis and some causes etc.

Healthy diet includes:

Protein (fond in fish, meat, poultry, dairy products, eggs, nuts and beans) fat (found in animal, dairy products, nuts and oils) Carbohydrates found in fruits, vegetables whole grains and beans and other legumes) vitamins (such as vitamin A,B,C,D,E and K) minerals (ca^{2+}, k^{+}. fe^{2+}) and water (both in what we drink and what naturally found in foods and advantages of healthy diet includes: Weight loss, reduced cancer risk, diabetes management, hearth health and stroke prevention , health of next generation , strong bones and teeth better mood and improved memory.

As far as cultural perspective is concerned. In Pakistan over all prevalence of obesity was found to be 25% in general population where as higher prevalence of obesity of 28% in medical students.

Obesity remains one of the biggest threats to our children putting millions of Americans at increased risk of chronic diseases and contributing to more than $147 billion to $ 150 billion in preventable health care spending.

Among Asians, obesity has been linked with metabolic syndrome like type 2 diabetes mellitus. A study from India reported increasing prevalence of obesity and its associated risk factors in an Urban population.

Approximately 80% of hearth diseases stroke and type 2 diabetes and 40% of cancer could be avoided through a healthy diet, regular physical activity and avoidance of tobacco use the onsets of type 2 diabetes in younger age groups is likely to result in major economic burden all over the world due to premature ill health and death.

In China according to WHO over all rates of obesity is between 5% and 6% for the country but 5% and 6% for the country but greater than 20% in some cities where fast food is popular.

In 2018 according to most recent behavioral risk factor surveillance system data, west Virginia has highest adult. Obesity rate at 38.1% and Colorado has lowest adult. Obesity rate.

In 2017 a study reported that more than one in two adults were over weight or obese in OECD countries adult obesity rates were highest in United states Mexico , New Zealand while they are lowest in Japan and Korea.

In 2019 recent studies showed that obesity rates are in American, 8060% in Pakistan and lowest (3.60%) in Bangladesh.

This study was carried out to assess the magnitude of obesity among students and to find out the relationship among obesity and dietary habits.

II. Material and Methodology

Study Design:

Descriptive cross sectional epidemiological study.

Study Population:

Students of class 1st, 2nd, 3rd, 4th and final year in Rai Medical college Sargodha, age (19-26 years)

Sample Size:

100 students of Rai Medical college Sargodha.

Sampling Technique:

Non-Probability convenient sampling Technique.

Inclusion Criteria:

Male student (n=50) and female students (n=50) of age (19-26 years) in Rai Medical College Sargodha.

Exclusion Criteria:

Unwilling students.

Tools of Collection:

- A questionnaire containing questions.
- Wight Machine.
- Measuring Tape.

Pre Testing:

It was pre-tested to check any problem in understanding the questions by subjects.

Questionnaire:

Necessary corrections was made and questionnaire about demographic data, dietary and exercise habits was finalized.

Data Collection:

Data was collected in 3rd week of august 2019.

Data Collection Procedure:

First of all permission was obtained from the supervisor and institutional authority for data collection.

Students of Rai Medical College was contacted directly.

The participants were briefed about nature of research.

All the participants were assured that the information they were provided will be used for study purpose and will be kept confidential.

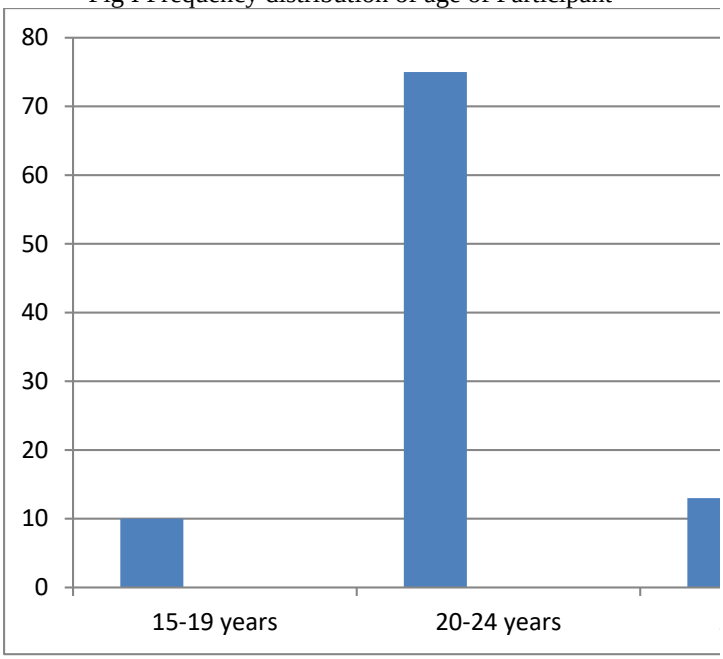
Objectives:

- To assess the magnitude of obesity among students.
- To find out the relationship among obesity and dietary habits.
- To examine impact of demographic variables of current study.

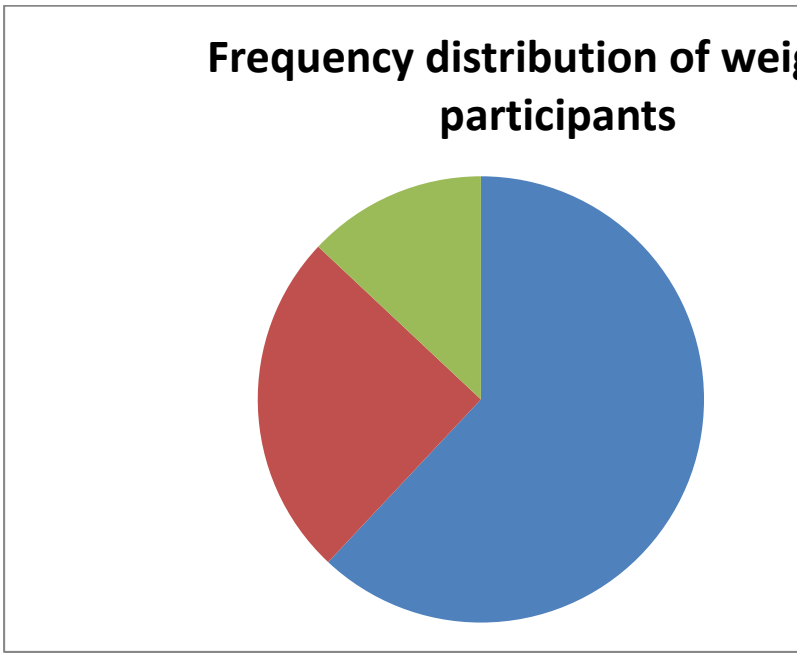
III. RESULTS:

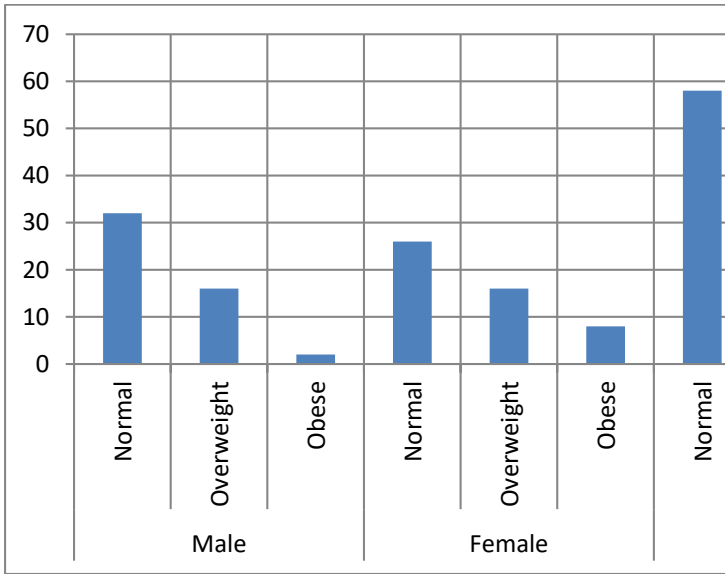
1. Out of total participants (100), 50% were male and 50% were female students. All the students were Pakistani nationals. Among the Pakistani 100% were belonged to Punjab and were Muslims.
2. Out of 100 participants students 10% were of age 15-19 years were 77% were of age 20-24 years and 11% were of age 25 -30 years (figure I)
3. 62% participants have weight in range of 60-65 kg, 25% have in range of 50-59 kg and 13% have in range of 70-90kg (Figure II)
4. According to classification of BMI out of 50 female students 26% were normal 16% were over weight and 8% were obese.
   Out of 50 male students 32% were normal 16 % were overwight and 2% were obese.
   Out of 100 students 58% were normal, 32% were over weight and 10% were obese (figure III6% students consumed tobacco.
5. No significant differences was found among male and female. Students when diatery habits and life style were compared by sex. There is strong BMI with dietary habits association of dairy products rich in fat.
   Students Junk food , fired food, soft drinks , consumption was associated with being over weight as medical having education is stressful through out training and this condition leads to irregularity in diet, mood swings and lack of exercise students.
   Eating cereals fruits and vegetables dairy products low in fat ad doing walk and exercise showed as protective association against overweight (Figure V)
6. BMI is strongly related with dietary habits of students.
   Among all students 0.68% students reported use of cereals 4 times 10% uses cereals 3 times , 11% uses cereals few times and 6% uses cereals 1 time/week in break fast.
   - 40% students use fruits and vegetables 4 times, 34% uses 3 times, 12 % use few times and 7% use 1 time/week.
   - 51% students consumed fried food >4 times/week 28% use fried food 3 times, 11% use few times and 5% use 1 time/week.
   - 50% students use dairy products >4 times/week, 20% use 1.3 times 6% use few times and 12% use 1 time/week.
   - 50% students consumed fast food 4 times, 28% use 1-3 times, 14% week use few times, 4% use 1 time.
   - 49% students drink soft drinks 4 times, 36% drink 1-3 times, 7% drink few time and 4% 1 time/week (figure IV)
7. BMI is related to exercise, 27% students exercise 15 minutes daily 25% students exercise 30 minutes daily and 48 students do not exercise daily so counseling of exercise is required (Table 01)

Fig I Frequency distribution of age of Participant



(Figure II) frequency distribution of weight of participants





Frequency distribution of BMI of participants (fig III)

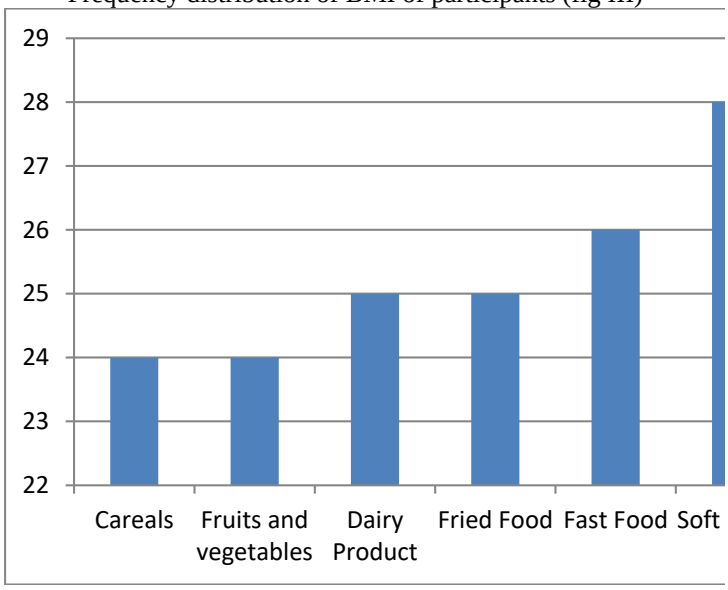


Fig iv. Frequency distribution of food preference of participants

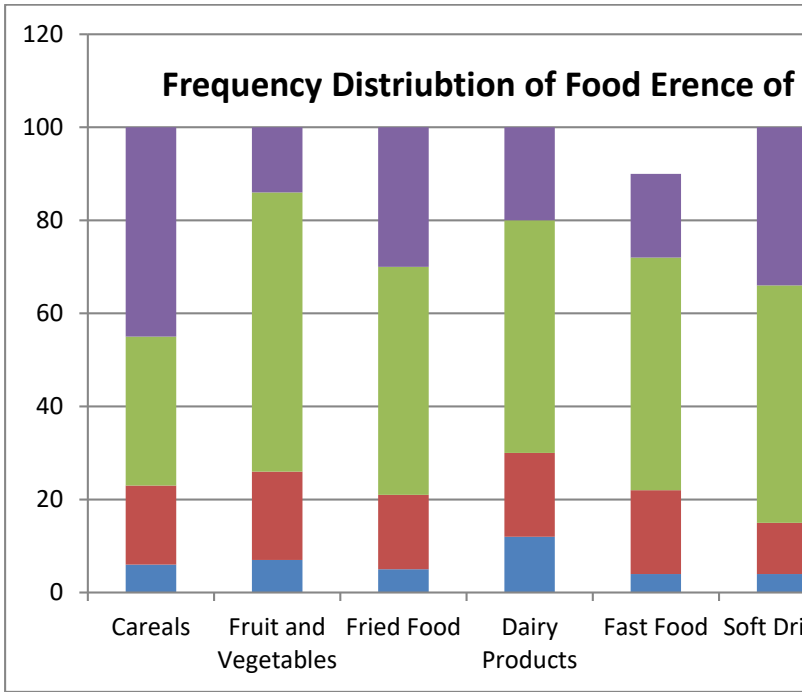


Fig V. Frequency distribution of BMI versus eating habits of participants.

Table 01: BMI is VS Duration of Exercise

BMI	Duration of Exercise			Total
	15 minutes	30 minutes	nil	
Underweight <18.5	0	0	0	0
Normal 19-24.9	18	14	26	58
Overweight 25-29.9	6	8	18	32
Obese > 30	3	3	4	10
Total	27	25	48	100

IV. Discussion

Regardless of predisposing factors diet and life style have great influence on morbidity and morality in life. Due to cumulative effect of adverse effects through out life of an individual it is particularly important to adopt a healthy diet and lifestyle practice. This study assessed the dietary habits and life style of medical students who represent a significant community of future health practitioners. Improvement in life style is made early in life and during medical life would produce physicians practicing and promoting healthy diet and active life style. A need for improvement is required in health seeking behavior of medical students. Physical inactivity and inappropriate dietary habits along with overweight student were alarming signs reported in our study whole a very low prevalence of tobacco consumption was noted. Similar findings have been reported in United Arab Emirates where 24% of medical students were overweight or obese with 77% having insufficient physical activity levels and 50% unhealthy dietary habits . Another study conducted of Aga Khan university on medical student reported that 33% had family history of CHD, 28% exercised regularly 9% were overweight and 8% reported smoking. The physical activity guidelines recommended moderate physical activity for at least 30 minutes preferably daily. Two American studies have reported much more regular exercise and a higher prevalence of smoking among students as compared to our study. Our study has found no difference between male and female students dietary habits. On the contrary a few studies have reported that females were more conscious of their diet and found underweight as compared to male students Junk food cola consumption and physical in activity were identified as the main cause for being over weight. Americans are getting nearly one third of their calories from Junk foods; soft drinks, sweets, desserts.

Alcholic beverages and salty snacks. This dietary habit is prevalent in our youngsters both males and females, despite knowing its harmful effects. It is a known fact that a healthy diet containing fiber and exercise can prevent obesity and chronic diseases. Our study had similar results showing that obesity was observed in students having caloric Junic food. Family history being associated with diabetes has also been reported on other studies from Pakistan. The results from previous studies done in that changes in life style are effective in preventing diabetes. The results of our study also calls for intervention regarding diet and exercise among the future physician population.

V. Conclusion

The dietary habits and life style of medical students were not healthy, Junk food and cola consumption was high with predominance of overweight and physical inactivity. Dietary and exercise counseling is required as a preventive strategy for this group.

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QUESTIONARE

PREVALENCE OF OBESITY AND DIETARY HABITS OF STUDENTS AT RAIMEDICAL COLLEGE SARGODHA

Name:_____ **Son *I* Daughter of**_____

Ag e:_____ **G e n d e r:** _____

Class;_____ **BMI:** _____

Address_____

Q1: What do you eat for breakfast most days?

_____

Q2: How often do you eat fried food?

_____

Q3: How often do you eat fruit and vegetables?

_____

Q4: How many times a week do you eat fast food or always?

_____

Q5: How often do you consume dairy products?

_____

Q6: How well do you know the guidelines of food pyramid?

_____

Q7: How often you drink soft drinks?

_____

Q8: Have your Physical health is negatively impacted by obesity?

_____

Q9: Do you see yourself as an obese person?

_____

Q10: Do you believe your**eating habits** are cause of your obesity conditions?

Q11: Are you suffering from diabetes Mellitus?

Q12: Do you **smoke** daily?

Q13: Have your **social life** been limited because of obesity?

Q14: Have you **experienced** shame or other uncomfortable feelings around obesity?

Q15: Do you believe exercise will help you loose weight?

Q16: Do you believe that you are depressed person and it contributes to your obesity?

Q17: Have you ever been told by **family** or **physician** that you are obese?

Q18: Do you feel comfortable **"Working Out"** in gym?

Q19: Do you believe that **supportive counseling** can assist in sustaining your obesity healing Regimen?

Q20: Do you have any other **Comorbidities?**

Growth Synergies Achieved by Kotak Mahindra Bank Limited by Being Merged with Ing Vysya

Rishabh Sancheti

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Abstract

Growth synergies have been obtained by Kotak and hence the merger has been a success. Having evaluated the Cost-Benefit Analysis, we obtain that an increase of profit with the benefits including the presence in SME and deposit base strengthening are outweighing the costs in the merger. Additionally, the AT Kearney synergy curve shows us that the initial IT cost and documentation have been short-term issues as with time, the cost efficiencies have expanded as economies of scale was obtained and hence growth synergies would be resulted.

Index Terms
Market Capitalization, Income Redistribution, Revenue Synergy

Introduction

Bigger. Bolder. Better. Kotak Mahindra Bank sent out a message to the whole banking industry with this quote. They spent $2.4 billion at the end of 2014 and merged with ING Vysya. The merger is in its 5th year and has increased Kotak's market share and expanded its customer base, net assets too.
As a result of the merger, Kotak's branches have more than doubled and have established a strong presence in the south of India too. The branches increased from 684 to 1,384 and the ATMs from 1,273 to 2,051. A leader in its small and medium enterprise segment in Europe, ING Vysya has added to Kotak's . From less than 10 per cent of loans, Small Medium Enterprise now contributes about a fifth of Kotak's loan portfolio. Hence, this would lead to the development of Kotak's product portfolio. For comparing the prices listed in the study to US dollar you can use the conversion rate of $1 = ₹70 (Indian Rupee) for convenience.
Challenging existing viewpoints in the Indian banking industry, the research question is worthy of investigation as this industry has seen many mergers where a loss-making bank and a profit-making bank combine, however this is an example of a rare instance where 2 profitable banks have merged to form something bolder and better- a strong entity. The bank is now in its 5th year since the merger and the revenue synergies and the cost efficiencies are particularly alien to the society.

Research and Methodology

To augment my knowledge on mergers and acquisitions, ING Vysya's past company profile and the current position of Kotak Mahindra Bank would be analysed. Scholarly articles such as ' Kotak delivering a steady track ; on track with merger integration' would be studied. Going through both the costs and revenues related with the merger would be efficient as the data would be both accurate and precise. This research aims to measure the growth synergies achieved in the merger through 2 tools through the dual lens of the quantitative and qualitative- Cost Benefit Analysis, and AT Kearney Synergy Curve. A Cost-Benefit Analysis would show the effectiveness of the merger in the last 4 years. Additionally, the AT Kearney Synergy Curve has also been utilised .The curve is used to display the synergies gained by the bank since merging. Hence, this research would analyse both the driving and restraining forces to Kotak since the merger and the synergies it has gained throughout. The position Kotak has reached due to the merger and the strategies it would adopt would also be evaluated.

Studies and Findings

1. COST AND BENEFIT ANALYSIS

Benefits-

- Increased Threat to Competitors

After the merger, Kotak Mahindra Bank surpasses Axis in terms of market capitalization to become the 4th largest bank They reached ₹1.20 lakh in 2014 and hence rocketed past Axis Bank with a market capitalization of ₹1,14 lakh . Recently, they also overtook ICICI in terms of market capitalization with ₹2.46 lakh crore, just behind HDFC bank at first. Now, due to the success of the merger, the market capitalization stands at ₹2.48 Lakh Crore.

- Loan Book Has Increased Significantly

Reports from 2016 tell us that its stand-alone loan book grew 3.3% from the previous quarter ago , which is above the 2.4% growth for the industry. The loan book has continued to grow. This growth was driven mainly by the corporate segment. Kotaks subsidiary businesses boosted its combined numbers. Its aggregate loan book increased 4.8% sequentially. Hence, an increase in its loan book has resulted in the overall increase in profits to Kotak Mahindra Bank.

- Deposit base has strengthened

From March 2016 to March 2017, CASA increased from 38.1% to 44%. For Q4 FY17, the mean CASA payments grew up by 35% to ₹60,265 crore in the total deposit. ING Vysya and Kotak both contribute to its deposit base. ING Vysya's healthy growth has been from current account deposits. The deposits grew from ₹23,282 crore in March 2016 to ₹27,261 in March 2017, thus growing by 19% ,and Kotak has built a strong CASA by growth in savings deposits. Reports from 2019, tell us that the deposits grew by 34% to amount to ₹ 73,958 crore. Thus by the facts , we see that the deposit base has strengthened with the combined statistics of the merger.

Costs –
- Provision of Loans has gone up

The combined book was under great stress as it amounted to 2.5% for Kotak Mahindra Bank in June 2015. Additionally, the provisions of loans launched up to ₹148 crore, from ₹84 crore during the same period last year. This is mainly due to the merger with ING Vysya. The bank couldn't cope up with the demand initially and hence consumer satisfaction was comparatively low. With satisfaction low, Kotak would expect a decrease in revenue with people withdrawing their accounts. Hence, as loans weren't maintained, the asset quality decreased.

- Increased Capital Expenditure

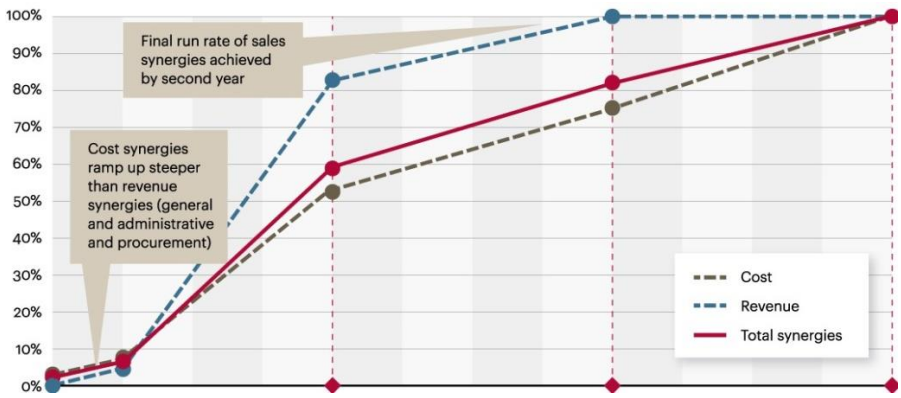
Due to the merger, there was an increase in the branches and ATMs as mentioned earlier in the benefits. This sounds positive; however, some ATMs and branches were very close to each other which brought higher costs to Kotak without impacting revenue as much. The branches increased from 684 to 1,384 and the ATMs from 1,273 to 2,051. This sudden increase served as a negative synergy with the assets not providing enough revenue for them to cover up their costs and turning it to profits for their shareholders in the short run.

- Unsatisfied employees

While some employees from ING Vysya were happy to work with Kotak, other employees felt less confident due to job duplication. The number of employees increased from 30,000 to 46,500 after the merger in Kotak. This discouraging mood had impacted the employees and hence their motivation level also decreased which effects the firm negatively. The employees wanted a tri-partite agreement with Kotak that guaranteed job security however Kotak didn't answer and ultimately declined the offer as some employees leaving wasn't a big cost for the firm.

Assessing both the benefits and the costs, it is clear to us that the benefits outweigh the costs. Most of the costs of the merger are short-run and hence in the long run, with factors like economies of scale coming into play, these problems won't occur. Therefore, through this tool we conclude that growth synergies are obtained.

2. **AT KEARNEY SYNERGY CURVE**



In the first year, the cost-efficiency curve gradient was less steep than the revenue synergy curve because of IT costs, legal and general documentation of the merger between Kotak Mahindra Bank and ING Vysya amounted to a stunning ₹63 crores. Hence,

the cost synergies wouldn't lift up freely due to the corporate culture change and the dismissal of employees. With a merger comes the combination of 2 cultures into one too and therefore the adoption of new working practices had reduced motivation of some employees which made them quit. Negative synergies have played a major role in allowing the cost synergies to grow in the initial year.

However, after the first year of the merger, uniting both the banks together with the resources they have, economies of scale were gained from the merger. In 2015-16 Kotak Mahindra Bank had registered a PAT of ₹1865.98 crore, about more than ₹350 crore than the previous year. With economies of scale coming into play, Kotak introduced reforms in other departments to increase revenue and decrease cost. Investing in Research and Development, Kotak had brought many technological changes. "Genie" – end to end Sales solution – New functionalities like KBank KYC[1] with promotion strategies such as getting vouchers free for completing KYC, on-line payments, image compression, deduplication, were added in the 2016-17 year.

Although, the costs did increase with the number of employees from 5,563 on March 31, 2016 to 5,806 as on March 31, 2017, the revenue synergies of large-scale operations bettered that significantly. The revenue ₹6101.51 crore in 2016-17 with the personal (employees expenses doubling) and administrative expenses increasing to a great extent, however the PAT had still increased slightly from ₹1865.98 crore to ₹2089.78 crore. In the next 2 years, with the employees cost not changing drastically overall due to the lesser inflow of the same, the revenue synergies had excelled. The firm also introduced Distributor Engagement – Konnect [2]– A chat-based solution enabling active conversation with distributors and providing real time resolution of customer queries on products and commission has been implemented. Moreover, it has also released KEYA, the first bilingual voice bot in Indian Banking[3], thus engaging in customer loyalty with minimum costs. The PBT was registered at ₹4084.30 in 2018, increasing more than two-fold since the start of the merger.

Furthermore, the company has launched zero-balance services from Kotak Mahindra Bank's app which would boosts the revenue due to technologies of scale, while not affecting the costs in the foreseeable future. Hence, the revenue synergies curve would boost up, while the cost synergies curve would increase steadily, thus the slope for revenue synergies would be steeper as profit has been made and hence the gap would augment with the continued trend.

Therefore, due to revenue and cost synergies being obtained as seen through the graphical representation of the curve, we, again, see that growth synergies are acquired due to the merger.

Conclusion

Thus, delving deep into the dual lens of the quantitative and qualitative, the extent to which growth synergies were achieved by Kotak Mahindra Bank Limited by being merged with ING Vysya has been proven. Both, the cost and benefit analysis and the AT Kearney synergy curve has helped us in reaching to the conclusion.

Appendix

Kotak Mahindra Bank Profit and Loss Statement

Standalone Profit & Loss account	**---------- in Rs. Cr. ----------**				
Net Profit for the Year	**4,084.30**	**3,411.50**	**2,089.78**	**1,865.98**	**1,502.52**
Profit brought forward	10,756.29	8,214.12	6,769.97	4,005.29	3,016.60
Total	**14,840.59**	**11,625.62**	**8,859.75**	**5,871.27**	**4,519.12**
Equity Dividend	114.21	0.07	91.84	82.07	63.08
Corporate Dividend Tax	21.70	-0.68	18.70	13.58	8.69

[1] Appendix 3
[2] Appendix 3
[3] Appendix 3

Per share data (annualised)					
Earning Per Share (Rs)	**21.43**	**18.53**	**11.39**	**24.16**	**19.51**
Equity Dividend (%)	14.00	12.00	10.00	18.00	16.00
Book Value (Rs)	196.69	150.01	130.61	183.09	159.35
Appropriations					
Transfer to Statutory Reserves	1,100.08	869.94	535.10	587.06	366.93
Transfer to Other Reserves	0.01	0.00	-0.01	93.30	75.13
Proposed Dividend/Transfer to Govt	135.91	-0.61	110.54	95.65	71.77
Balance c/f to Balance Sheet	13,604.60	10,756.29	8,214.12	5,095.26	4,005.29
Total	**14,840.60**	**11,625.62**	**8,859.75**	**5,871.27**	**4,519.12**

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Text Analysis: Naïve Bayes Algorithm using Python JupyterLab

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Abstract-The use of mobile phones has skyrocketed during the last decade hence it has generated bulk of junk messages. However, emerging machine learning algorithms are one such solutions which are used to detect and filter spam messages recently. Naïve Bayes is a powerful yet simple classification machine learning algorithm which used in predictive modelling. Thus, Naïve Bayes categorize as four forms of its implementations; however, Multinomial Naïve Bayes is used in this study. Further, it has pre-processed the data using bag – of words (BoW) using tokenizing data with Naïve Bayes algorithm. This study will explore the process of spam filtering using Naïve Bayes classifier and further predict the classification of new text as ham or spam. In addition to that, the data analysis is carried out in Python-Jupyter Lab which is the next-generation open source web-based user interface.

Index Terms**—**Machine Learning, Analysis of Algorithms, Spam Filtering, Naïve Bayes Algorithm, Multinomial Naive Bayes, Classification Algorithm, Bag- Of- Words

I. Introduction

The volumes of Short Messages (SMS) are growing fast due to its features of rapidness, effectiveness and low cost. However, unsolicited or unwanted text messages generate huge threats for both individuals and organizations in numerous ways. The Text Retrieval Conference (TREC) defines the term 'spam' as an unsolicited, unwanted messages that was sent indiscriminately(Cormack,2008). Further, the spams are usually unsolicited and also being a carrier of malware including advertisements, fraud, phishing messages, promotions etc. Many people suffer from spam messages hence its annoyance to individuals and also considered as less reliable sources. Further, spams generate loss of productivity, misuse of data, storage and bandwidth, spread of viruses and ultimately financial loss for the organizations [Wang, 2013).

Naïve Bayes is the simplest probabilistic classifier in machine learning which used in predictive modelling. The predicator variables in the Naïve Bayes are conditionally independent of other features. Further, Naïve Bayes classifier work with correlating with tokens and calculate the probability using Bayes' Theorem to predict the spam non-spam occurrences. Moreover, it has used bag of words feature which commonly used in text classification to identify spam messages. Although, this algorithm is simple in nature, this often used in more sophisticated activities. This study will explore the process of spam filtering using Naïve Bayes classifier and further predict the classification of new text as ham or spam.

II. Machine Learning Algorithms

Machine learning technologies are becoming trends in almost every filed of technological activities. Basically, machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed (Leimbach, 1994). Further, the process of learning begins by using collection of data or observation then searching patterns of gathered data and finally aiming for decision making (Edgar & Manz, 2017). Therefore, the aim of the machine learning is to learn things automatically by computers without human intervention.

All the machine learning algorithms are often categorized into four different types including supervised, unsupervised, semi-supervised and reinforcement (Omar, et. al, 2013).

Supervised Learning: This is used in the situations of dataset which consists with a target or outcome variable (dependent variable – DV) which can be predicted from a given set of predicators (independent variables – IVs) (F.Y.O et. al, 2017). Further, the goal of this is to predict the output for the new data once the algorithm identifies the known data. In addition to that, supervised learning algorithms has two further processes such as classification and regression. The most widely supervised learning algorithms are Linear Regression, Logistic Regression, random forest, gradient boosted trees, support vector machine (SVM), neural networks, decision trees, Naïve Bayes and nearest neighbor (Ghorbani, et. al, 2015). In classification algorithm, incoming or new data is labeled based on the past samples of data and algorithms are trained to recognize the certain types of objects then classify accordingly. This is

mainly differentiating the data based on similar features. Furthermore, regression is used to identify the patterns and calculating the predictions based on continuous outcome.

Unsupervised Learning: In unsupervised learning, it consists with only input data and corresponding results are unknown. The goal of this model is to detect the underline structure or distribution the data set through learning more about the data (Dy & Brodley, 2004). Further, this has grouped into two segments due to the complexity of the logic including clustering and association (Khanum, 2015). Discovering the inherent groups in the data set is performed in the clustering process. However, association rule is used to describe the large proportions of data in the association process. The most popular examples of unsupervised learning algorithms are K-Means clustering, t-SNE (t-Distributed Stochastic Neighbor Embedding and PCA (Principal Component Analysis and Association Rule (Dy & Brodley, 2004).

Semi-supervised Learning: These algorithms represent a middle ground between supervised and unsupervised features. However, some models combine the features of both aspects (Prakash & Nithya, 2014). This is basically assigns the situations where the dataset consists with both labeled and unlabeled data for training.

Reinforcement Learning: This interacts with its environment by producing actions and discovers errors or rewards. The decisions are taken sequentially i. e. outcome depends on the state of the current input and the next input depends on the output of the previous input (Mao, et. al, 2016).

III. NAÏVE BAYES CLASSIFIER

Naïve Bayes classifier is a supervised learning technique which is used for classification tasks. Further, the classifier is mainly used in analytical and predictive problems when the dimensionality of the inputs is high. Despite the simplicity, this is often used in more sophisticated classification methods (Dada, et. al, 2019).

Bayes Theorem: The classifier in Naïve Bayes is based on the Bayes theorem.

Likelihood

Class Prior Probability

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

Posterior Probability

Predictor Prior

$$P(A|B)=P(B_1|A)\times P(B_2|A)\times P(B_3|A)\times \ldots\ldots\ldots\ldots P(B_n|A)\times P(A)$$

According to Bayes Theorem, it can be found the probability of A happening, when B has occurred. In this formula, B is the evidence and A is the hypothesis. Further, the presence of one particular feature does not affect to the other hence that is referred as 'naïve'. In this formula,

$P(A|B)$ is the posterior probability of class (A, target) given predictor (B, attributes)
$P(A)$ is class prior probability
$P(B|A)$ is the likelyhodd of the probability of predictor in a given class
$P(B)$ is the prior probability of predictor

IV. SAMPLE DATA SET

The dataset is received from https://www.kaggle.com in order to validate Naïve Bayes classification algorithm using Spam/Ham classification from SMS dataset.

V. DATA ANALYSIS

In order to build the Naïve Bayes model, the following stages were carried out. The major stages were identified as data acquisition, data pre-processing, splitting the data as training and testing, model creation and model evaluation.

Figure 1: Steps of Machine Learning Process

a) Data Acquisition: The sample data set (spam.csv) is loaded to Python-Jupiter lab. The dataset contains messages which composed by two columns (v1: label including ham or spam and v2: SMS which contains raw text). Further, the data set is comprised of total 5572 observations of messages. It includes 4825 ham messages and 747 spam messages.

```
In [3]: import numpy as np
        import pandas as pd
        import nltk
```

```
In [4]: import pandas
        df_sms = pd.read_csv('C:\\Users\\LAB-User\\Desktop\\spam.csv',encoding='latin-1')
        df_sms.head()
```

```
In [9]: #Number of observations in each label spam and ham
        df_sms.label.value_counts()

Out[9]: ham     4825
        spam     747
        Name: label, dtype: int64
```

```
In [7]: print (len(df_sms))

        5572
```

b) Data Pre-Processing: Data pre-processing is the process of cleaning the data before applying the algorithms. The data set includes an additional unnamed column. Therefore, it has dropped the unwanted columns Unnamed:2, Unnamed: 3 and Unnamed:4 using coding. The following code indicates how it removes the additional column and the label with SMS text content of sample raw data using head and tail function. Further, it has used bag-of-words methods in data cleaning process.

```
In [5]: df_sms = df_sms.drop(["Unnamed: 2", "Unnamed: 3", "Unnamed: 4"], axis=1)
        df_sms = df_sms.rename(columns={"v1":"label", "v2":"sms"})

In [6]: df_sms.head()
```

Out[6]:

	label	sms
0	ham	Go until jurong point, crazy.. Available only ...
1	ham	Ok lar... Joking wif u oni...
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...
3	ham	U dun say so early hor... U c already then say...
4	ham	Nah I don't think he goes to usf, he lives aro...

```
In [8]: df_sms.tail()
```

Out[8]:

	label	sms
5567	spam	This is the 2nd time we have tried 2 contact u...
5568	ham	Will Ì_ b going to esplanade fr home?
5569	ham	Pity, * was in mood for that. So...any other s...
5570	ham	The guy did some bitching but I acted like i'd...
5571	ham	Rofl. Its true to its name

Further, following descriptive information indicates how the label, message and length of each message.

```
In [11]: df_sms['length'] = df_sms['sms'].apply(len)
         df_sms.head()
```

Out[11]:

	label	sms	length
0	ham	Go until jurong point, crazy.. Available only ...	111
1	ham	Ok lar... Joking wif u oni...	29
2	spam	Free entry in 2 a wkly comp to win FA Cup fina...	155
3	ham	U dun say so early hor... U c already then say...	49
4	ham	Nah I don't think he goes to usf, he lives aro...	61

Implementation of Bag-of-Words (BoW): BoW is a very common feature extraction procedure in Natural Language Processing (Belinkov & Glass, 2019). It is highly required to check whether the text document is best fit as a feature vector prior to apply machine learning algorithms.

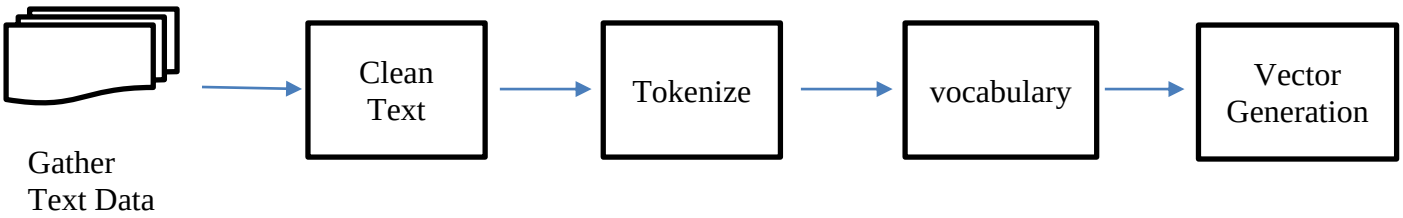

Figure 2: Steps of Bag of Words (BoW)

All these rows of data converted into tokens or individual words. Vocabulary is the collection of unique words. Further, those tokens were observed and found the frequency of each token. Any order or structure of the words in the document (bag of words) is discarded. However, this is used when the known words are in the document only.

Tokenization: The text corpus is split into individual elements. Further, it has converted all strings into lower cases in this stage.

```
documents = ['Hello, how are you!',
             'Win money, win from home.',
             'Call me now.',
             'Hello, Call hello you tomorrow?']

lower_case_documents = []
lower_case_documents = [d.lower() for d in documents]
print(lower_case_documents)
```

```
['hello, how are you!', 'win money, win from home.', 'call me now.', 'hello, call hello you tomorrow?']
```

The above outcome shows how it has converted the messages of text into lower cases. Then, it has removed all the punctuation in the same tokenization stage.

```
sans_punctuation_documents = []
import string

for i in lower_case_documents:
    sans_punctuation_documents.append(i.translate(str.maketrans("","", string.punctuation)))

sans_punctuation_documents
```

```
['hello how are you',
 'win money win from home',
 'call me now',
 'hello call hello you tomorrow']
```

The above code with the outcome shows how it has removed the punctuations in the text. In addition, that, the below code indicate how it used convert sentences into words or tokenization.

```
In [17]: preprocessed_documents = [[w for w in d.split()] for d in sans_punctuation_documents]
         preprocessed_documents

Out[17]: [['hello', 'how', 'are', 'you'],
          ['win', 'money', 'win', 'from', 'home'],
          ['call', 'me', 'now'],
          ['hello', 'call', 'hello', 'you', 'tomorrow']]
```

Then, it has found the count of occurrence of each token using Term Frequency – Inverse Document Frequency (TF – IDF) technique. TF is the measure frequency of a word in a data set whereas IDF measures the rank of the specific word.

Term Frequency (TF): This is a scoring of the frequency of the word in the current document.

$$TF(t) = \frac{Number\ of\ times\ the\ word\ (t)\ occurs\ in\ the\ text}{Total\ number\ of\ words\ in\ the\ text}$$

Inverse Document Frequency (IDF): This is a method of scoring how rare the word is across the document.

$$IDF(t) = \frac{Total\ number\ of\ documents}{Number\ of\ documents\ with\ term\ t\ in\ it}$$

```
In [18]: frequency_list = []
         import pprint
         from collections import Counter

         frequency_list = [Counter(d) for d in preprocessed_documents]
         pprint.pprint(frequency_list)

         [Counter({'hello': 1, 'how': 1, 'are': 1, 'you': 1}),
          Counter({'win': 2, 'money': 1, 'from': 1, 'home': 1}),
          Counter({'call': 1, 'me': 1, 'now': 1}),
          Counter({'hello': 2, 'call': 1, 'you': 1, 'tomorrow': 1})]
```

In order to acquire good results with TF-IDF, a huge corpus is needed. Then, it performed vector generation i. e. counting the occurrences of tokens and built a sparse matrix.

Evaluation of Bag-of-Words using scikit-learn in JupyterLab

The mapping from textual data to vector is referred as feature extraction. Then, the CountVectonizer() method is used to data cleaning process. Further, the steps of cleaning include converting all data to lower cases and removing all punctuation marks in the data set. Steps followed in CountVectorizer as follows.

- Create an instance of the CountVeconizer class

```
In [19]: from sklearn.feature_extraction.text import CountVectorizer
         count_vector = CountVectorizer()
```

- Call the fit () function to find the vocabulary from one or more documents

```
In [20]: count_vector.fit(documents)
         count_vector.get_feature_names()
```

```
In [20]: count_vector.fit(documents)
         count_vector.get_feature_names()

Out[20]: ['are',
          'call',
          'from',
          'hello',
          'home',
          'how',
          'me',
          'money',
          'now',
          'tomorrow',
          'win',
          'you']
```

- Call the transform () function on one or more documents as it needed to encoded each as a vector

```
In [21]: doc_array = count_vector.transform(documents).toarray()
         doc_array

Out[21]: array([[1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1],
                [0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 2, 0],
                [0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0],
                [0, 1, 0, 2, 0, 0, 0, 0, 0, 1, 0, 1]], dtype=int64)
```

```
In [22]: frequency_matrix = pd.DataFrame(doc_array, columns = count_vector.get_feature_names())
         frequency_matrix
```

Out[22]:

	are	call	from	hello	home	how	me	money	now	tomorrow	win	you
0	1	0	0	1	0	1	0	0	0	0	0	1
1	0	0	1	0	1	0	0	1	0	0	2	0
2	0	1	0	0	0	0	1	0	1	0	0	0
3	0	1	0	2	0	0	0	0	0	1	0	1

c) Splitting Dataset in Training and Testing Sets

The data set is split into training and testing test (X_train is for training data of ‘sms_message’ colomn, y_train is for training data of ‘label’ column, x_test is for testing data for ‘sms_message’ colomn and y_test is our testing data for the 'label' column).

```
In [23]: from sklearn.cross_validation import train_test_split

         X_train, X_test, y_train, y_test = train_test_split(df_sms['sms'],
                                                             df_sms['label'],test_size=0.20,
                                                             random_state=1)
```

```
C:\ProgramData\Anaconda3\lib\site-packages\sklearn\cross_validation.py:41: DeprecationWarning: This module was
deprecated in version 0.18 in favor of the model_selection module into which all the refactored classes and fun
ctions are moved. Also note that the interface of the new CV iterators are different from that of this module.
This module will be removed in 0.20.
  "This module will be removed in 0.20.", DeprecationWarning)
```

Then, the data set needed to convert into matrix using CountVectonizer(). Further, it is required to fit the training data (x_train) into CountVectonizer() and receive the matrix. Furthermore, transforming testing data (x_test) to return the matrix.

```
In [25]: # Instantiate the CountVectorizer method
         count_vector = CountVectorizer()

         # Fit the training data and then return the matrix
         training_data = count_vector.fit_transform(X_train)

         # Transform testing data and return the matrix.
         testing_data = count_vector.transform(X_test)
```

d) Model Creation: Multinomial Naive Bayes Implementation

Naïve Bayes consists with four forms of its implementations such as Gaussian, Multinomial, Complement and Bernoulli Naïve Bayes (Rennie, et. al, 2003). The Multinomial Naïve Bayes has been used in this study due to the classification of discrete features such as word counts. It takes integer word counts as inputs. However, Gaussian is used for continuous data as inputs whereas complement classifier estimates parameters of a category. But, Bernoulli assumes the distribution of probability as Bernullian.

Therefore, it has imported MulinomialNB Classifier in training data set using fit ().

```
In [26]: from sklearn.naive_bayes import MultinomialNB
         naive_bayes = MultinomialNB()
         naive_bayes.fit(training_data,y_train)

Out[26]: MultinomialNB(alpha=1.0, class_prior=None, fit_prior=True)
```

According to the code snippets, it can clearly be seen that the algorithm has been trained using the training data set. Further, predictions on the test data can be processed using predict ().

```
In [27]: predictions = naive_bayes.predict(testing_data)
```

e) Model Evaluation

Predictions are done using test data. Further, accuracy of the predictions is checked in this stage.

Accuracy score indicates how often the classifier makes the correct predictions. Further, the ratio of correct predictions to the total predictions. Precision Score indicates the proportion of messages classified as spam were true spam or true positives

irrespectively correct classification. Recall Score is the proportion of messages which actually indicated as spams were classified as spams.

```
In [28]: from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score
         print('Accuracy score: {}'.format(accuracy_score(y_test, predictions)))
         print('Precision score: {}'.format(precision_score(y_test, predictions)))
         print('Recall score: {}'.format(recall_score(y_test, predictions)))
         print('F1 score: {}'.format(f1_score(y_test, predictions)))

         Accuracy score: 0.9847533632286996
         Precision score: 0.9420289855072463
         Recall score: 0.935251798561151
         F1 score: 0.9386281588447652
```

With considering the above output data, accuracy score of data set is 98%. Further, it has indicated as 2 messages as spams and other 98 of messages as non-spams in a sample of 100 messages. It has further used F1 score to evaluate the weighted average of the precision and recall scores. This value mainly ranges between 0 and 1. As this model receives all four matrices close to 1 this fits with the model best.

VI. CONCLUSION

The study covers how it detected the spam and non-spam messages using Naïve Bayes algorithm. This algorithm allows to handle large number of features i. e. words. Thus, Naïve Bayes support for handling large number words easily.

Further, the data set followed set of processes of machine learning in order to build the model. The data set acquired from the kaggle site and performed pre-processing using many methods including bag-of-words. Then, split the data into train and test model. Furthermore, it has built the model and evaluated. The accuracy of the model is tested using accuracy score, precision score, recall score and F1 score.

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Evaluation of Growth and Yield Attributes of Commonly Grown Potato *(Solanum Tuberosum*) Varieties at Kavre, Nepal

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Abstract- A varietal trial was conducted to evaluate growth and yield attributing characteristics of nine commonly grown potato varieties collected from central region of Nepal namely; Khumal Upahar, IPY -8, Khumal Seto-1, Jankdev, Khumal Ujjawol, Cardinal, Panauti Local, MS 42.3 and Khumal Bikash. The experiment was laid out on randomized complete block design (RCBD) with three replications. Parameters on, growth parameter such as plant height (cm), number of leaves per plant, number of main stem per hill, canopy diameter (cm) (at different days after planting) and yield parameters such as tuber weight per plant (g), tuber number per plant, tuber distribution by grading on number and weight was recorded. Collected data were analyzed using MS-Excel and R Studio. The plant height, number of main stem per hill and canopy diameter at different days after planting varied significantly up to harvest. At harvest, the tallest plant (57.25 cm) was recorded in Janakdev and shortest in (23.87) cardinal. The maximum number of leaves per plant (109.8) was observed in Janakdev and minimum (50.40) in cardinal. The highest (7.01) and lowest (4.13) number of main stem per hill was recorded in cardinal and Khumal upahar while maximum and minimum canopy was observed in Janakdev (60.96) and cardinal (40.42) respectively. All the yield attributing parameters was found significant at 5% level. The maximum tuber weight per plant (585g) was recorded in Jankdev however highest number of tuber (20.903) was produced by MS-42. Highest number of small size tuber (<25gm) was recorded from cardinal (69.234) while highest number of large size tuber (<50gm) was recorded in Janakdev (48.197). Tuber did not differ significantly among the varieties but numerically highest yield (33.40 t ha^{-1}) was obtained from variety Janakdev and lowest (14.2 t ha^{-1}) from cardinal.

Index Terms- Growth parameters, potato, R-studio, yield attributes, Yield

I. INTRODUCTION

Potato (*Solanum tuberosum* L) of the Solanaceae family is the world's number one non-cereal which feeds more than a billion people on daily basis (FAO 2013). It is third most important food crop in the world after rice and wheat in terms of consumption (FAO, 2011). Potato covers 1,99,971 ha area under cultivation with production of 28,05,582 mt. and productivity of 14.03 mt/ha in Nepal (ABPSD, 2016). It is the most potential food crops that could contribute to address global hunger problem by reducing poverty among smallholder farmers in developing countries (Timsina, Kafle, & Sapkota, 2011). It also serves as healthy replacement to most of the cereal crops and provides more calories, vitamins, and nutrients per area of land sown than other staple crops (Nunn & Qian, 2011). Potato tuber contains 70-80% water, 20.6% carbohydrate, 2.1% protein, 0.3% fat, 1.1% crude fiber and 0.9% 000000ash (Gemmechu, 2017).

National Potato Research Program (NPRP) under Nepal Agriculture Research Council (NARC) is working for the development, evaluation and conservation of different potato varieties and genotypes while the mandate of dissemination of improved production technologies is given to Potato Development program under Department of Agriculture in Nepal. Potato is the major vegetable crop of mid hills and terai and a stable food of high hills and mountain regions of Nepal (NPDP, 2007). It is primarily a temperate crop but can be cultivated from an altitude of 100 to 4000 masl in Nepal (FAO, 2013). The high value crop is preferred for short cropping cycle (3-4 months) and higher yields compared to cereal crops (K.C., 2016). One hectare of potatoes can yield two to four times the quantity of grain crops. Likewise, potatoes are up to seven times more efficient in using water than cereals (CIP). Potato is financially more remunerative than cereals from food security and can be recommended as a partial replacement of cereals (Anwar, Shabbir, Shahid, & Samreen, 2015). Potato is used mainly for three purposes, as table purpose (vegetable and number of recipes), as a seed tuber and as a processed food like chips, wafers, flakes, starch, granules, flour, potato biscuits, potato patties, puffs, wedges, pancakes, dehydrated mashed potatoes, canned potatoes.

In Nepal, potato occupies 5th position in the average area and 2nd position in productivity and 1st in productivity (ABPSD , 2016). Nepal is one of the top twenty country in terms of potato contribution in human diet, which is increasing due to the adoption of improved potato varieties which have direct impact on farmers income, household level food and nutrient security as well (Timsina, Kafle, & Sapkota, 2011).There are twelve released and registered varieties namely Kufri jyoti, Kufri Sindhuri, Desire, Janakdev, Khumal Seto-1, Khumal Rato-2, Khumal laxmi, IPY-8, Khumal Ujjawol, Khumal Upahar, TPS-1,TPS-2 and two recommended varieties as Cardinal and NPI-106 in Nepal. Khumal Bikash is newly released variety (2075). Improved varieties have high yield potential and choice of improved varieties is the most critical factors determining productivity (Gairhe, Gauchan, & Timilsina, 2017). According to Sapkota & Bajracharya, (2017) potato cultivation is popular among farmers due to its wider adaptability, high yield

potential and high demand that contribute about 6.57 and 2.17% in Agriculture Gross Domestic Product (AGDP) and Gross Domestic Product) GDP respectively.

Kavre district rank first in terms of productivity and production of potato in Nepal. Kavre district which is also super zone for potato production produces both in spring and winter season in 9,785 hectare area potato production was found to be 3,37404MT with average productivity of 19.2 MT/ha (Dr.Kalika psd upadhaya, 2074). There has always been a demand of high yielding varieties which are resistant to disease and insects and even grow well under drought and dry condition. Moreover, the production and productivity is also influenced by specific varieties and quality of planting materials. Therefore, this research was conducted at Kavre district with an aim to identify promising high yielding variety for the mid hills condition of Nepal.

II. MATERIALS AND METHODS

A field experiment was conducted at Panauti-5, Kavre, Nepal during the period from January 2019 to July 2019. The geographical situation of the experimental field is at latitude of 27º36'59.99''N and longitude of 85º32'59.66''E having subtropical climate. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The selected field was firstly divided into three equal blocks and each block was further divided into twelve unit plots. The size of each unit plot was 17.64 m^2 (4.2 m × 2.8 m ×1.5 m). The total number of plot was twenty seven. All the blocks were separated by 1m buffer zone and each plot was separated by 0.5 m spacing between them. In this research nine commonly grown potato varieties viz. Khumal Upahar, IPY-8, Khumal Seto-1, Janakdev, Khumal Ujjawol, Cardinal, Panuti Local, MS 42 and Khumal Bikash were used. The experimental location was uniformly fertilized with 30mt ha^{-1} FYM and chemical fertilizers N, P_2O_5, and K_2O at 100:100:60 kg ha^{-1} respectively. The total FYM, P_2O_5, and K_2O and half of N were applied as basal dose. The rest of the urea was applied 45 days after planting (DAP). Single hand weeding were dine to check the weed infestation in the experimental field at 40 DAP. The field was irrigated twice at 20 DAP and 50 DAP using furrow method of irrigation. Late blight of potato was the most common disease during experimentation so one foliar spray of Diathene M 45 at 2ml lit^{-1} was applied at 50 DAP to control late blight. Earthing up of experimental field and halum pulling was done at 45 DAP and 115 DAP respectively. Data were recorded on growth parameters (at 45, 53, 61, 69 and 77 days after planting however number of stem per hill was recorded only thrice during entire research period (at 45, 53 and 61 days after transplanting). The recorded data were analyzed using MS-Excel and software package R-Studio.

III. RESULT AND DISCUSSION

Potato Plant Height

Effect of potatoes varieties on plant height during the early stages at 45DAP and 53 DAP was found non-significant (Table 1). However significant result was observed from 61days onwards till final harvesting. At 61 DAP Janakdev was recorded maximum height (18.75cm) and Khumal Seto -1(10.33cm) was recorded minimum height. At 69 DAP maximum height recorded on Janakdev (19.767cm) at par with IPY-8 (25.792cm) and minimum height recorded was Khumal Ujjawol (17.358cm) at par with Cardinal (17.917cm). At 77 DAP Janakdev (57.250cm) was recorded maximum which was at par with IPY-8 (54.733cm) and minimum height was recorded on Cardinal (23.875cm). At earlier stage of crop there was slow increment in plant height which may be due to low temperature. After 61 DAP, suitable temperature and proper irrigation led to higher plant height. These differences in plant height among the varieties may be caused by plant genetics and the quality of the plant material (Touria , Abul, Humayun, & Abu, 2017)

Table1: Average plant height (cm) of potato varieties at Kavre, 2019

Treatments	Plant Height (cm)				
	45 Days	53 Days	61 Days	69 Days	77 Days
Khumal Upahar	8.29	9.00	12.70^{cd}	19.41^{bcd}	45.29^{ab}
IPY-8	9.29	9.74	14.27^{C}	25.79^{a}	54.73^{a}
Khumal Seto-1	9.20	11.68	17.91^{ab}	24.60^{ab}	40.08^{b}
Janakdev	10.35	12.91	18.75^{a}	29.76^{a}	57.25^{a}
Khumal Ujjawol	7.96	9.39	10.33^{d}	17.35^{d}	45.12^{ab}
Cardinal	8.67	9.65	11.54^{cd}	17.91^{d}	23.87^{c}
Panauti local	9.12	9.91	14.62^{bc}	18.66^{cd}	38.12^{b}
MS 42.3	11.68	11.85	14.79^{bc}	24.00^{abc}	40.08^{b}
Khumal Bikash	9.49	10.74	12.95^{cd}	18.29^{cd}	45.12^{ab}
LSD	2.83^{NS}	3.13^{NS}	3.58^{**}	5.42^{**}	12^{**}
SEM(±)	0.94	1.04	1.19	1.8	4.01
CV%	17.5	19.1	14.5	14.4	16

Grand mean	9.34	10.5	14.5	21.8	43.3

Mean followed by common letter(s) within columns are non-significantly different based on DMRT P=0.05, **Significant at 0.01 P level, ***Significant at 0.001 SEM: Standard Error of Mean, CV: Coefficient of Variance

Number of Leaves per Potato Plant

The result of statistical analysis showed that the effect of different varieties on number of leaves during early stage at 45 DAP was found non-significant (Table 2). At 53 DAP maximum leaf number was recorded on Janakdev (34.927)which was at par with MS 42.3(33.428) and Khumal Seto-1(32.998).The minimum leaf number was recorded on Khumal Upahar(22.763) which was at par with Panauti Local(24.667) and Khumal Ujjawol(25.553).At 61 DAP maximum leaf number was recorded on MS 42.3(59.707) and minimum leaf number was recorded on Khumal Ujjawol(31.958) which was at par with Khumal Upahar (33.125) and Khumal Bikash(36.383). At 69 DAP maximum leaf recorded at MS 42.3(60.792) Which was at par with Janakdev (57.958) and minimum leaf number was recorded on Khumal Ujjawol (37.875) which was at par with Khumal Upahar (40.125).At 77 DAP Maximum leaf number was recorded at Janakdev (109.87) at par with MS 42.3(107.583) and minimum leaf number was recorded at cardinal (50.408).

Table 2: Average number of leaves of potato varieties at Kavre, 2019

Treatments	No of leaves				
	45 Days	53 Days	61 Days	69 Days	77 Days
Khumal Upahar	18.04	22.76^{b}	33.12^{d}	40.12^{c}	61.24^{bc}
IPY-8	26.52	32.70^{a}	50.87^{ab}	54.66^{ab}	70.63^{bc}
Khumal Seto -1	24.20	32.99^{a}	42.41^{bcd}	47.25^{bc}	64.18^{bc}
Jankdev	30.12	34.92^{a}	49.54^{abc}	57.95^{ab}	109.8^{a}
Khumal Ujjawol	16.99	23.55^{b}	31.95^{d}	39.87^{c}	67.12^{bc}
Cardinal	24.25	29.60^{ab}	39.70^{bcd}	42.83^{bc}	50.40^{c}
Panauti Local	24.25	24.66^{b}	38.16^{cd}	46.55^{bc}	78.41^{b}
MS 42.3	28.70	33.42^{a}	59.70^{a}	62.12^{a}	107.58^{a}
Khumal Bikash	24.68	29.20^{ab}	36.38^{d}	45.33^{bc}	62.15^{bc}
LSD	10.5^{NS}	6.9**	11.5**	9.49***	21.3***
SEM(±)	3.51	2.30	3.83	3.16	7.093
CV%	25.2	13.6	15.7	11.3	16.5
Grand mean	24.2	29.3	42.4	48.5	74.6

Mean followed by common letter(s) within columns are non-significantly different based on DMRT P=0.05, **Significant at 0.01 P level, ***Significant at 0.001 SEM: Standard Error of Mean, CV: Coefficient of Variance

Number of main stem per hill

The effect of different potato varieties on number of main stem per hill was significant among the treatment (Table 3) .At 45 DAP maximum stem number was recorded on MS 42.3(5.958) and minimum was recorded on Khumal Ujjawol (3.72). At 53 DAP maximum stem number was recorded on cardinal (7.017) whereas minimum on Khumal Upahar (4.136). Same data were recorded during 61 DAP.

Table 3: Average number of main stems per hill of potato varieties at Kavre, 2019

Treatments	Number of stem per hill		
	45 Days	53 Days	61 Days
Khumal Upahar	4.04^{bc}	4.13^{d}	4.13^{c}
IPY-8	4.50^{bc}	5.06^{bcd}	5.06^{bc}
Khumal Seto-1	5.18^{ab}	5.82^{abc}	5.82^{ab}
Janakdev	4.17^{bc}	4.99^{bcd}	4.99^{bc}
Khumal Ujjawol	3.72^{c}	4.24^{cd}	4.24^{c}

Cardinal	5.33^{ab}	7.01^{a}	7.01^{a}
Panuti local	4.75^{abc}	4.80^{bcd}	4.80^{bc}
MS 42.3	5.95^{a}	6.02^{ab}	6.07^{ab}
Khumal Bikash	4.37^{bc}	4.49^{bcd}	4.49^{bc}
LSD	1.19*	1.48*	1.48*
Grand mean	4.67	5.23	5.23
SEM(±)	0.39	0.49	0.49
CV %	14.7	16.3	13.3
Grand mean	4.67	5.23	5.23

Mean followed by common letter(s) within columns are non-significantly different based on DMRT P=0.05, **Significant at 0.01 P level, ***Significant at 0.001 SEM: Standard Error of Mean, CV: Coefficient of Variance

Canopy diameter

Effect of potato varieties on canopy diameter at different stages of growth is presented in Table 3. The result of statistical analysis showed that effect the effect of different varieties on canopy diameter at 45,53,61,69 and 77 DAP was found significant. At 45 DAP highest canopy was recorded on Janakdev (23.04cm) and minimum canopy diameter was recorded at Khumal Ujjawol (12.91cm). At 53 DAP maximum canopy was recorded on Jankdev (28.72cm) and minimum was recorded on Panauti Local (21.79cm). At 61 DAP maximum canopy diameter was recorded on MS 42.3 (36cm) and minimum was recorded at Khumal Ujjawol(25.89cm).At 69 DAP highest Janakdev (48.49cm) and minimum canopy diameter was recorded on cardinal (31.438cm) which was at par with Khumal Bikash(31.67cm) and Khumal Ujjawol(33.18cm). At 77 DAP maximum canopy was recorded on Janakdev (60.96cm) and minimum was recorded on cardinal (40.42cm).

Table 4: Average canopy diameter (cm) of different potato varieties at Kavre, 2019

Treatments	Canopy diameter (cm)				
	45 Days	53 Days	61 Days	69 Days	77 Days
Khumal Upahar	15.87^{bc}	26.18^{abcd}	30.75^{bcde}	43.24^{ab}	53.21^{abc}
IPY-8	15.83^{bc}	27.06^{ab}	31.89^{abcd}	42.67^{ab}	52.88^{abc}
Khumal Seto-1	17.95^{abc}	25.68^{abcd}	33.89^{abc}	39.91^{abc}	51.88^{bc}
Janakdev	23.04^{a}	28.72^{a}	35.00^{ab}	48.49^{a}	60.96^{a}
Khumal Ujjawol	12.91^{c}	20.47^{e}	25.83^{e}	33.18^{c}	45.64^{cd}
Cardinal	15.55^{bc}	22.97^{cde}	28.35^{de}	31.43^{c}	40.42^{d}
Panuti local	18.56^{abc}	21.79^{de}	29.47^{cde}	37.10^{bc}	48.95^{bc}
MS	20.85^{ab}	27.54^{ab}	36.00^{a}	43.60^{ab}	55.40^{ab}
Khumal Bikash	21.26^{ab}	24.12^{bcde}	29.20^{cde}	33.16^{c}	45.18^{cd}
LSD	5.49*	4**	4.67**	8.39**	7.57**
SEM(±)	1.83	1.335	1.557	2.916	2.52
CV%	17.6	9.27	8.39	12.4	8.65
Grand mean	18	25	31.2	39.2	50.5

Mean followed by common letter(s) within columns are non-significantly different based on DMRT P=0.05, **Significant at 0.01 P level, ***Significant at 0.001 SEM: Standard Error of Mean, CV: Coefficient of Variance

Number and weight of tuber per plant

The effect of different potato varieties on number and weight of tuber per plant were significant (Table 5).The highest number of tuber per plant (20.903) was recorded from MS 42.3. Panauti Local showed the lowest number of tuber per plant (6.222) which was at par Khumal Upahar (8.457).The highest weight per plant (585g) was recorded from Janakdev and lowest weight per plant (237.33g) was recorded from Cardinal.

Table 5: Average number of tuber and weight of tuber per plant of potato varieties at Kavre, 2019

Treatments	Tuber number per plant	Tuber weight per plant(g)
Khumal Upahar	8.45^{e}	436.67^{d}
IPY-8	15.66	500.33^{c}
Khumal Seto-1	17.51^{bc}	532.33^{bc}
Janakdev	10.40^{de}	585^{a}
Khumal Ujjawol	18.32^{b}	480.66^{cd}
Cardinal	11.34^{d}	237.33^{f}
Panauti Local	6.22^{e}	313^{e}
MS 32	20.90^{a}	555^{ab}
Khumal Bikash	8.02^{fg}	302^{e}
LSD	2.07***	94***
SEM	0.69	16.70
CV	9.2	6.6
Grand Mean	13	438

Mean followed by common letter(s) within columns are non-significantly different based on DMRT P=0.05, **Significant at 0.01 P level, ***Significant at 0.001 SEM: Standard Error of Mean, CV: Coefficient of Variance

Number of tuber by grade basis (%)

The effect of different potato varieties on number by tuber grade is presented in table 9. There was significant effect of varieties on medium tuber and highly significant result was seen on small and large tuber class.Highest number of small size tuber (<25gm) was recorded from cardinal(69.234) and Janakdev (23.906) which was at par with Khumal Upahar(25.996) and Panauti Local (28.546). Highest number of medium size tuber (25-50gm) was recorded on Khumal Seto -1(37.191) and lowest was recorded on Cardinal (21.903). Highest number of large size tuber (<50gm) was recorded on Janakdev (48.197) which was at par with Khumal Upahar (45.104) and Panauti Local (43.756) and lowest number was recorded at MS 42.3 (9.144).

Table 5 : Percentage of number of tuber on grade basis of potato varieties at Kavre, 2019

Treatment	Tuber size distribution number %		
	Small (<25g)	Medium(25-50g)	Large(>50g)
Khumal Upahar	25.99^{e}	28.90^{b}	45.10^{a}
IPY- 8	50.07^{bcd}	28.86^{b}	21.05^{bc}
Khumal Seto-1	47.94^{cd}	37.19^{a}	14.86^{cd}
Janakdev	23.90^{e}	27.89^{bc}	48.19^{a}
Khumal Ujjawol	56.77^{bc}	28.41^{bc}	14.81^{cd}
Cardinal	69.23^{a}	21.90^{c}	8.85^{d}
Panuti local	28.54^{e}	27.69^{bc}	43.75^{a}
MS 42.3	59.63^{ab}	31.22^{ab}	9.14^{d}
Khumal Bikash	44.09^{d}	31.04^{ab}	24.86^{b}
SEM(±)	3.48	2.06	2.79
LSD	10.7***	6.18*	8.38***
CV%	13.4	12.1	19
Grand mean	45.1	29.4	25.5

Mean followed by common letter(s) within columns are non-significantly different based on DMRT P=0.05, **Significant at 0.01 P level, *** Significant at 0.001
SEM: Standard Error of Mean, CV: Coefficient of Variance

Weight of tuber per plant on tuber class

The effect of different potato varieties on weight of tuber were significant (Table 6). Highest weight of small size tuber (<25gm) was recorded from MS 42.3 (149.148g) and minimum weight was recorded from Khumal Bikash (30.481g). Highest weight of medium tuber was recorded from Khumal Seto-1 (233.33g) and lowest weight was recorded from Panuti (62.208) which was at par with Jankdev (114.028g) .Highest large tuber was recorded from Janakdev (428.75g) and lowest was recorded from Cardinal (65.972g).

Table 6 : Average weight of tuber per plant on grade basis potato varieties at Panauti, Kavre, 2019

Treatment	Tuber grade weight (g)		
	Small (<25g)	Medium (25-50g)	Large (>50g)
Khumal Upahar	30.48^{c}	112.33^{c}	293.75^{b}
IPY-8	97.37^{b}	176.66^{b}	226.38^{bc}
Khumal Seto-1	115.85^{ab}	233.33^{a}	175.27^{c}
Janakdev	41.88^{c}	114.02^{c}	428.75^{a}
Khumal Ujjawol	120.85^{ab}	179.30^{b}	180.55^{c}
Cardinal	87.92^{b}	83.11^{cd}	65.97^{d}
Panuti local	24.07^{c}	62.20^{d}	226.9^{bc}
MS	149.14^{a}	211.94^{ab}	192.77^{c}
Khumal Bikash	47^{c}	88.33^{cd}	166.52^{c}
SEM(±)	11.72	7.73	25.36
LSD	35.2***	40.2***	76***
CV%	25.6	16.6	20.2
Grand mean	79.4	140	217

Mean followed by common letter(s) within columns are non-significantly different based on DMRT P=0.05, **Significant at 0.01 P level, ***Significant at 0.001 SEM: Standard Error of Mean, CV: Coefficient of Variance

Tuber yield (t/ha)

The effect of different potato varieties on tuber yield (t/ha) was significant. The highest tuber yield (33.40 t/ha) was recorded from Janakdev which was statistically similar with MS 42.3 (31.70t/ha) and lowest yield was recorded on Cardinal (14.2t/ha).Tuber yield is influenced by many factors such as; environment and cultivars. The environmental factors including soil temperature, moisture, light intensity, nutrient supply and proper control of disease and pests affect the tuber yield (Struik & Wiersema, 1999).

Table 7 : Average yield (t/ha) of potato varieties at Kavre, 2019

Treatment	Yield (t/ha)
Khumal Upahar	24.95^{c}
IPY-8	28.59^{b}
Khumal Seto-1	30.42^{ab}
Janakdev	33.40^{a}
Khumal Ujjawol	27.46^{bc}
Cardinal	13.57^{e}
Panuti local	17.89^{d}
MS	31.70^{a}
Khumal Bikash	17.24^{d}
SEM(±)	0.95
LSD	2.86***
CV%	6.6
Grand mean	25

Mean followed by common letter(s) within columns are non-significantly different based on DMRT P=0.05, **Significant at 0.01 P level, ***Significant at 0.001 SEM: Standard Error of Mean, CV: Coefficient of Variance

I. CONCLUSION

From the findings of the study it can be concluded that among the commonly grown potato varieties in central region of Nepal some varieties have high yield potential such as Janakdev (33.40 mt ha^{-1}) and MS 42.3 (31.70 mt ha^{-1}). Moreover, these varieties are well adapted to the agro-ecology of this region. So, farmers can grow either of these variety for better yield of potato.

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Doppler Sonographic evaluation of the Splenic artery among Sickle Cell Anemia Patients in a Nigerian Tertiary Health Institution.

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Abstract

Introduction: Doppler sonography has revolutionalized the use of ultrasonography in medicine and its use in the vascular imaging of sickle cell patients is invaluable. The aim of this study was to evaluate the splenic artery Doppler indices in sickle cell anemia and to compare the indices with Hemoglobin AA subjects. **Methods:** This was a case control study carried out at the Alex Ekwueme Federal University Teaching Hospital between July 2017 and March 2018. Participants were scanned using the trans-abdominal route with a 3.5MHz curvilinear transducer of a Medison Accuvix A30 (Samsung Medical Systems, February 2013). The splenic artery Peak Systolic Velocity (PSV), End Diastolic Velocity (EDV), Pulsatility Index (PI), Resistivity Index (RI) and Systolic/ Diastolic ratio (S/D ratio) were measured. Data analysis was carried out using Statistical Package for Social Sciences version 20.0 (SPSS Inc Chicago, IL, USA). **Results**: One hundred subjects with Sickle Cell Anemia (SCA) and one hundred Hemoglobin AA control participated in the study and were made up 100 males and 100 females with age range 0 to 30 years. The splenic artery PSV, EDV, PI, RI and S/D ratio are all statistically significantly higher in patients with Hb SS compared with Hb AA with p values of 0.00, 0.00, 0.00, 0.00 and 0.00 respectively. There was no correlation between the Doppler parameters and age as well as Doppler parameters and sex in both patients with Hb SS and Hb AA control. **Conclusion**: PSV, EDV, PI, RI and S/D ratio of the splenic artery in patients with Hb SS are significantly higher than that of control which suggests an increased risk of splenic complications in SCA patients.

Keywords: Sickle Cell Anemia, Splenic Artery, Doppler, Ultrasonography.

INTRODUCTION

Among people of the African racial origin, sickle cell disease (SCD) is one of the commonest haemoglobinopathy.[1] SCD is a group of inherited haemoglobin abnormality characterized by chronic haemolysis. The haemolysis which is the hallmark of the disease is usually due to an increased tendency of haemoglobin molecules within the red cells to polymerise and deform the red cell into a sickle shape especially in hypoxic states.[2] The commonest form of SCD especially in West Africa and Nigeria, is Sickle Cell Anemia (SCA).[3] Others include, haemoglobin SC disease, sickle beta plus thalassaemia, sickle beta zero thalassemia (which has similar severity with sickle cell anemia), haemoglobin SD Punjab disease and haemoglobin SO Arab disease.3

SCD includes a spectrum of disorders where patients at one end of the spectrum may present with no symptom (heterozygous patients) while those at the other end may require repeated blood transfusions (homozygous patients) and bone marrow transplantation.[4] The symptoms can present as early as 6 months of life and may linger into adulthood.[5]

The complications of sickle cell anemia are multisystemic with affectation of several major organs simultaneously or at different times with the spleen being a commonly affected organ.[6] Most of the sickle cell deaths occur following one or more complications.

Anatomically, the spleen has a slow, tortuous microcirculation that makes it extremely susceptible to congestion, sludging, and polymerization.[7] Over 77% of patients with sickle cell anemia manifest with various degrees of splenic abnormalities before the age of 2years.[8] These abnormalities can be functional or structural. It can range from simple non functional splenomegaly to splenic infarction and occasionally frank splenic abscess.

Doppler ultrasonography is a non invasive radiologic technique of assessing the vessels and vascular flow. Power and Colour Doppler sonography are currently the method of choice for imaging blood flow.[9]

Currently, there is no cure for SCA and even simple, inexpensive and cost-effective procedures such as the use of penicillins to prevent infections are not readily available to most patients in Nigeria.[10] SCA patients with changes in the splenic artery Doppler indices may therefore benefit from preventive measures to avoid further complications. These measures include the use of prophylactic antibiotics, adequate rest, good nutrition, folic acid supplementation, high fluid intake, parental education and psychological support.[11]

This study therefore aimed at determining the splenic artery Doppler indices in patients with sickle cell anemia and comparing these indices with subjects with AA haemoglobin genotype of the same age group and sex. The findings will go a long way in identifying early splenic changes that may be associated with fatal or irreversible complications in the patients with sickle cell anemia.

Methods:

This was a case control study of the splenic artery Doppler indices of 100 patients with homozygous haemoglobin SS and 100 with normal haemoglobin aged 0 to 30 years conducted in the Ultrasound Unit of Radiology Department of Alex Ekwueme Federal Teaching Hospital Abakaliki (AE-FUTHA) formerly known as Federal Teaching Hospital Abakaliki (FETHA) in Ebonyi State, South East of Nigeria. Homozygous SS subjects and the control group for this study were selected by simple random sampling. Subjects were stratified according to age group and matched with a control group.

All sonograms were done by the researcher alone to eliminate inter observer variability. These sonograms were obtained with a curvi-linear transducer of 3.5MHz of a Medison Accuvix A30 (Samsung Medical Systems, February 2013) with an insonation angle of 60 degrees, a pulse repetition frequency (PRF) of 4kHz and a sample volume of 2mm . The privacy of the subjects was guaranteed. The subjects were positioned in the supine position or the right lateral decubitus position on the examination couch. The left arm was raised away from the abdomen. The abdomen was exposed superiorly to the xiphisternum and inferiorly to the pubic symphysis. Coupling gel was applied in order to exclude the air between the skin and the transducer. The splenic artery was scanned in longitudinal and transverse planes using the left intercostal coronal approach via the 9th intercostal space. The subjects were asked to take a very deep breath and hold it. The Doppler indices were taken 1cm from the splenic hilum and measured three times before an average was taken. The following Doppler parameters were documented in the worksheet: PSV, EDV, PI, RI, S/D ratio. The data obtained from this study was analyzed using Statistical Package for Social Sciences (SPSS) for Windows, Version 20.0. Statistical tests were considered significant at p-value less than or equal to 0.05

Results:

Table 1: Demographic characteristics of the study population

Parameters	**Genotype**							
	AA				SS			
	Range	Min	Max	Mean±SD	Range	Min	Max	Mean±SD
Age (yrs)	27.00	3.00	30.00	17.28±7.61	26.00	3.00	29.00	17.11±7.46
Height(m)	0.96	0.94	1.90	1.56±0.25	0.96	0.98	1.94	1.60±0.25
Weight(Kg)	97.71	17.67	115.38	60.89±21.30	66.68	17.96	84.64	54.03±16.95

BMI(Kg/m^2)	20.50	18.50	39.00	24.14±4.36	11.00	17.00	28.00	20.49±2.42

All the study subjects were Christians and speak Igbo language. The modal age for each group is 14years (6%) and 18years (6%) for AA and SS respectively.

Table 2a: Showing age and Doppler indices in subjects with Hb AA genotype

Age (Yrs)	**N**	**PSV (cm/s) mean ±SD**	**EDV (cm/s) mean ±SD**	**RI mean ±SD**	**PI mean ±SD**	**S/D RATIO mean ±SD**
0-4	8	57.26±2.01	19.67±3.39	0.66±0.05	0.99±0.14	2.96±0.33
5-9	14	60.49±3.61	21.97±2.56	0.64±0.03	1.02±0.13	2.78±0.22
10-14	16	60.40±3.79	20.89±2.47	0.65±0.038	1.03±0.12	2.92±0.29
15-19	19	60.67±2.56	22.47±3.48	0.63±0.05	1.04±0.11	2.75±0.34
20-24	27	60.49±1.37	24.75±2.04	0.59±0.03	1.05±0.10	2.46±0.15
25-29	16	58.07±1.76	21.31±3.49	0.63±0.05	1.01±0.08	2.77±0.31

Table 2b: Showing age and Doppler indices in patients with Hb SS genotype

Age Yrs	**N**	**PSV (cm/s) mean ±SD**	**EDV (cm/s) mean ±SD**	**RI mean ±SD**	**PI mean ±SD**	**S/D RATIO mean ±SD**
0-4	6	72.81±4.88	21.81±0.69	0.70±0.01	1.17±0.13	3.34±0.16
5-9	14	75.03±1.54	27.38±2.57	0.63±0.04	1.12±0.09	2.77±0.33
10-14	12	72.16±3.15	23.87±2.71	0.67±0.03	1.10±0.08	3.05±0.30
15-19	26	72.95±1.92	26.68±2.35	0.63±0.03	1.08±0.11	2.75±0.20
20-24	24	73.73±3.33	25.02±2.73	0.66±0.03	1.07±0.11	2.97±0.28

25-29	18	73.21±3.93	24.24±3.46	0.67±0.04	1.13±0.12	3.06±0.35

Table 2b shows that the modal age group was 15-19years (26%).

Table 2c: Comparison of the splenic artery Doppler indices in patients with Hb SS and those with Hb AA

Splenic artery indices	**AA Mean±SD**	**SCA Mean±SD**	Mean diff	t-test	df	P-value
PSV(cm/s)	60.26±2.92	73.35±2.92	-13.09	-31.727	198	0.000
EDV(cm/s)	22.21±3.02	25.32±3.02	-3.11	-7.272	198	0.000
PI	1.04±0.11	1.10±0.11	-0.06	-3.914	198	0.000
RI	0.63±0.45	0.66±0.04	-0.02	-4.082	198	0.000
S/D	2.76±0.34	2.93±2.93	-0.18	-3.831	198	0.000

* P<0.05 there is significant difference

The Relationship between Doppler indices and age in SCA patients and those with AA haemoglobin genotype are as shown in fig. 1 – 5 below.

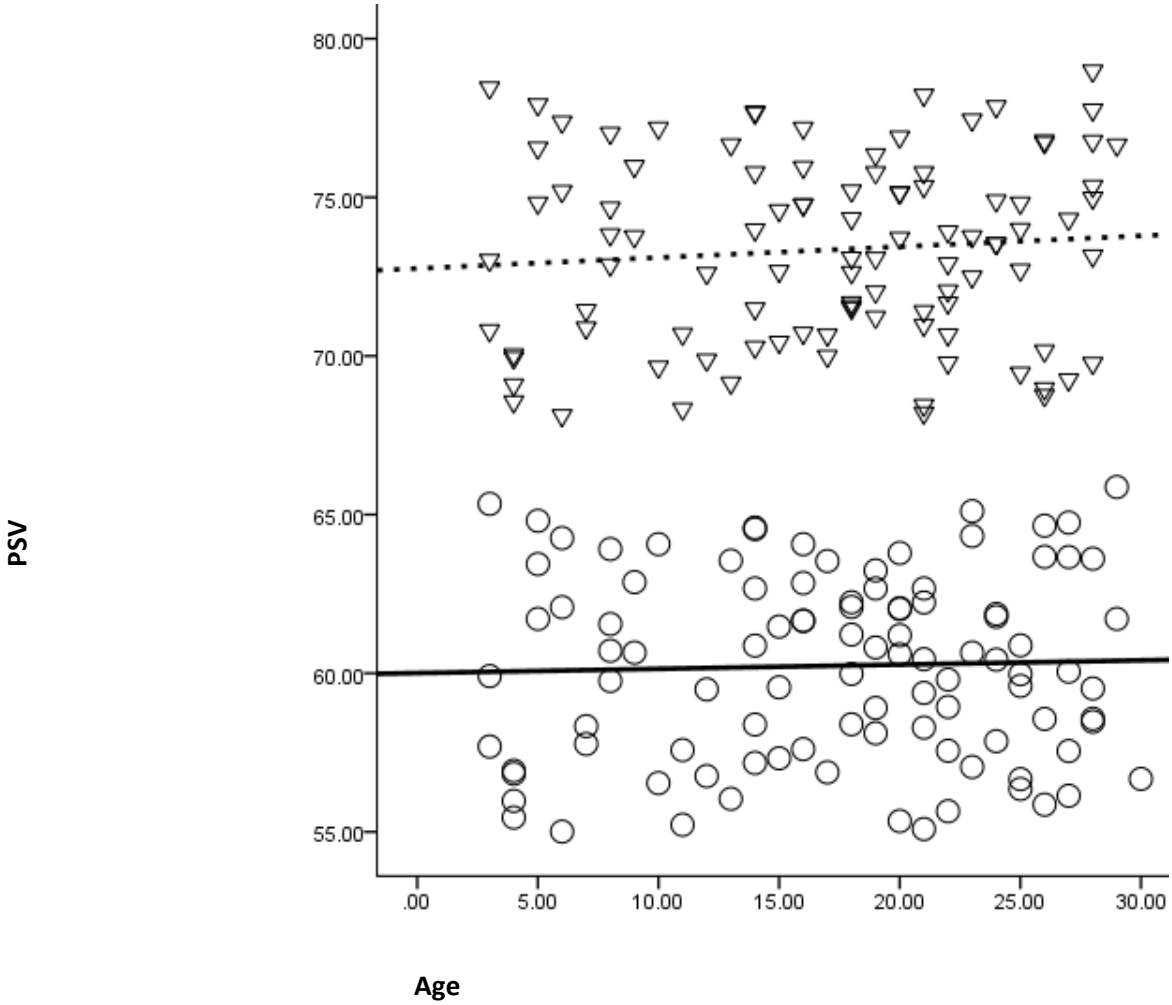

Fig. 7: A scatter plot with trend line of the relationship between PSV and Age of AA and SS haemoglobin

From the fig 7 above, R_{AA}= 0.035, P $value_{AA}$= 0.732, Y_{AA} = 60.006+0.013(Age)

R_{SS}= 0.088, P $value_{SS}$= 0.386, Y_{SS} =72.759+0.034(Age),

Key: O = control group, Δ = patients with Hb SS R= Pearson's correlation coefficient

Y= correlation equation P = the level of significance

Statistically, r>0.3 is significant and p<0.05 is significant

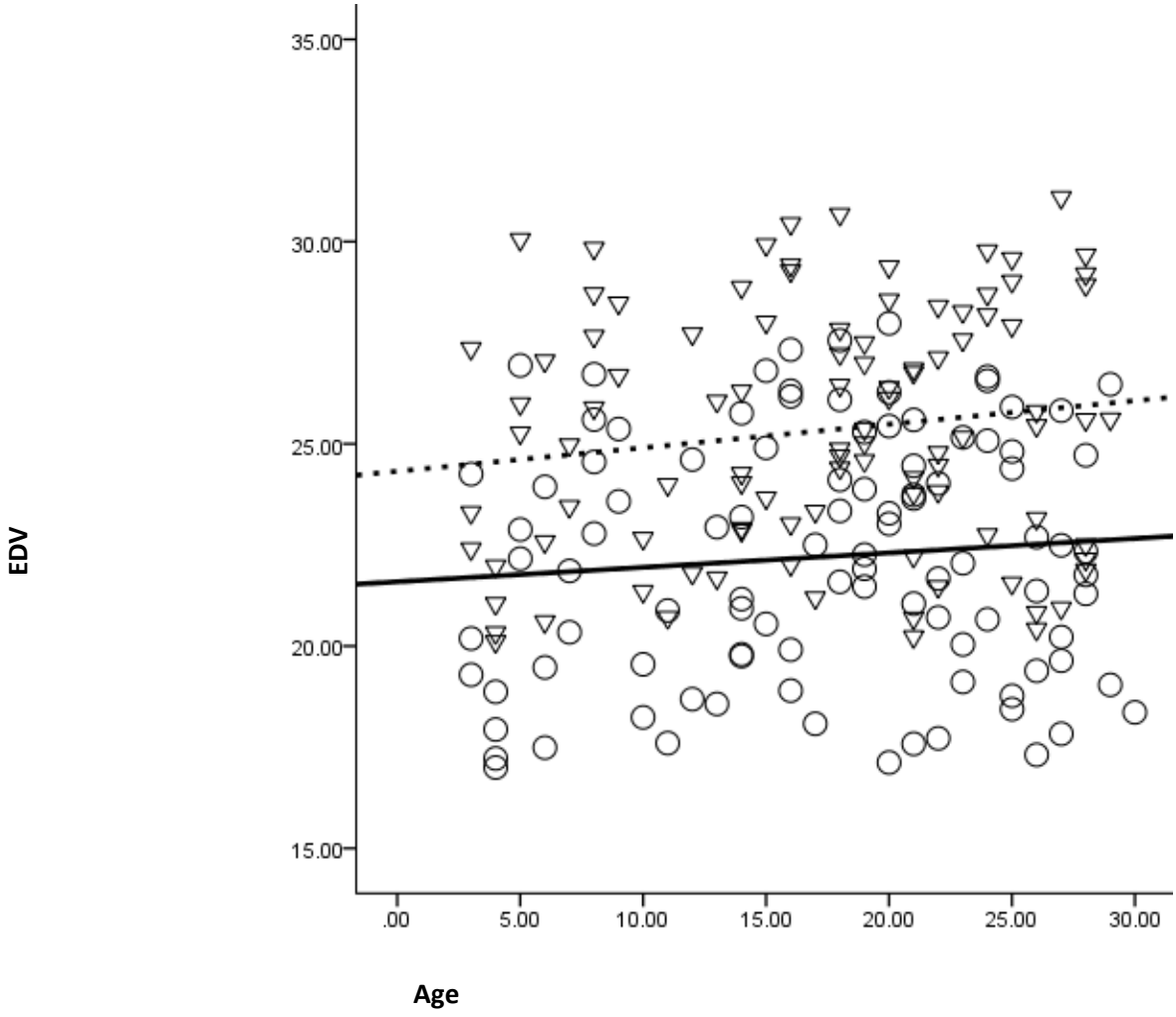

Fig. 8: A scatter plot with trend line of the relationship between EDV and Age of AA and SS haemoglobin

From the fig 8 above, R_{AA}= 0.090, P $value_{AA}$= 0.375, Y_{AA} = 21.591+0.036(Age)

R_{SS}= 0.144, P $value_{SS}$= 0.154, Y_{SS} =24.322+0.058(Age)

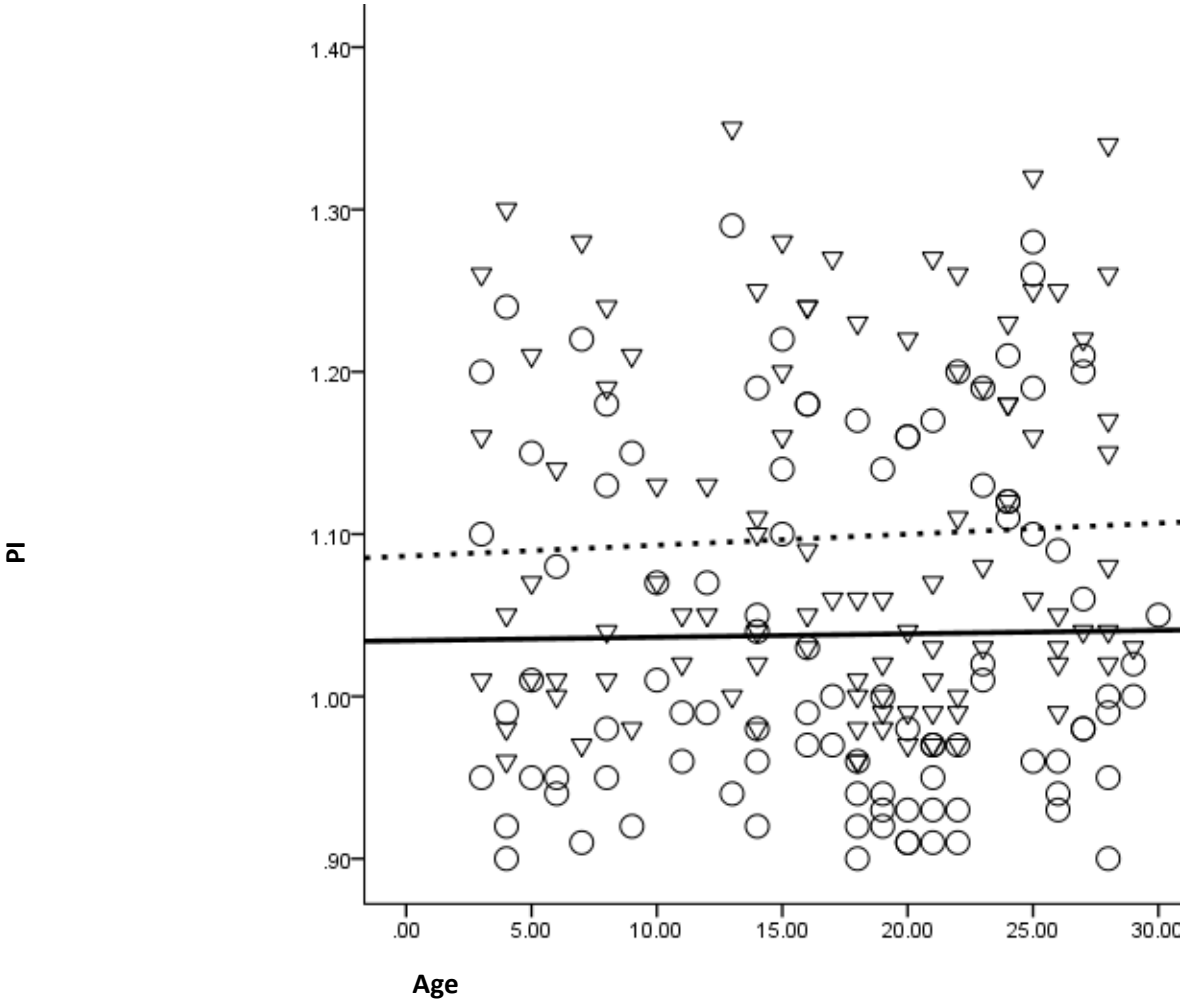

Fig. 9: A scatter plot with trend line of the relationship between PI and Age of AA and SS haemoglobin

From the fig 9 above, R_{AA}= 0.015, P $value_{AA}$=0.884, Y_{AA} = 1.034+0.000(Age)

R_{SS}=0.047, P $value_{SS}$=0.645, Y_{SS} =1.086+0.001(Age)

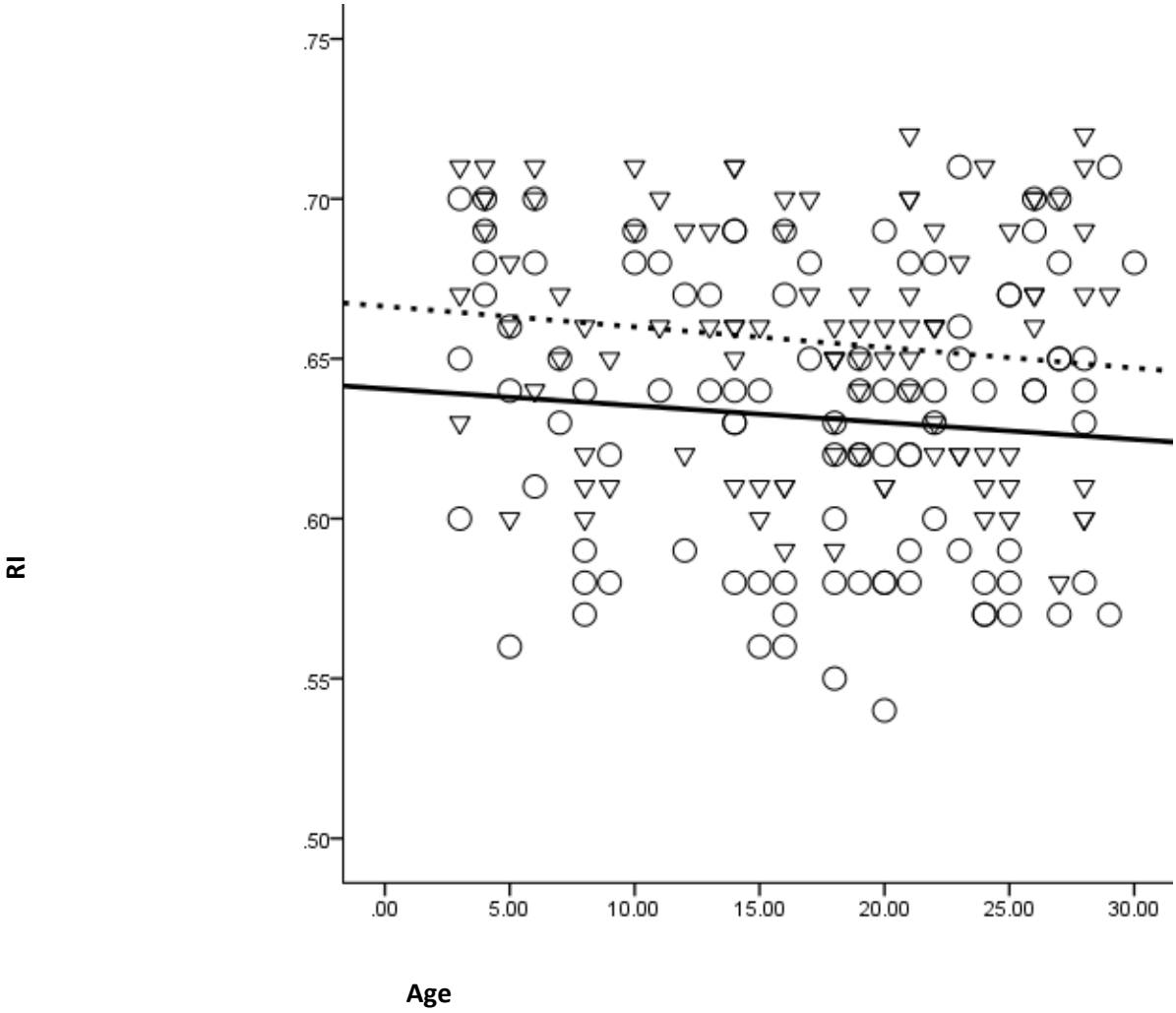

Fig. 10: A scatter plot with trend line of the relationship between RI and Age of AA and SS haemoglobin

From the fig 10 above, R_{AA}= 0.089, P value$_{AA}$=0.376, Y_{AA} = 0.641-0.001(Age)

R_{SS}=0.128, P value$_{SS}$=0.206,Y_{SS} = 0.666-0.001(Age)

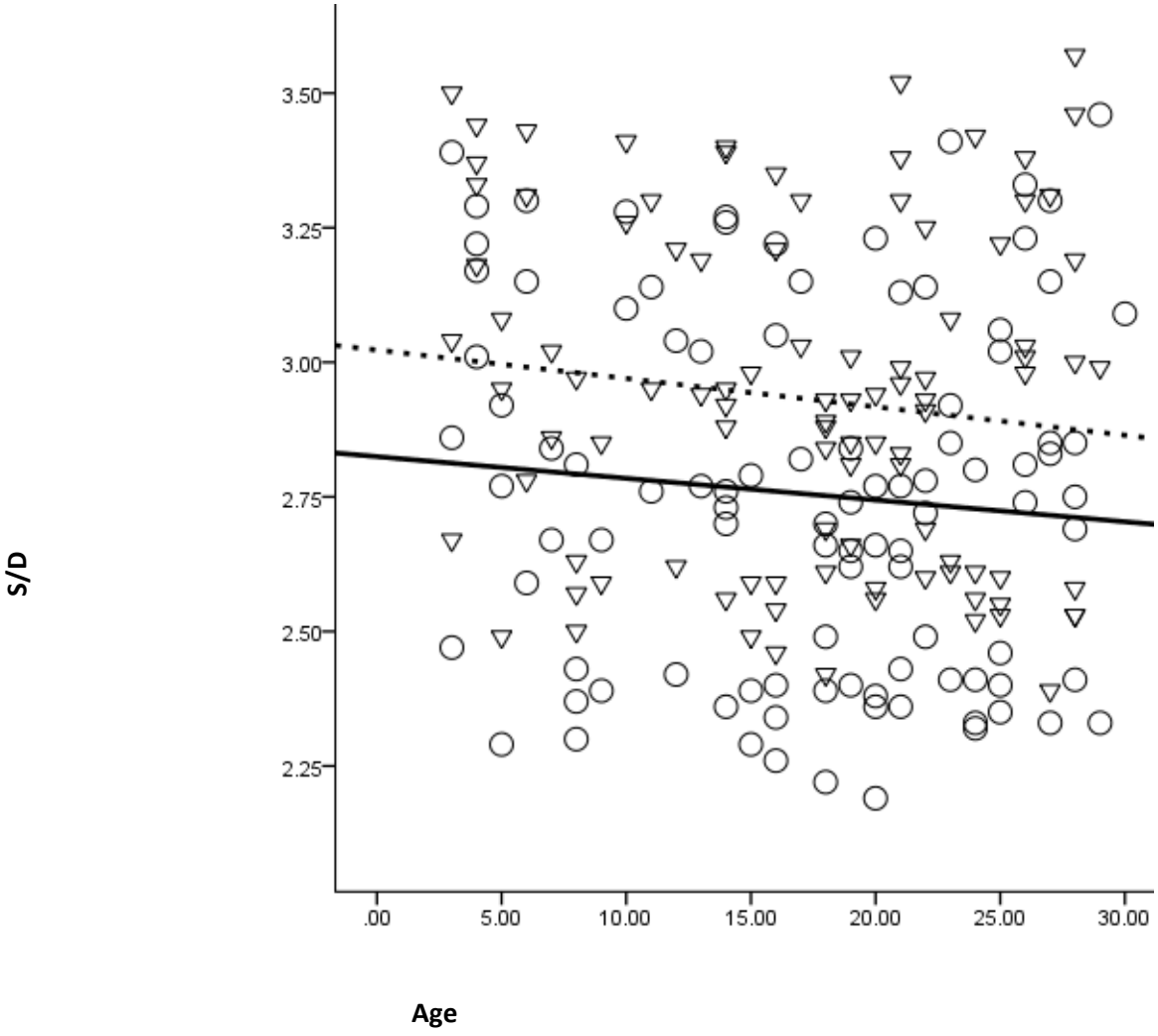

Fig. 11: A scatter plot with trend line of the relationship between S/D and Age of AA and SS haemoglobin.

From the fig 11 above, R_{AA}= 0.091, P $value_{AA}$=0.370, Y_{AA} = 2.825-0.004(Age)

R_{SS}=0.125, P $value_{SS}$=0.217,Y_{SS} =3.023-0.005(Age)

Discussion

In this study, no patient below the age of three years had SS haemoglobin genotype. This is probably due to persistence of fetal haemoglobin (Hb F) in the fetal circulation in the first year of life[12] and also the fact that the index study is a hospital based study. Other reasons for the delayed presentation of children with Hb SS to the hospitals in Abakaliki may be due to the local socio-cultural beliefs, poverty, illiteracy, ignorance and lack of a state or local government health insurance schemes. Sick children with Hb SS are traditionally referred to as *ogbanje (meaning born to die or children who come and go)* and are commonly taken to the native doctors,

herbalist homes, spiritual homes, the churches/ prayer houses and later to the patent medicine shops before they are eventually brought to the hospitals[13].

From the data obtained in this study, the splenic artery Doppler indices of those with Hb SS genotype are higher than those with normal Hb genotype and the difference is statistically significant for PSV, EDV, RI, PI and S/D ratio with p values 0.00, 0.00, 0.00, 0.00 and 0.00 respectively. Studies on splenic artery Doppler indices in patients with Hb SS genotype are not readily available in the literature for comparison. However Doppler studies of other vessels in patients with Hb SS genotype also showed increased Doppler indices which the authors attributed to various degrees of anemia and vasculopathy.

Taori et al[14] found an increase in the PI and RI in the main renal, segmental and interlobar arteries in patients with SCD. RI was found to be a less variable index than PI. The elevated PI was found to be highly significant when comparing those with SS genotype and AA genotype (p values 0.0001, 0.0001, 0.0001, respectively, for main renal, segmental, and interlobar arteries) and also when comparing those with AS genotype and AA genotype (p values 0.0001, 0.0001, 0.0001, respectively). RI was also observed to be significantly elevated in both the SS and AS groups compared with the AA group in the main renal, segmental, and interlobar arteries when comparing SS genotype and AA genotype groups (p values 0.0001, 0.0001, 0.0001, respectively). Also when the RI of subjects with AS genotype and those with AA genotype were compared, it was significantly higher in those with AS (p values 0.0001, 0.0001,0.0001, respectively).

Aaslid R[15] observed that the blood velocity is directly related to the cerebral blood flow and inversely related to the diameter of the vessel.

In Columbia, Brass et al[16] found that children with SCA have 40 to 50% higher mean velocity of flow than those without anemia.

Adams et al[17] also found that in contrast to children without anemia, arterial velocities were higher in children with anemia and vasculopathy.

No correlation was noted between age and the splenic artery Doppler indices in both those with Hb SS genotype and those with normal Hb genotype. For those with normal Hb genotype, the p values are 0.732, 0.375, 0.884, 0.376 and 0.370 for the PSV, EDV, PI, RI and S/D ratio respectively. Their correlation coefficients (r) are 0.035, 0.090, 0.015, 0.089 and 0.091 for the PSV, EDV, PI, RI and S/D ratio respectively.

For those with Hb SS genotype, the p values are 0.386, 0.154, 0.645, 0.206 and 0.217 for the PSV, EDV, PI, RI and S/D ratio respectively. Their correlation coefficients(r) are 0.088, 0.144, 0.047, 0.128 and 0.125 for the PSV, EDV, PI, RI and S/D ratio respectively.

There was no statistically significant difference between the Doppler indices in males and females with Hb SS genotype with the p values of 0.931, 0.986, 0.942, 0.958, and 0.987 for the PSV, EDV, PI, RI and S/D ratio respectively.

Other Doppler studies documented no statistically significant correlation with age.[14,15,16,17] The changes in Doppler parameters are usually associated with vascular occlusions and increased vascular resistance which are age independent.[14]

Splenic artery Doppler sonography can therefore be used to monitor the spleen in sickle cell anemia and pick up early changes before the changes become late or irreversible.

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The Effect of Combination of Fresh Feed with Commercial Artificial Feed on Growth and Survival of Snakehead Fish (*Channa striata*)

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Abstract- This research aims to determine the combination of fresh feed of sardine fish (*Sardinella*) with artificial feed on the growth and survival of snakehead fish (*Channa striata*). This research method was carried out using a Completely Randomized Design (CRD) with 5 treatments and 4 replications. The treatments used in this research are 100% artificial feed (A), 75% artificial feed and 25% fresh feed of sardine fish (*Sardinella*) (B), 50% artificial feed with 50% fresh feed of sardine fish (*Sardinella*) (C), 25% artificial feed with 75% of fresh feed of sardine fish (*Sardinella*) (D), 100% of fresh feed of sardine fish (*Sardinella*) (E). The results showed that each treatment, namely growth, survival rate and feed consumption level, there was no significant difference in the combination of feed in snakehead fish (*Channa striata*). This shows that fresh feed (*Sardinella*) and artificial feed can be used as feed for raising snakehead fish (*Channa striata*).

Keywords: Effect, combination, fresh feed, commercial Artificial feed, Growth, Survival rate.

I. INTRODUCTION

Snakehead fish (*Channa striata*) is a type of freshwater fish that has high economic value as fresh and processed fish consumption (Mustafa *et al.*, 2012). Snakehead fish (*Channa striata*) has special competitiveness, including high levels of albumin, so it is also in demand as a raw material for health products and the pharmaceutical industry (Ndobe, 2017). The albumin content in Snakehead fish is around 62.24 g/kg (Retta, 2016). As well as being a biomedical material due to its albumin content which can accelerate the post-operative wound healing process (Wahab *et al*., 2015).

The main problem of snakehead fish (*C. striata*) is the aquaculture of snakehead fish that has been conducted is currently limited to rearing efforts (Rahman 2015). This is because the feed is incomplete and easily degenerated (Haiwen et al., 2014). Aditya et al. (2012) added that the quality of fresh feed is also influenced by several factors, namely seasonality, perishability, quality is not equal and the price is relatively expensive due to competition from humans who need fresh fish for consumption, to overcome this it needs to be combined with another type of feed that is able to complete the nutritional content of feed according to the nutritional needs of snakehead fish (*C.striata*), one of the solutions is commercially-made feed. The advantage of commercially-made feed as the main energy source, has an equal quality and a more complete nutritional content in accordance with what is needed of snakehead fish (*C.Striata*), is not easy to rot, easy to store and distribute (Rahadiyani, 2014). Feed is an important source of nutrition for the growth and development of aquatic biota. Feed with the best nutrition will encourage the growth of the biota to be more optima. In addition, feed nutrition also acquires an important role in controlling the metabolic system of the aquatic biota body and helps to protect the biota's immune system from disease infection Rusydi (2014).

Based on the above, information about the best combination of fresh feed with artificial feed needs to be published in the context of developing aquaculture of snakehead fish (*C.striata*) in the future.

II. MATERIALS AND METHODS

A. Time and Place of Research

This research was conducted at the Fish Seed Center of Maros, South Sulawesi. From March to June 2019. Proximate Analysis of fish feed, conducted at the Laboratory of Animal Food Chemistry, Faculty of Animal Husbandry, Hasanuddin University.

B. Data Collection Method

The test fish used was Snakehead fish seed originating from the Fish Seedling Center of Maros, measuring length 3-4 cm and weighing 0.08-0.10 g. Snakehead fish that are sampled first are acclimated to the maintenance environment for 1 hour then feed adaptation is carried out for 1 week before being given test feed according to the treatment both maintained in net cage and in the aquarium.

The maintenance container used consists of two types, namely: net cage used in length, width, and height of 100x100x100 cm which is installed in a pond, used as a maintenance container for observation, growth, and survival. While the aquarium used is length, width, and

height of 50x40x35 cm respectively. The side of the container is covered with black plastic, used as a maintenance container for observing feed consumption levels.

The design pattern used is a Completely Randomized Design (CRD). A Completely Randomized Design (CRD) consists of 5 treatments and 3 replications, namely:

A: 100% artificial feed & 0% fresh feed.
B: 75% artificial feed & 25% fresh feed.
C: 50% artificial feed & 50% fresh feed.
D: 25% artificial feed & 75% fresh feed.
E: 0% artificial feed & 100% fresh feed.

C. Observed Parameters

1. Survival Rate (%)

Snakehead fish survival can be calculated using the Effendie (1997) formula as follows:

$$\mathbf{SR = Nt/No \times 100}$$

Note: **Nt** = The number of fish that lived at the end of the research (fish)
No = The number of fish at the beginning of the research (fish)

2. Growth

Specific Growth Rate

During the maintenance period calculated by the Effendi (1997) formula:

$$\mathbf{RG} \quad \frac{\mathbf{Ln_{Wt} - Ln_{W0}}}{\mathbf{t}}$$

Note: **Wt** = Average individual weight of fish at the end of the research (gr)
W0 = Average individual weight of fish at the beginning of the research (gr)
T = Length of Maintenance (day)

3. Proximate Analysis

Proximate analysis is an analysis conducted to calculate the chemical composition of feed, including analysis of water content, ash, fat, and protein.

4. Water Quality

During the research, several water quality parameters were measured. The parameters measured are temperature, pH, dissolved oxygen, and ammonia. Temperature is measured using a thermometer, pH is measured using a pH meter, O2 is dissolved with a DO meter, while ammonia is measured using a spectrophotometer. Temperature, pH, and O2 are measured twice a day ie mornning (08.00 am) and afternoon (05.00 pm). The ammonia was measured once a week during the research.

III. RESULTS

A. Feed Nutrition Value

The results of the proximate analysis of the combination of fresh feed with artificial feed used during the research are presented in Table 1 below:

Table 1. Proximate analysis of feed raw materials

Composition (%)	Artificial Feed	Fresh Feed
Water	9,32	79,54
Crude Protein	59,00	78,35
Crude Fat	5,90	8,27
Crude Fiber	2,73	0,39
EMWN	22,75	0,56
Ash	9,61	12,43

Description : 1. Except for water, all fractions are stated in dry matters
1. EMWN: Extract Material Without Nitrogen

The calculation results of the nutritional composition of a combination of artificial feed and fresh feed in dry material are in table 2.

Table 2. Nutritional composition of a combination of artificial feed and fresh feed

Composition (%)	A	B	C	D	E
Crude Protein	59,00	63,83	68,68	73,51	78,35
Crude Fat	5,90	6,49	7,09	7,68	8,27
Crude Fiber	2,73	2,15	1,56	0,98	0,39
EMWN	22,75	17,20	11,66	5,83	0,56
Ash	9,61	10,32	11,02	11,73	12,43

Description: in dry ingredients

The results of the calculation of the nutritional composition of fresh feed of Sardine fish *Sardinella* with artificial feed showed that in treatment E had a very high crude protein level of 78.35%, crude fat 8.27%, and Ash 12.43%. But the crude fiber and EMWN in treatment E are very low where the crude fiber is 0.39% and EMWN is 0.56%. Whereas in treatment A of crude protein 59.00%, crude fat 5.90%, and ash 9.61%. But in crude fiber and EMWN has a percentage of 2.73% and EMWN 22.75%.

B. Feed Consumption Rate

Data from the analysis of variance shows that the level of feed consumption of Snakehead fish seed (*Channa Striata*) has no effect is presented in table 3.

Table 3. Average level of feed consumption of Snakehead fish seed (*Channa striata*)

Treatment	**Feed Consumption Rate**
A	26.02 ± 3.75^{a}
B	32.64 ± 22.06^{a}
C	40.07 ± 22.43^{a}
D	34.80 ± 15.04^{a}
E	$21.38 \quad 7.45^{a}$

The results of analysis of variance of various combinations of fresh feed of Sardine fish *Sardinella* with artificial feed did not influence (P> 0.05) on the level of feed consumption of Snakehead fish (*Channa striata*) after 60 days of maintenance.

C. Survival

Percentage data from the results of analysis of variance which show that the survival of the Snakehead fish seed *Channa Striata* has no effect is presented in table 4.

Table 4. Average survival rate (%) of Snakehead fish seeds *Channa striata*

Treatment	Feed Consumption Rate
A	43.33 ± 1.44[a]
B	40.83 ± 5.77[a]
C	53.33 ± 10.10[a]
D	57.50 ±11.45[a]
E	55.00 ± 8.66[a]

Based on the results of the analysis showed that the combination of fresh feed of Sardine fish *Sardinella* with artificial feed had no effect (P> 0.05) on the survival rate of Snakehead fish (*Channa striata*).

D. Growth

Specific Growth Rate

Percentage data from the results of analysis of variance showing that the specific growth rate of Snakehead fish seeds *Channa Striata* has no effect is presented in Table 5.

Table 5. Average specific growth rates of Snakehead fish seeds *Channa striata*

Treatment	Growth
A	0.66 ± 0.12[a]
B	0.68 ± 0.14[a]
C	0.60 ± 0.01[a]
D	0.53 ± 0.15[a]
E	0.68 ±0.10[a]

The results of analysis of variance of various combinations of fresh feed of Sardine fish *Sardinella* with artificial feed did not have an effect (P> 0.05) on the specific growth rate of Snakehead fish (*Channa striata*). This shows that each treatment on a combination of feed has no significant effect (P> 0.05).

E. Water Quality

The range of water quality parameter values obtained during the research is presented in Table 6.

Tabel 6. Range of water quality values for maintenance media during the research

Parameter	Range obtained
Temperature (^{0}C)	28-33
pH	7-8,5
DO (ppm)	3.20-6,40
Ammonia (ppm)	0,0140-0,0463

IV. DISCUSSION

Based on table 2 where the protein content ranges from 59.00 to 78.35%, it is higher when compared to the research of Chau et al. 2010 which states that snakehead fish need protein by 58%. Furthermore according to Sagada et al. (2017) states that snakehead fish need protein by 51%. Based on this opinion it can be concluded that the protein content in feed A, B, C, D, E is able to supply the protein needs of snakehead fish (*C.striata*). According to Quinitio et al. (1999) very high levels of protein feed will negatively impact snakehead fish (*C. striata*). This is because, only the excess protein will minimally be digested and absorbed by fish. Undigested protein will be wasted in maintenance media and reduced to nitrogen and sulfide compounds that can be harmful to fish health.

The fat content of feed used ranges from 5.90 to 8.27%. The feed A, B, C, D, E are still in accordance with the needs of snakehead fish according to Nasution, 2006 the need for fat content of snakehead fish is 6.01. In addition, the results of research by Li et al. (2018) stated that the fat requirement for fish is 6.84. According to Munir et al. (2016) states that snakehead fish requires 12% fat. Meanwhile, according to Mujiman (2004), the need of fat for freshwater fish ranges from 4-18%. Pratoomchat et al. (2002) and Satphaty et al. (2003) in Aslamyah and Fujaya (2009) state that fat is one of the most important feed components for growth, which serves to maintain the structure and integrity of cell membranes in the form of phospholipids and as a source of energy.

Carbohydrates are in the form of crude fiber and Extract Material Without Nitrogen (ENWN). The result of crude fiber and low ENWN in treatment E is 0.39% crude fiber and 0.56% ENWN while the ENWN value in treatments A 22.75, B 17.20, C 11.66, D 5.83 and for crude fiber in treatments A 2.73, B 2.15, C 1.56, D 0.98, the results of this study indicate that treatment E has a lower carbohydrate value than treatments A, B, C, D. At treatment E means energy for all fish activity is mostly protein. As for treatments A, B, C, D, supply the carbohydrate requirements for snakehead fish. The results of Dayal et al. (2016) stated that snakehead fish need carbohydrates as much as 24.74, according to the research results of Arockiaraj et al. (1999), Striped Murrel fish (*Channa striatus*) (Bloch) requires carbohydrates of 34.4%. The use of carbohydrates if excessive will cause fat accumulation and reduce the level of feed consumption, while the level of carbohydrates that are too low causing some protein to be used for energy (Wang et al, 2005).

The level of feed consumption, growth, and survival of snakehead fish (*C. striata*) did not show any significant effect (P> 0.05) on the combination of fresh feed of sardine fish (*Sardinella*) with commercially-made feed. What causes the level of feed consumption has no real effect is suspected that the fresh feed of sardine fish (*Sardinella*) with commercially-made feed does not change the taste and odor of fish feed. If the taste of feed is in accordance with the wishes of the fish, then the feed will be consumed. Conversely, if the feed do not taste good, then the feed will be left or not eaten. According to Khasani (2013), the attraction of fish to feed to eat is very important in the formulation of fish feed. According to Samsudin et al. (2008), good feed for fish are determined by its nutritional value.

The growth of snakehead fish (*C. striata*) from the results of the research showed no significant effect. The growth is determined by the rate of feed consumption and the feed quality of snakehead fish (*C. striata*). Judging from the quality of snakehead fish feed (*C. striata*) from table 5 shows the protein content in accordance with snakehead fish needs. These results are compared with the results of the

Sagada research (2017) that examined the effect of protein levels in feed on fish growth and found optimal growth in protein 51% and not much different in the research of Chau et al. (2010) which states snakehead fish need protein by 58% it can be concluded that the use of a combination of feed can meet the needs of fish protein used for growth. In proximate analysis of carbohydrates shows that carbohydrates in feed in treatments A, B, C, D have carbohydrate content that can support fish growth. This is in accordance with what was stated by Das and Tripathi (1991) carbohydrates can increase fish growth with carbohydrate content by 5, 23-10,16%. While in treatment E has a low carbohydrate content, the protein content is used in part for the growth of snakehead fish (*C.striata*), where the results of research Erfanullah et al. (1995) stated that the lowest use of carbohydrates in feed was 5.04%.

The survival of snakehead fish (*C. striata*) in this research had no significant effect, because seen from the quality of feed and feed consumption levels in tables 2 and 3, the protein and fat content were sufficient to maintain the survival of snakehead fish (*C. striata*). in accordance with the statement of Hien et al. (2015) that the suitable protein content for the needs of snakehead fish can support the survival of snakehead fish while for carbohydrates in treatment E is still low. Then the protein in treatment E is used mostly for energy on the survival of snakehead fish. The level of feed consumption is a determining parameter on the use of feed in order to support good survival.

Water quality is an external factor that can affect the success of aquaculture. The results of water quality research during the study were within the range that can be tolerated by snakehead fish seeds. During the research, water temperature ranged from 28 to 33^0C, pH ranged from 7 to 8.5, dissolved oxygen ranged from 3.20 to6.40 ppm, while the ammonia content ranged from 0.0140 to 0.0463 ppm.

V. CONCLUSIONS

Based on the results of research various combinations of fresh feed with commercial artificial feed showed growth, survival, feed consumption levels and albumin content gave the same response.

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Are Pupils On-Trend? The Vocabulary Awareness of Selected Pupils Regarding On-Trend Words in the Philippines

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Abstract – Language has many characteristics and one of which is its dynamicity. Words do not remain stagnant; they evolve over time based on the in – culture, or society where a particular language is used. Since language change affects all language and exempts nothing, Filipino language is counted in such phenomena. This research determines the vocabulary knowledge of elementary students using the Vocabulary Knowledge Scale proposed by Wesche and Paribakht (1996); their reasons why the students use the on – trend words; and the relationship of the socio – demographic profile of the respondents and preference to their vocabulary knowledge. This research made use of descriptive research method and percentage, weighted mean and Pearson R Correlation in processing the gathered data. It was found out that pupils were aware about the on-trend words despite of their young age. This research also found out that sex has a relationship with vocabulary awareness while word preference and age do not.

Index Terms – Awareness, VKS, Pupil, On – Trend Words

Introduction

One of the serious impairments that a person may have is the inability to communicate with other people. Communication can be done in several ways such as facial expressions, gestures, writing, drawing and the most used, through language.

Language has many characteristics and one of which is its dynamicity. Words do not remain stagnant; they evolve over time based on the in – culture, or society where a particular language is used. According to Language Wire Magazine, the amount of words is currently growing at a staggering rate, faster than before.

According to Nordquist (2018), language change is the phenomenon by which permanent alterations are made and the use of a language over time. In an anthropological perspective on language change, Ottenheimer (2009) claims that there are many factors influencing the rate at which language change; this includes the attitudes of the speakers in terms of barrowing and changing.

Since language change affects all language and exempts nothing, Filipino language is counted in such phenomena. The news website Rappler, recently reported that there were new Filipino words added in the Oxford dictionary and one of which is the word, “Trapo” or also known as a “a traditional politician”. This proves that language in the Philippines is rich in multilingualism. “Trapo” is just one of the words included in the Oxford dictionary not mentioning *bongga, bagoong, bihon, calamansi, carinderia, sorbetes, and turon.*

This research determines the vocabulary knowledge of elementary students using the Vocabulary Knowledge Scale proposed by Wesche and Paribakht (1996); their reasons why the students use the on – trend words; and the relationship of the socio – demographic profile of the respondents and preference to their vocabulary knowledge.

Statement of the Problem

This research aimed to answer the following:

1. How the profile of the respondents may be described in terms of their:
   A. Age; and
   B. Sex?
2. How may the specific trending word may be described by the respondents using the Vocabulary Knowledge Scale (VKS) by Wesche and Paribakht (1996)?
3. Where the respondents acquire on – trend – words?
4. Why the respondents prefer to use on – trend – words?
5. Is there a significant relationship between the age of the respondents and their vocabulary awareness (based on VKS)?
6. Is there a significant relationship between the preference of the respondents in using on – trend words and their vocabulary awareness (based on VKS)?
7. Is there a significant relationship between the age of the respondents and their vocabulary awareness (based on VKS)?

Significance of the Study

This study will be beneficial to the following:

To the **LANGUAGE TEACHERS**, the results of this study might be used by language teachers how students give meanings to words and how words change based on the trend, and culture of the people today. Moreover, this might help the teachers in adjusting their way of communicating to the students.

To **PUBLIC HIGH SCHOOLS**, the teachers in the secondary level will find the research beneficial because the results of this research would reflect the culture that their students have since culture and language are symbiotic (Madison, 2018).

To **FUTURE RESEARCHERS,** they may use the results of this research for their future undertakings.

Hypotheses of the Study

The study hypothesizes the following:

1. There is no significant relationship between the age of the respondents and the respondents' description of on – trend words (based on VKS);

2. There is no significant relationship between the preferences of the respondents and their vocabulary awareness (using VKS); and

3. There is no significant relationship between the age of the respondents and vocabulary awareness.

Definition of Terms

The following words were often used in the entire course of the research. They were operationally and/ or technically defined:

Awareness – the consciousness of someone that a certain word exists.

On – trend words – words which are currently being used by Filipinos as enumerated by Valdeavilla 2018.

Origin – where did the respondents learn the on – trend words.

Vocabulary – a list or collection of words or of words and phrases (merriam – dictionary); Word knowledge of someone.

VKS – Vocabulary Knowledge Scale. VKS is a 5-point self-report scale developed by Wesche & Paribakht (1996) that allows students to indicate how well they know items of vocabulary (Brown, 2008).

Research Method

This research made use of descriptive research method which according to Bhat (2018) is a research method that describes the characteristics of the population or phenomenon that is being studied. Moreover, this research method focuses more on the "what" of the research subject rather than its "whys".

Research Locale

The research was conducted at Yuson Elementary School, Guimba, Nueva Ecija. The school has a small population, so small that it has only one section per grade.

Respondents of the study

The respondents of the research were the grade 5 and grade 6 students of Yuson Elementary School. They were chosen as respondents because of their hypothetical or assumed age of 10 – 12 years old (en.wikipedia). According to Critical Period Hypothesis (CPH) proposed by Penfield and Roberts (1959) and popularized by Lenneberg in 1967, the age 5 to puberty is the period when the child absorbs the language the most.

The respondents came from Grade 5 Aguinaldo and Grade 6 Earth; both were star sections. The researcher made all the students of both sections answer the questionnaires to make the results more reliable. Thus, there was no margin of error in data tallying and interpretation of this research.

Instrumentation

The instruments used in this research was questionnaire. Aside from describing the demographic profiles of the respondents, the questionnaire determined the vocabulary knowledge of the respondents toward the given words using the Vocabulary Knowledge

Scale developed by Wesche and Paribakht (1996). VKS intends to determine how well a particular respondent knows a given word. The depth of vocabulary knowledge was measured using the following indicators:

A. (4 points) = The respondent knows what the word/ phrase means and can use it in a sentence.
B. (3 points)= The respondent knows what the word/ phrase means but is not sure how to use it.
C. (2 points) = The respondent has seen the word/ phrase but is not sure what it means.
D. (1 point = The respondent has never seen the word before.

Also, the questionnaire determined where did the respondents learned the words stated in the VKS and their reasons why they use such words.

Data Gathering and Procedures

After the researcher had devised their research instruments, he made a request letter for him to be authorized to conduct the research at Yuson Elementary School. He sought the permission of its school principal, Alex S. Calambacan. Then, he was assisted to meet the respondents and made them answer the questionnaires.

In terms of the test administration, the researcher followed some of Brown's (2008) way in conducting VKS instruments. Below were the procedures made and observed by the researcher:

- The researcher gave each student respondent a copy of the VKS questionnaire and made sure that a student respondent understood the four choices.
- The students were not allowed to use any learning resources such as dictionaries and gadgets.
- While the students were answering, the researcher wrote the following on the board:
    - *"If your answer is A, make a sentence using that word."*
    - *"If your answer is B, explain what the word means."*
- The respondents were only given a maximum of 20 minutes to answer the questionnaire.

Statistical Treatment

To interpret the data gathered, this research made use of various statistical formula. They are the following:

1. Percentage

This statistical tool was used to determine the percentage of the socio – demographical information of the respondents.

2. Weighted Mean

This statistical tool was used to determine the average of the VKS results of the respondents.

3. Pearson r Correlation

This statistical tool was used to determine the significant relationship of the VKS results to the preferences of the respondents in on trend words.

Verbal Interpretation

For VKS

VERBAL INTERPRETATION	RANGE
Knows the word/ phrase and can use it in a sentence.	3.26 – 4.0
Knows the word/ phrase but is not sure how to use it.	2.51 – 3.25
Has seen the word/ phrase before but do not know what it means.	1.76 – 2.50
Has never seen the word.	1. 0 – 1.75

For Likert Scale

VERBAL INTERPRETATION	RANGE
Extremely	4.21 – 5.0
Very	3.41 – 4.20
Moderate	2.61 – 3.40
Slightly	1.81 – 2.60
Not at all	1.0 – 1.80

RESULTS AND DISCUSSION

This chapter shows the results of the data gathered by the researchers such as the demographic profile of the respondents, their vocabulary knowledge, where they did learn the on – trend words, and reasons for preferring on – trend words.

Socio – demographic Profile of the Respondents

Age

AGE	#	%
10 years old	15	60%
11 years old	9	36%
12 years old	1	4%
Total	25	100%

The table above shows that most of the respondents are 10 years old which is 60% of the respondents; 36% of them are 11 years old; and only 4% is 12 years old.

This means that the respondents are in the entry – level of the Critical Period Hypothesis as proposed by Penefield and Roberts (1959) and Lenneberg (1967). Thus, the words that they encounter can be absorbed quickly and may have a long influence to them.

Sex

SEX	#	%
Female	16	64%
Male	9	36%
Total	25	100%

The table above shows that most of the respondents are female, composed of 64% of the total respondents. 36% are males.

According to Collom (2015), women are good in language than men. It is reported that women outnumber men 3 to 1 when it comes to language instruction.

Vocabulary Knowledge of the Student Respondents

WORD	A	B	C	D	MEAN	RANK	V. I.
Kilig	17	7	0	1	3.6	2	Knows the word/ phrase and can use it in a sentence.
Gigil	17	4	2	2	3.44	5	Knows the word/ phrase and can use it in a sentence.
Susmariosep	3	16	3	3	2.76	9	Knows the word/ phrase but is not sure how to use it.
Nyek	4	13	4	4	2.68	10	Knows the word/ phrase but is not sure how to use it.
Charot	8	14	0	3	3.08	7	Knows the word/ phrase but is not sure how to use it.
Chibog	2	4	6	12	1.76	13	Has seen the word/ phrase before but do not know what it means.
Jowa	6	13	2	3	2.8	8	Knows the word/ phrase but is not sure how to use it.

Basta	20	4	0	1	3.72	1	Knows the word/ phrase and can use it in a sentence.
Lodi	12	13	0	0	3.48	4	Knows the word/ phrase and can use it in a sentence.
Petmalu	14	11	0	0	3.56	3	Knows the word/ phrase and can use it in a sentence.
Werpa	12	11	1	0	3.32	6	Knows the word/ phrase and can use it in a sentence.
Mumshie	4	12	3	5	2.52	11	Knows the word/ phrase but is not sure how to use it.
Bes	13	11	1	0	3.48	4	Knows the word/ phrase and can use it in a sentence.
Chika	3	13	1	8	2.44	12	Has seen the word/ phrase before but do not know what it means.
				Mean	3.045		

Based on the table above, the word *basta* was the word which the student respondents really know, they can use it in a sentence such as “Basta wag mo kong kakalimotan.”, and “Basta dun tayo magkikita.” Based on them, its English equivalent may be “Be sure”, and “Unless”. Moreover, some of the meanings of *basta* based on the operational use of the students does not have any equivalent in the English language. This result is opposing the google translation *that’s enough.*

Kilig is ranked as second; they know it and can use it in a sentence. Examples are “Ako’y kniikilig pag may love.”, “Kinikilig ako kay KathNiel.”, “Kinikilig ako sa sweet.” etc. *Kilig’s* English equivalent based on the operational use of the students, is *romantic excitement*. However, in most of the sentences of the students, they use *kilig* as a verb thus, *kilig* may also be considered as a word which has no exact English equivalent.

The other words which the student respondents are familiar of are *Petmalu, Lodi, Bes, Gigil, and Werpa.* The student respondents were able to use them in sentences. The word *petmalu* is explained by the students as an adjective which is applied to a person who has done a job or a deed which is unique and worthy to be recognized for. *Bes* is a name – call to people who are in someone’s inner circle; however, in some of the sentences of the student respondents, it can also be defined (based on their operational use of the word) as an adjective to describe a person who can be benefited from. *Gigil* is defined by the student respondents as gnashing whenever someone is really angry and/ or someone feels if s/ he saw something cute or lovely. *Werpa* is defined by the students (based on their operational use of the word) as an expression that indicates admiration, and joy; moreover, they use it as an interjection.

The word that the student respondents are not familiar to them are *chibog*, and *chika.* The student respondents do not know the meaning of the aforementioned words and cannot use them in a sentence. The explanation for this is that, the words *chika* and *chibog* were words which were being used in late 90s of the Filipinos thus, tendency of learning word can be met by the student respondents if they will be meeting people who were born that time or were influenced by people who have lived that time.

Where did the respondents learn the on – trend – words?

WHERE?	YES	%	NO	%
Family	7	28	17	68
Neighborhood	19	76	5	20
Friends	24	96	1	4
Classmates	24	96	1	4
Teachers	10	40	15	60
Social Media	24	96	1	4
Video Clips	22	88	3	12
Television Shows	24	96	1	4
Movies	24	96	1	4
Advertisements	21	84	4	16

Based on the table above, friends, classmates, television shows, and movies are the ones that influence them to learn the on – trend words.

According to theladders.com, a friend is a person whom we spend our time to at least 50 hours for casual friend and 90 hours for a real friend. This figures are enough to influence someone in his/ her language development.

It is also no wonder why social media was also ranked as first in influencing word development of the student respondents because last 2017, Filipinos spent three hours and 57 minutes per day on social media platform in 2017, the highest in the world. What they read, hear and watch in social media can be adapted by the student respondents. This is supported by the CPH.

Movies and television shows today especially the domestic ones comply with the generation Z's language thus, they often use such irregular terms in their shows. On average, people spend four hours and four minutes watching television per day and 30 minutes via DVR (NY Times).

However, the results show that family is the most uninfluential in terms of word acquisition.

This result opposes the findings of Engle (2004) that family is influential to the language development of the child. Moreover, this result is in conflict with Tamis – LeMonda, et al. (2009) who highlighted that children's experiences at home (i.e. learning activities, parenting quality and learning materials) are critical to early language growth and learning.

Reasons of preferring on – trend – words.

STATEMENT	WEIGHTED MEAN	RANK	VI

I use on – trend words because I feel that I'm "in" whenever I use them.	2.12	3	Slightly
I use on – trend words because I think I will be more understandable by doing such.	2.28	1	Slightly
I think the on-trend words exist from the time that I was born.	1.44	8	Not at all
On-trend words are my keys in connecting to other people.	2.04	4	Slightly
I use on – trend words because they are being used in media such as in movies, songs, and the likes.	2.2	2	Slightly
Whenever I use on – trend words, I perceive myself as "cool".	1.56	7	Not at all
I use on – trend words because accepted languages are "baduy".	1.36	9	Not at all
On-trend words are better than accepted words thus I use them.	1.68	6	Not at all
I am used with accepted language thus I prefer on – trend words.	2.12	3	Slightly
I use on – trend words for me to try something new.	1.72	5	Not at all
Mean	1.852		

Based on the results, the main reason why the student respondents use such words is for them to be understood by the person that they are communicating with, at least slightly; to be "in" or considered as "updated"; to be "connected" to other people; to comply with the standards of media resources; and wants to try something new since they were used to accepted language. These however, were verbally interpreted as "slightly".

It can be noticed on the results that the responds of the respondents are more onto "connection – compliance" which is one of the purposes of communication.

Relationship of word preference to the VKS results

Descriptive Statistics			
	Mean	Std. Deviation	N
VKS Results	3.0457	.56891	14

Preference	1.8520	.33786	10

Correlations			
		VKS Results	Preference
VKS Results	Pearson Correlation	1	.439
	Sig. (1-tailed)		.102
	N	14	10
Preference	Pearson Correlation	.439	1
	Sig. (1-tailed)	.102	
	N	10	10

Based on the table above, since sig is .102, it can be drawn that there is no significant relationship between the word preference and the vocabulary awareness of the students.

Thus, being aware in an on – trend word does not need someone to be interested about that word.

Relationship Between VKS Results and the Sex of the Students

Descriptive Statistics			
	Mean	Std. Deviation	N
Sex	17.5000	2.12132	2
VKS Results	3.0457	.56891	14

Correlations		
	VAR00001	VAR00002

VAR00001	Pearson Correlation	1	-1.000**
	Sig. (2-tailed)		.
	N	2	2
VAR00002	Pearson Correlation	-1.000**	1
	Sig. (2-tailed)	.	
	N	2	14
**. Correlation is significant at the 0.01 level (2-tailed).			

The table above determines if the sex of the students has something to do with their vocabulary awareness. Based on the results, the sex of the respondents has an effect to their vocabulary awareness.

It can be drawn that the sex of someone has an effect to his/ her awareness of on – trend words.

Relationship between the Age of the Respondents to their VKS Results

Descriptive Statistics			
	Mean	Std. Deviation	N
VAR00001	8.3333	7.02377	3
VAR00002	3.0457	.56891	14

Correlations			
		VAR00001	VAR00002
VAR00001	Pearson Correlation	1	.966
	Sig. (2-tailed)		.166
	N	3	3
VAR00002	Pearson Correlation	.966	1
	Sig. (2-tailed)	.166	
	N	3	14

The table above shows the relationship of the age of the respondents to their VKS results.

Based on the results, the significance level is .166, indicating that there is a no significant relationship between the age of the respondents and their VKS results.

SUMMARY, CONLUSIONS AND RECOMMENDATIONS

This chapter presents the summaries of the results of the research, the conclusions drawn and the recommendations of this research.

Summary

The summary of the research findings are the following:

- The respondents of the study are ranging from 10 to 12 years old.
- Majority are female respondents.
- The words *basta, kilig, petmalu, lodi, bes, gigil,* and *werpa* were the mastered words of the students.
- Student respondents' friends, classmates, television shows, and movies influenced them the most in acquiring the on – trend words.
- There is no significant relationship between the word preference of the respondents to their vocabulary awareness
- There is a significant relationship between the sex of the respondents to their vocabulary awareness.
- The age of the respondents has no significant relationship with their vocabulary awareness.

Conclusions

Using the data gathered, the following conclusions were drawn:

- That the age of the respondents are ranging from 10 to 12 years old. The respondents are in the entry – level of the Critical Period Hypothesis.
- The sex of the majority of the respondents is female which can be considered as a factor in learning the language.
- On – trend words have no definite equivalence in the English language.
- On – trend words' meanings depend on the operational use of the person who is using the language.

- The results oppose some of the established researches in language acquisition.
- The respondents acquired the on – trend words outside their inner circle.
- The respondents prefers on – trend words for them to be connected.
- Word preference has no effect in one's awareness of on – trend words.
- Sex plays a role in making oneself aware of an on – trend word.
- Age does not have an impact to one's vocabulary awareness.

Recommendations

Armed with the findings and conclusions of this study, the following recommendations may be considered:

- Conduct this research to a bigger number of population for a more reliable results.
- Cite more studies about sex of an individual as an influence in acquiring on – trend words.
- Determine the stable of meanings of the on – trend words.
- Make researches that are related to this study to further enhance the results found by this research.

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Appendix A - Questionnaire

Name (optional): _____

Grade and Section (optional): _____

I. PROFILE

Direction: Check (√) the circle that corresponds to your answer:

1. **Age**

   ○ 9 years old

   ○ 10 years old

   ○ 11 years old

   ○ 12 years old

   ○ Others. Please specify: _____

2. **Sex**

   ○ Male

   ○ Female

II. VOCABULARY KNOWLEDGE SCALE *(adapted from Wesche and Paribakht (1996) used by Brown (2008))*

Direction: Below is the Vocabulary Knowledge Scale. It determines if you are familiar with the given words and if presumably, you are familiar with the word: to what extent? Check (√) the column that corresponds to your answer.

A = I know this word/ phrase means and I can use it in a sentence.
B = I know what this word/ phrase means, but I am not sure how to use it.
C = I've seen this word/ phrase before, but I don't know what it means.
D = I've never seen this word/ phrase before.

Words	A	B	C	D
Kilig				
Gigil				
Susmariosep				
Nyek				
Charot				
Chibog				
Jowa				
Basta				
Lodi				
Petmalu				
Werpa				
Mumshie				
Bes				
Chika				

III. WORD ACQUISITION

Direction: This part of the questionnaire seeks to determine how you acquired the words in part II. Check (√) the column that corresponds to your answer.

How did you acquire/ adapt the words in Part II of this questionnaire?	Yes	No
Family		
Neighborhood		
Friends		

Classmates		
Teachers		
Social Media (Facebook, Instagram, and the likes.)		
Video clips (usually found in Youtube)		
Television shows		
Movies		
Advertisements		

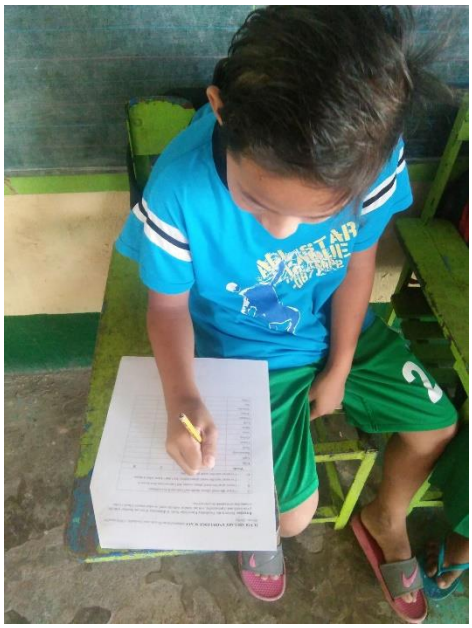
IV. WHY DO YOU USE ON – TREND WORDS?

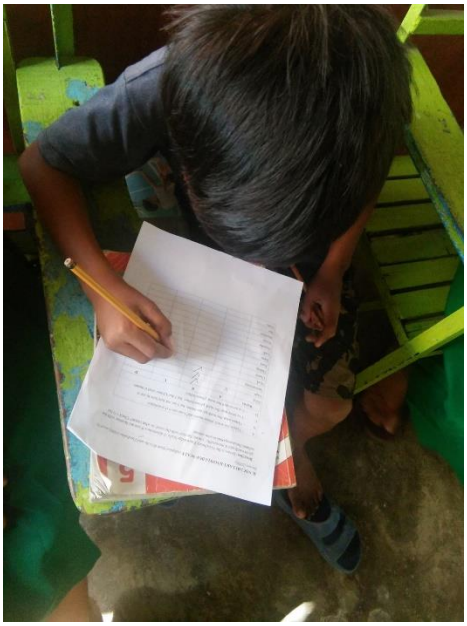
Direction: Check (√) the column that corresponds to your answer.

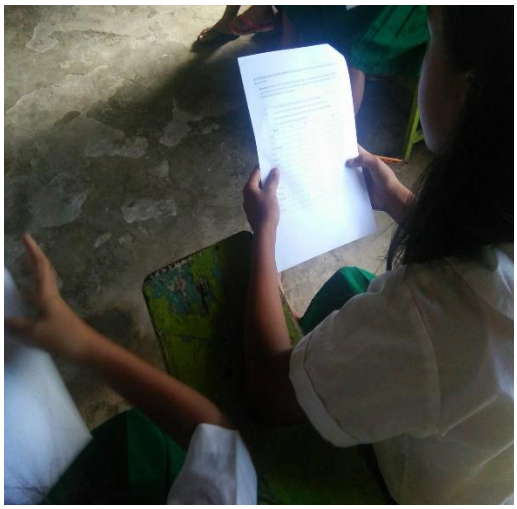
Statement	**1 (Not at all)**	**2 (Slightly)**	**3 (Moderate)**	**4 (Very)**	**5 (Extremely)**
1. I use on – trend words because I feel that I'm "in" whenever I use them.					
2. I use on – trend words because I think I will be more understandable by doing such.					
3. I think the on-trend words exist from the time that I was born.					
4. On-trend words are my keys in connecting to other people.					
5. I use on – trend words because they are being used in media such as in movies, songs, and the likes.					
6. Whenever I use on – trend words, I perceive myself as "cool".					

7. I use on – trend words because accepted languages are “baduy”.					
8. On-trend words are better than accepted words thus I use them.					
9. I am used with accepted language thus I prefer on – trend words.					
10. I use on – trend words for me to try something new.					

Appendix B – Documentations







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Parametric Study of Engine Operation on Petrol and Liquefied Petroleum Gas

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Abstract

This study expounds on useful parameters for engine tests in the case of a single-cylinder, four-stroke, spark-ignition engine. Deviations from desired operation standards and the resulting losses provide reasons for the study and analysis of those parameters. Knowledge obtained from such studies is useful in planning for improvements and better utilisation of fuels – petrol and liquefied petroleum gas, (LPG) in this case.

The set-up of the experiment consisted of an engine system, coupled to a hydraulic dynamometer, and connected to a versatile data acquisition system, (VDAS). LPG operation was achieved through an improvised system to introduce it to the test engine. Gaseous fuels are considered as less polluting and are regarded to as clean fuels. The engine was run at different speeds and varying loads. Performance parameters namely, torque, air mass flow rate, power, exhaust gas temperature, brake mean effective pressure and volumetric efficiency were recorded.

Tabulation and graphical representation of parametric values was done. At speeds below 2400 rpm, petrol exhibited superior performance characteristics; while beyond this speed, LPG's performance characteristics proved better.

Key words: LPG, Petrol, SI Engine, VDAS

Introduction

Ideally, engines should operate at maximum thermal and volumetric efficiencies, with minimum mass fuel consumption, and with reduced specific fuel consumption while at the same time producing greater power output and lesser emissions.

In reality, these ideals are not always met because of several contributing factors like fuel quality, adverse ambient operating conditions e.g. extremely cold climatic conditions, engine structure, frictional losses, heat losses due to cooling etc.

As a consequence, the engine operation may exhibit unfavourable characteristics such as: more fuel consumption, incomplete combustion, production of less brake power and hydrocarbon, (HC) and NO_X concentrations beyond legal emission limits. This poses a greater threat to the environment and also leads to higher operation costs.

To counter these obstacles, and to reduce effects of wear and tear thus increasing engine life; research has been carried out extensively, to look into the possibility of using alternative fuels in running internal combustion engines. One such fuel is Liquefied Petroleum Gas (LPG) which can be used to operate a petrol-fuelled Spark Ignition (SI) engine.

This study analysed data from a spark ignition engine under both LPG and petrol operations and a comparison was made. Four stroke, single cylinder Otto engines can be used widely in farms in rural parts of Kenya to carry out useful tasks such as running reciprocating pumps for irrigation and water storage in tanks positioned at any practical height above the ground. These engines may also be used to run the rotor of a generator and provide electricity for lighting.

This project seeks to improve on the utilization of LPG which is mainly used for cooking locally and globally. As well as providing users of LPG with an understanding of the fuel consumption behaviour of the engine at various loading conditions, this study will also give an insight on other parameters of the LPG-fuelled engine e.g. efficiency and the power output.

Since LPG is easily available and at an affordable cost, the analysis also targets to cut on the fuel costs incurred in running these engines. The findings of this study should aid in maintenance hence increase the engine life in both petrol and LPG fuel operations. In summary, the users of petrol and LPG fuels should be able to make better informed decisions.

Finally, this study provides a foundation upon which improvements can be made on petrol and LPG engine operations. If found that LPG performs better than Petrol, LPG usage can be promoted by policy makers in the country as its properties also point to reduced emission.

Set-Up

The major components of the setup were:
- Engine
- Hydraulic dynamometer
- VDAS software
- VDAS display module
- Fuel tank
- LPG Cylinder

1.1 Engine

The base engine for this experiment was TD201 Four-Stroke Petrol Engine, a small modern engine, specifically adopted for use with TecQuipment's TD200 Small Engine Test set.

Table 0.1 - Technical details of the engine

Item	**Specifications**
Dimensions (when fitted to Base Plate)	Width 400 mm, height 400 mm, depth 300 mm
Net weight (with base plate)	20 kg
Fuel type	Unleaded Petrol (Gasoline) LPG
Fuel tank	Red-painted steel with vents and a filler cap
Exhaust outlet	Normally 1"BSP
Ignition system	Electric
Absolute Maximum Power	4.4 kw (6hp) at 4000 rpm.
Bore	67 mm
Stroke/Crank Radius	49 mm/24.5 mm
Connecting Rod length	85 mm
Engine Capacity	172cc or 172 cm^3
Compression Ratio	8.5:1
Oil type*	SAE20, SAE30 or Multigrade 10W-30
Oil Capacity	0.65 litres
LPG	2.74 kPa
Tubes	Flexible plastic able to withstand 30 bar
Gas cylinder	4.5 kg, steel vessel , pressure 30 bar

1.2 Hydraulic dynamometer

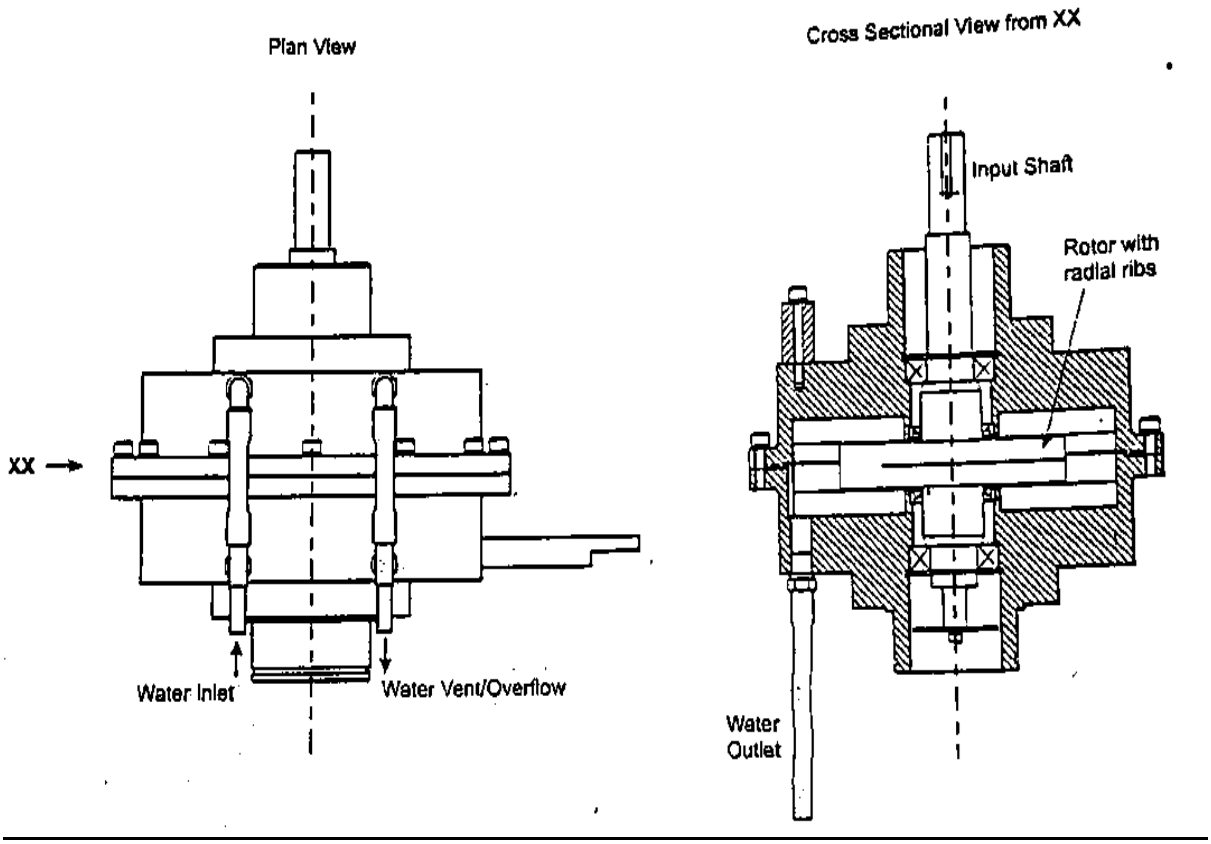

Figure 0.1 - Hydraulic dynamometer

A trunnion-mounted hydraulic dynamometer was fixed on the test bed. Load applied depended on water flow rate and the level of water in the dynamometer casing. The flow rate was controlled by an accurate needle valve.

Torque was measured by means of an electric load cell on the side of the Dynamometer.

A proximity sensor measured the dynamometer's speed of rotation.

When the rotor was turned by the engine, the ribs on the casing and rotor were caused to churn. This gave a resistive torque which was measured by the load cell. The amount of resistance varied with changes in water flow rate and the height of water in the casing.

Control of dynamometer load was indirect by means of a needle valve at the water inlet. Load control was an open loop system.

1.3 Versatile Data Acquisition System (VDAS)

The TecQuipment VDAS (Versatile Data Acquisition System) is an excellent software for use with many TecQuipment's products.

The software did the following:

- Display real time data on an analogue meter or in a digital format.
- Log data for printing or for viewing later.
- Export data as HTML format for use by another computer software.
- Perform real-time calculations on data to generate user-defined data.
- Use data to create and print data charts and data tables.
- Record data automatically or with some manual input.

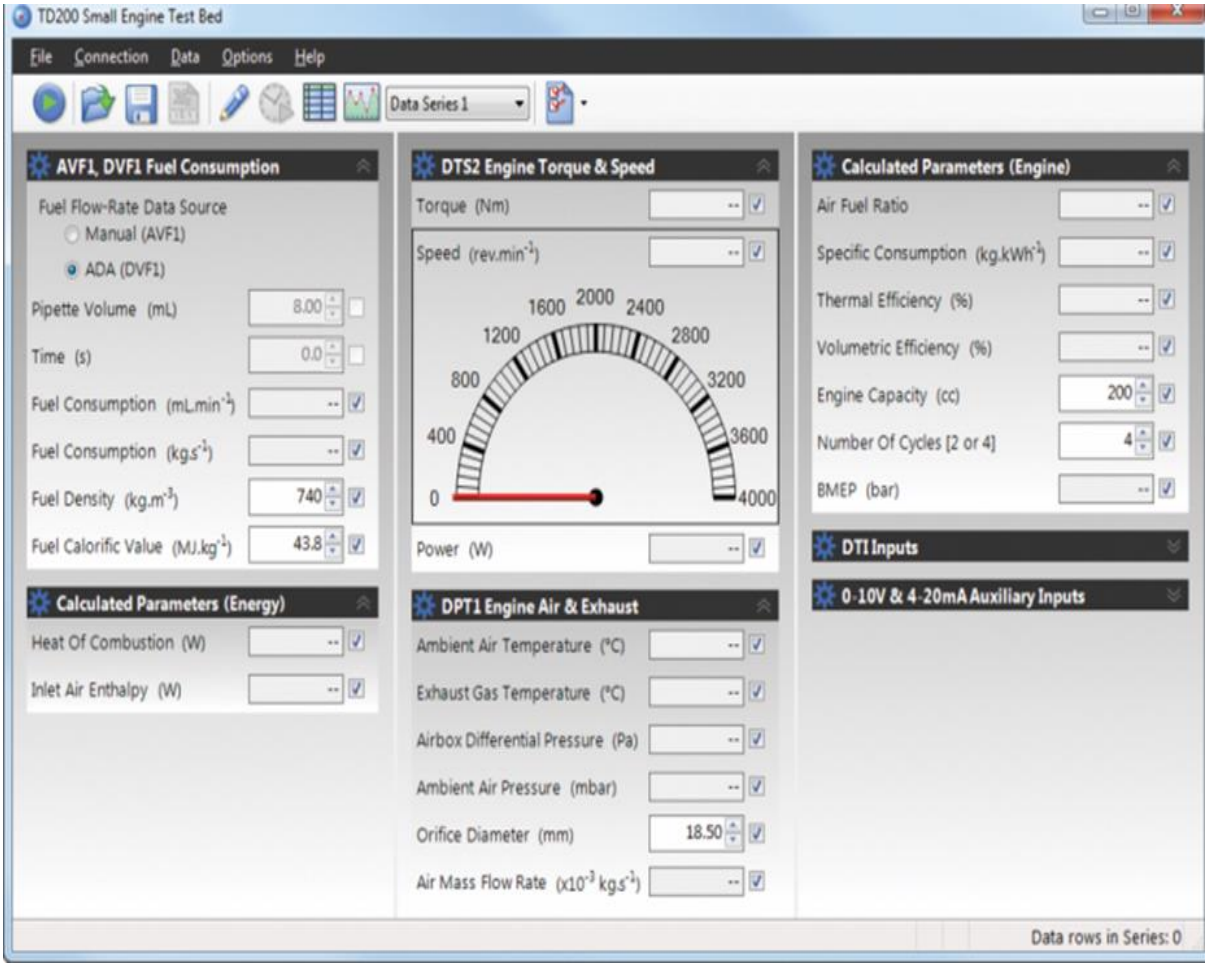

Figure 0.2 - VDAS software display

1.4 LPG injection system

LPG was stored under high pressure: as a liquid in a steel cylinder. Since LPG boils at a temperature of -42°C and a pressure of zero, it drew heat from the steel walls of the gas cylinder. The walls of the gas cylinder drew heat from ambient air.

LPG boiled and turned to gas when some pressure was released by turning on gas consumption. This process is called vaporization. It caused the gas cylinder temperature to reduce.

Once the LPG had vaporized and released via the control valve on the cylinder outlet, it flowed along a tube strong enough to withstand high pressure (30 bar) and into a flow-meter. The flow-meter was held perpendicular to the horizontal. It had a light ball which was raised through a certain height depending on the amount of gas flowing across it.

The position of the ball indicated gas flow rate from the LPG cylinder. Flow rate variation at the cylinder outlet had a direct effect on engine parameters, the rate of LPG consumption included. From the flow-meter, gas flowed into the carburettor where it mixed with air from the air box at the venturi throat, then, flowed into the manifold before finally being injected into the combustion chamber.

Methodology

1.5 Data collection for petrol

The TecQuipment VDAS Software was set to run after the engine was started. At the interface, a connection to the panel was created to enable data input to the monitor. This had to be repeated for each successive data series to be recorded.

The data could be captured manually or automatically by a timed data acquisition system within the software.

For automatic timed data acquisition, the time interval between data capturing as well as the number of readings desired were specified. Data acquisition would then be prompted by clicking “start” and this would stop after the final reading had been taken.

The downside of this method was that the software took no note of inconsistencies that arose during engine operation, and therefore, values recorded this way at times proved inconsistent.

For the manual data acquisition system, the user was able to record data values at no specified time interval. The manual system was preferred over automatic timed data acquisition as it allowed engine behaviour to be monitored and data values would then be captured when the engine was running smoothly and in a stable manner.

Upon starting the engine, the choke and the throttle were held at fixed positions. The engine speed was varied by allowing different amounts of load to pass through the inlet valve and reach the hydraulic dynamometer.

Readings for engine speed were taken by directly observing the values on the VDAS panel or by sticking a reflective marker on the coupling between the engine shaft and the dynamometer shaft and using a photo tachometer to measure the speed. The tachometer readings and the VDAS panel readings showed negligible deviations from each other.

At a specific load, three sets of data series were captured and the mean value of each recorded parameter was calculated. An allowance of +50 or -50 to the rpm readings was permitted at every speed and load conditions.

Fuel consumption was displayed on the frame-mounted VDAS panel as the engine was fitted with sensors that monitor the same. However, on the frame was also a pipette that allowed fuel consumption to be monitored manually by observing and timing using a stopwatch, the period it took to empty 8 ml, 16 ml or 24 ml of petrol from the pipette. The amount emptied would then be divided by the time period between two successive fuel refills of the pipette to find the rate of consumption.

Exhaust gas temperature was measured by an exhaust thermocouple and was displayed on the VDAS panel. However, for ambient temperature: both manual measurements using a mercury-in-glass thermometer, as well as the automatic method of using a thermocouple; were used interchangeably as they showed negligible deviation from each other.

The engine had a modified cylinder head and crank to allow usage with a cylinder head pressure transducer and a crank angle encoder. The pressure transducer gave values for in-cylinder pressure while the crank angle analyser was connected to the Engine Cycle Analyser (ECA100 software) to display crank position during each cycle.

Also, air pressure differential was displayed on the frame-mounted panel but manual recording of this was also possible by using a manometer linked to the airbox by a pipe on one end while the other end was open to atmospheric pressure. The resulting head was in inches of water.

From the formula;

$$\Delta p = H_w \cdot \rho_w \cdot g$$

Where; Δp – *Pressure differential*
H_w – *Head in metres (1 inch = 0.0254m)*
ρ_w – *Density of water in* $kg.m^{-3}$
g – *Gravity constant*

the pressure differential was calculated and was found to be similar to that displayed on the VDAS panel.

Parameters such as torque could be taken directly from the readings whereas other parameters like air mass flow rate were derived from the readings taken, through calculations. Manual calculations yielded results similar to that of the software e.g. for air mass flow rate, which was calculated from differential pressure, Δp, the findings are shown below.

Applying the formula:

$$\dot{m}_a = C_d \frac{\pi d^2}{4} \sqrt{\frac{2 p_A \Delta p}{R T_A}}$$

and the operating conditions were such that:

$C_d = 0.6$
$d = 0.0185m$
$p_A = 832\ mbar$
$R = 287\ J.kg^{-1}K$
$T_A = 299.5\ K$

At 2145 rpm

$$\dot{m}_a = 0.6\times\frac{\pi\times0.0185\times0.0185}{4}\sqrt{\frac{2\times83200\times68}{287\times299.5}} = 1.85\times10^{-3}\ kg.s^{-1}$$

At 2450 rpm

$$\dot{m}_a = 0.6\times\frac{\pi\times0.0185\times0.0185}{4}\sqrt{\frac{2\times83200\times90}{287\times299.5}} = 2.13\times10^{-3}\ kg.s^{-1}$$

At 2761 rpm

$$\dot{m}_a = 0.6\times\frac{\pi\times0.0185\times0.0185}{4}\sqrt{\frac{2\times83200\times115}{287\times299.5}} = 2.41\times10^{-3}\ kg.s^{-1}$$

At 3032 rpm

$$\dot{m}_a = 0.6\times\frac{\pi\times0.0185\times0.0185}{4}\sqrt{\frac{2\times83200\times139}{287\times299.5}} = 2.65\times10^{-3}\ kg.s^{-1}$$

At 3327 rpm

$$\dot{m}_a = 0.6\times\frac{\pi\times0.0185\times0.0185}{4}\sqrt{\frac{2\times83200\times165}{287\times299.5}} = 2.88\times10^{-3}\ kg.s^{-1}$$

At 3627 rpm

$$\dot{m}_a = 0.6\times\frac{\pi\times0.0185\times0.0185}{4}\sqrt{\frac{2\times83200\times179}{287\times299.5}} = 3.00\times10^{-3}\ kg.s^{-1}$$

Table 0.1 - Air mass flow rate indicated by the VDAS software

Speed (rpm)	**Δp (Pa)**	**$\dot{m}_a$ (× 10^{-3} kg.s^{-1})**
2145	-68	1.85
2450	-90	2.13
2761	-115	2.41
3032	-139	2.65
3327	-165	2.88
3627	-179	3.00

The air mass flow rate obtained from manual calculations tallied with that indicated by the VDAS Software.

1.6 Data collection for LPG

Data collection for LPG was similar to that of petrol in the sense that the choke and throttle were maintained at a fixed position. Engine speed variation was possible in two different ways. Firstly, by adjusting load at the dynamometer where more resistive torque resulted in reduced engine speed and vice versa: and secondly, by varying the amount of gas flowing through the LPG cylinder outlet, through the flow meter and into the carburettor.

Engine speed readings from the VDAS panel and tachometer were used interchangeably as they differed only slightly.

Connections between the engine, the panel and the computer were alike to that used in recording data for petrol. The steps taken in capturing data with the computer were repeated with the option of using automatic timed data acquisition or going the manual way. The manual method was preferred.

Again, three sets of data series were captured at each speed and the average value calculated for each parameter at that speed.

LPG flowing from the storage cylinder was measured in Standard Cubic Feet per Hour (SFCH) by an air flow meter. An assumption was made: that one hundred percent of the gas flowing across the air flow meter was used up in the engine combustion process.

Exhaust gas temperature was measured by an exhaust thermocouple while ambient temperature was measured by means of a thermocouple or manually by a mercury-in-glass thermometer.

The in-cylinder pressure and crank position were obtained from the cylinder head pressure transducer and crank angle encoder respectively: as was the case with petrol.

Air mass flow rate readings were taken from the VDAS computer program, as well as being calculated manually, from air pressure differential readings. The procedure followed here was similar to that used in petrol analysis.

Torque and power readings were taken directly from the computer.

A comparison was made between the values of air mass flow rate recorded by the computer and that found by manual calculation.

Applying the formula:

$$\dot{m}_a = C_d \frac{\pi d^2}{4} \sqrt{\frac{2 p_A \Delta p}{R T_A}}$$

and the operating conditions were such that:

$C_d = 0.6$
$d = 0.0185m$
$p_A = 833\ mbar$
$R = 287\ J.kg^{-1}K$
$T_A = 300.1\ K$

At 2106 rpm

$$\dot{m}_a = 0.6 \times \frac{\pi \times 0.0185 \times 0.0185}{4} \sqrt{\frac{2 \times 83300 \times 65}{287 \times 300.1}} = 1.81 \times 10^{-3}\ kg.s^{-1}$$

At 2412 rpm

$$\dot{m}_a = 0.6 \times \frac{\pi \times 0.0185 \times 0.0185}{4} \sqrt{\frac{2 \times 83300 \times 74}{287 \times 300.1}} = 1.93 \times 10^{-3}\ kg.s^{-1}$$

At 2712 rpm

$$\dot{m}_a = 0.6 \times \frac{\pi \times 0.0185 \times 0.0185}{4} \sqrt{\frac{2 \times 83300 \times 104}{287 \times 300.1}} = 2.29 \times 10^{-3}\ kg.s^{-1}$$

At 3012 rpm

$$\dot{m}_a = 0.6 \times \frac{\pi \times 0.0185 \times 0.0185}{4} \sqrt{\frac{2 \times 83300 \times 133}{287 \times 300.1}} = 2.59 \times 10^{-3}\ kg.s^{-1}$$

At 3310 rpm

$$\dot{m}_a = 0.6 \times \frac{\pi \times 0.0185 \times 0.0185}{4} \sqrt{\frac{2 \times 83300 \times 149}{287 \times 300.1}} = 2.74 \times 10^{-3}\ kg.s^{-1}$$

At 3607 rpm

$$\dot{m}_a = 0.6 \times \frac{\pi \times 0.0185 \times 0.0185}{4} \sqrt{\frac{2 \times 83300 \times 165}{287 \times 300.1}} = 2.88 \times 10^{-3}\ kg.s^{-1}$$

Table 0.2 - Air mass flow rate indicated by the VDAS software

Speed (rpm)	Δp (Pa)	$\dot{m}_a$ (× 10^{-3} kg.s^{-1})
2106	-65	1.81
2412	-74	1.93
2712	-104	2.29
3012	-133	2.59
3310	-149	2.74
3607	-165	2.88

Values from the computer and that obtained from manual calculations matched.

Results & Discussion

Experimental results obtained from the tests conducted provided a basis for parametric analysis.

Table 0.1 - Readings for petrol

Speed (rpm)	**Torque** (N.m)	**Power** (W)	**BMEP** (bar	**Volumetric Efficiency** (%)	**Air Mass Flow Rate** (x10^{-3} kg/s)	**Exhaust Gas Temp.** (°C)
2145	7.4	1677	4.67	53.36	1.85	496
2450	7.3	1886	4.62	53.92	2.13	539
2761	6.1	1770	3.84	54.05	2.41	557
3032	6.0	1926	3.81	54.12	2.65	580
3327	4.1	1424	2.66	53.72	2.88	587
3627	3.1	1161	1.92	51.41	3.00	588

Table 0.2 - Readings for LPG

Speed (rpm)	**Torque** (N.m)	**Power** (W)	**BMEP** (bar)	**Volumetric Efficiency** (%)	**Air Mass Flow Rate** (x10^{-3} kg/s)	**Exhaust Gas Temp.** (°C)
2106	6.5	1445	4.09	53.2	1.81	500
2412	7.3	1825	4.54	49.51	1.93	512
2712	7.2	2024	4.49	51.44	2.29	540
3012	7.0	2222	4.43	53.36	2.59	567
3310	6.8	2354	4.27	51.45	2.74	580
3607	6.6	2486	4.11	49.55	2.88	593

The values displayed on the tables above represent the average of three different data series with close to identical values. This was done in order to improve on the accuracy of the results obtained.

The difference in values obtained for petrol and LPG was largely due to dissimilarities in their internal properties as shown in the table below:

Table 0.3 - Properties of petrol and LPG

Properties	**Petrol**	**LPG**
Chemical Structure	C_7H_{17}/C_4 to C_{12}	C_3H_8
Molecular Weight (kg/kmol)	106.2	44
Density (kg.m^{-3})	740	550 (liquid) or 1.898 (gaseous)
Boiling Point (°C)	80 - 437	- 42
Specific Gravity	0.74	0.55 (liquid) or 0.0019 (gaseous)
Research Octane Number (RON)	96	103
Motor Octane Number (MON)	87	94
Flammability Limits (Volume % in air)	1.4 - 7.6	2.2 - 9.5
Flash Point (°C)	- 43	- 104
Auto-ignition Temperature (°C)	246	470
Flame Temperature (°C)	1954	1967
Laminar Flame Speed (m/sec)	0.3	0.38
Lower Heating Value (MJ/kg)	43.44	46.67
High Heating Value (MJ/kg)	46.53	50.15
Latent Heat of Vaporization (kJ/kg)	9.94	14.52
Energy Density (MJ/L)	34.2	26
Stoichiometric Air-Fuel-Ratio (AFR)	14.6	15.5

The values obtained from tests with petrol, were used for reference in calculating the percentage change resulting from modification to LPG. Therefore, all the increase and reductions mentioned in the discussion stand for LPG'S results with respect to that obtained from tests with petrol at the same speed.

1.7 Torque

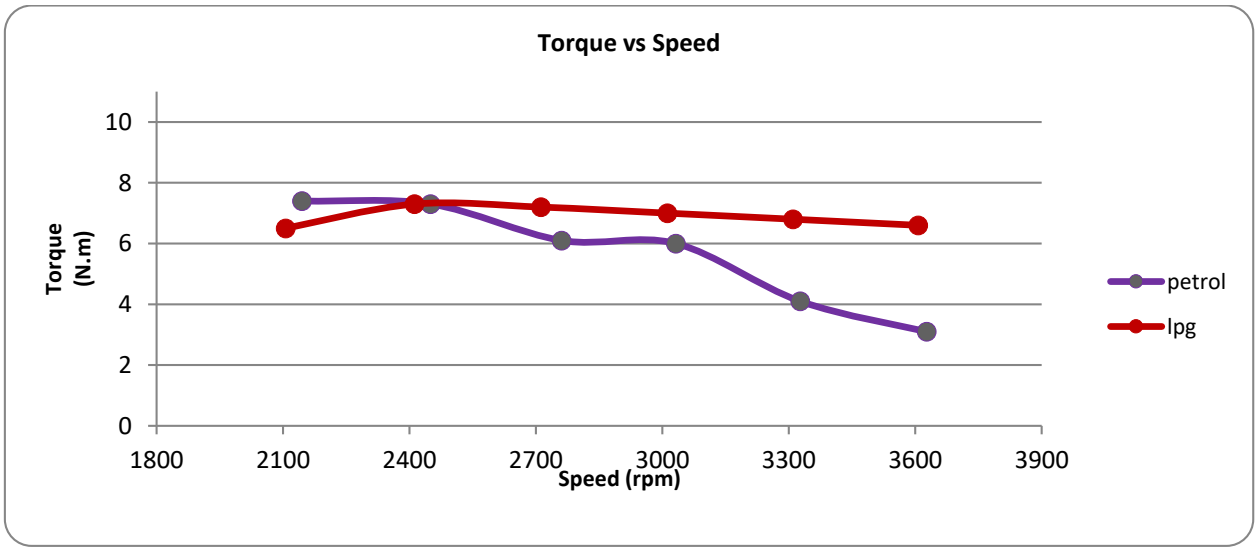

Figure 0.1 - Torque against speed

Table 0.4 - LPG's torque deviation from petrol value

Speed (rpm)	2100	2400	2700	3000	3300	3600
% Change	-12	0	18	17	66	113

LPG generated a higher torque in all the experimental speeds except at 2100 rpm and at 2400 rpm.

At 2100 rpm, torque produced was less by 12%.

At 2400 rpm, the resulting torque was same for both petrol and LPG.

As speed increased to 2700 rpm, to 3000 rpm, to 3300 rpm and to 3600 rpm; torque increased by 18%, 17%, 66% and 113% respectively.

At 2700 rpm and at 3000 rpm, the increase in torque was relatively small as compared to the very rapid increase observed at speeds beyond 3000 rpm.

At 3600 rpm, torque from LPG operation was more than double that produced from running the engine on petrol.

The engine test was carried out with both the choke and the throttle at 100% open positions.

This allowed increased airflow into the carburettor and this paved way for lean operating conditions. Under the lean conditions, LPG had a higher laminar flame speed than petrol.

Because of faster flame propagation, LPG also displayed faster fuel burning rate and shorter combustion durations as compared to petrol. As a consequence, the engine attained higher values for pressure and temperature conditions with LPG as fuel in comparison to those attained with petrol as fuel.

Again, the faster fuel burning rate and the shorter combustion durations prompted the LPG-fuelled engine to increased fuel consumption. Excess enthalpy from the higher LPG consumption further boosted the in-cylinder pressure and the in-cylinder temperature.

When compared to petrol, the higher pressure and higher temperature realised from LPG combustion yielded more power; to carry more load, hence greater torque.

1.8 Air mass flow rate

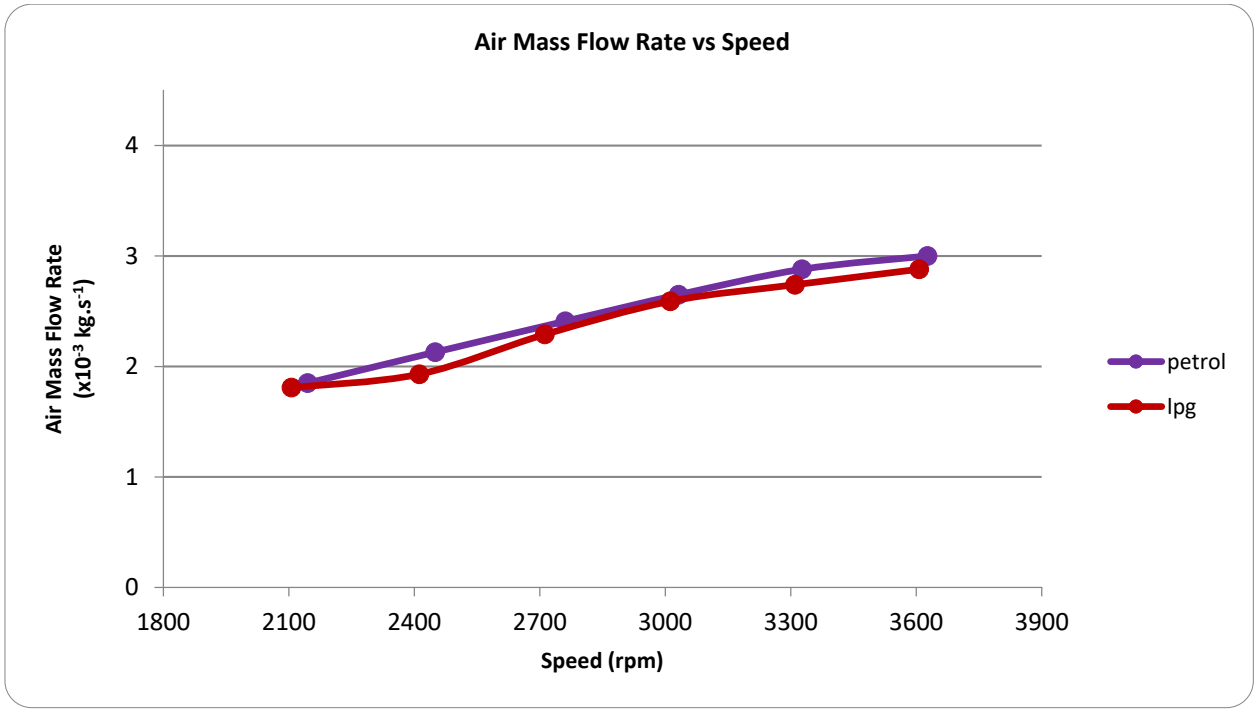

Figure 0.2 - Air mass flow rate against speed

Table 0.5 - LPG's air mass flow rate deviation from petrol value

Speed (rpm)	2100	2400	2700	3000	3300	3600
% Change	-2	-9	-5	-2	-5	-4

LPG had a lower mass flow rate in all the experimental speeds.

At 2400 rpm, the largest decrease in air mass flow rate was observed at 9% reduction.

At 2100 rpm, 2700 rpm, 3000 rpm, 3300 rpm and 3600 rpm, the percentage reduction in air mass flow rate was quite similar.

The reductions observed in LPG's air mass flow rate, were as a result of LPG displacing 15 – 20% greater volume of air as compared to petrol. This meant that a lesser volume of air was introduced into the combustion chamber during the intake stroke for LPG as compared to petrol's intake stroke. Therefore, at similar rpm's, LPG exhibited lesser air volume flow rate into the engine.

Considering that air density was constant during both engine operations and that;

$$\textit{air mass flow rate} = \textit{air density} \times \textit{air volume flow rate}$$

then LPG resulted in lesser air mass flow rate due to its lesser volume flow rate.

1.9 Power

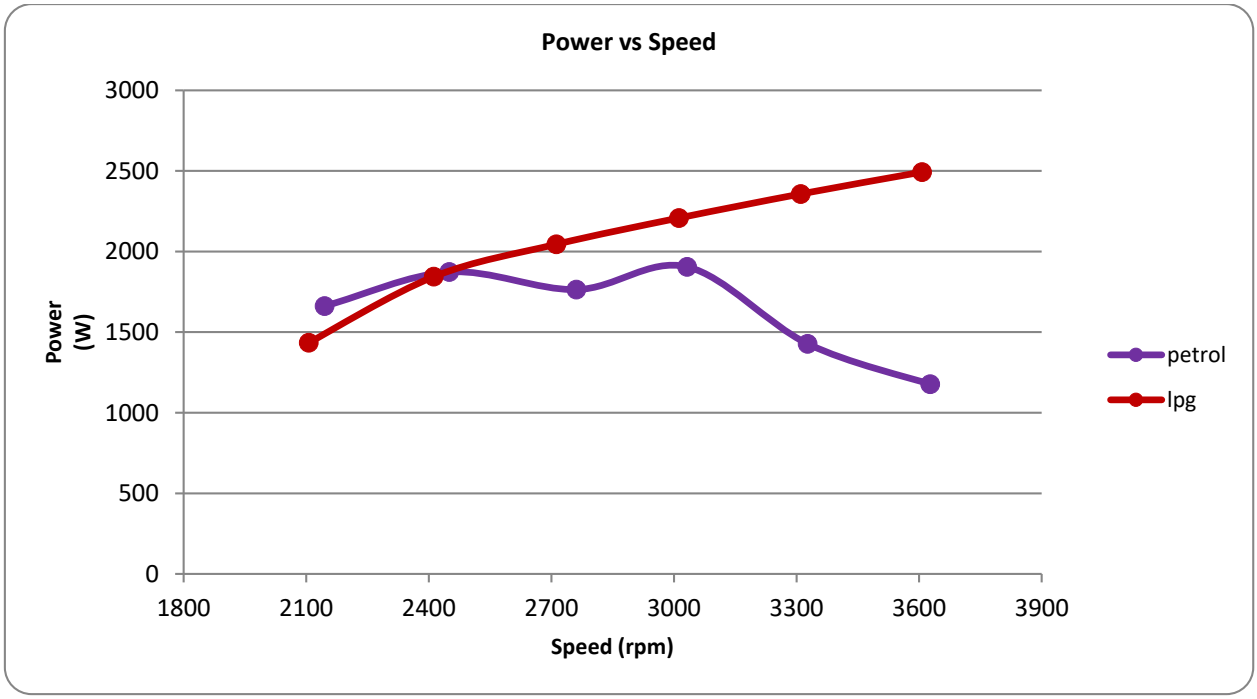

Figure 0.3 - Power against speed

Table 0.6 - LPG's power deviation from petrol value

Speed (rpm)	2100	2400	2700	3000	3300	3600
% Change	-14	-2	16	16	65	112

LPG resulted in a higher power in all the experimental speeds except at 2100 rpm and at 2400 rpm.

At 2100 rpm, power decreased by 14%.

At 2400 rpm, power output for petrol and LPG was almost equal.

As speed increased to 2700 rpm, to 3000 rpm, to 3300 rpm and to 3600 rpm; power increased by 16%, 16%, 65% and 112% respectively.

At 2700 rpm and at 3000 rpm, the increase in brake power was relatively small as compared to the increase observed at speeds of beyond 3000 rpm.

Beyond 3000 rpm, power increase was very rapid: and at 3600 rpm, power generated by LPG was more than double that produced by petrol.

Because of LPG's gaseous nature, it had improved fuel distribution throughout the combustion chamber as compared to petrol. A more uniform fuel distribution caused a more stable combustion of fuel-air mixture that led to a higher in-cylinder temperature and pressure in the LPG-fuelled engine. This, in addition to the higher heat of combustion possessed by LPG, resulted in greater power output as in-cylinder pressure was also directly proportional to brake power.

LPG's better fuel distribution and stable combustion also contributed to the smoother acceleration it showed when compared to that of petrol. This was observed in their respective power profiles where; petrol produced a sharp decline in power output at speeds beyond 3000 rpm whereas LPG exhibited a steady rise in brake power.

1.10 Exhaust gas temperature

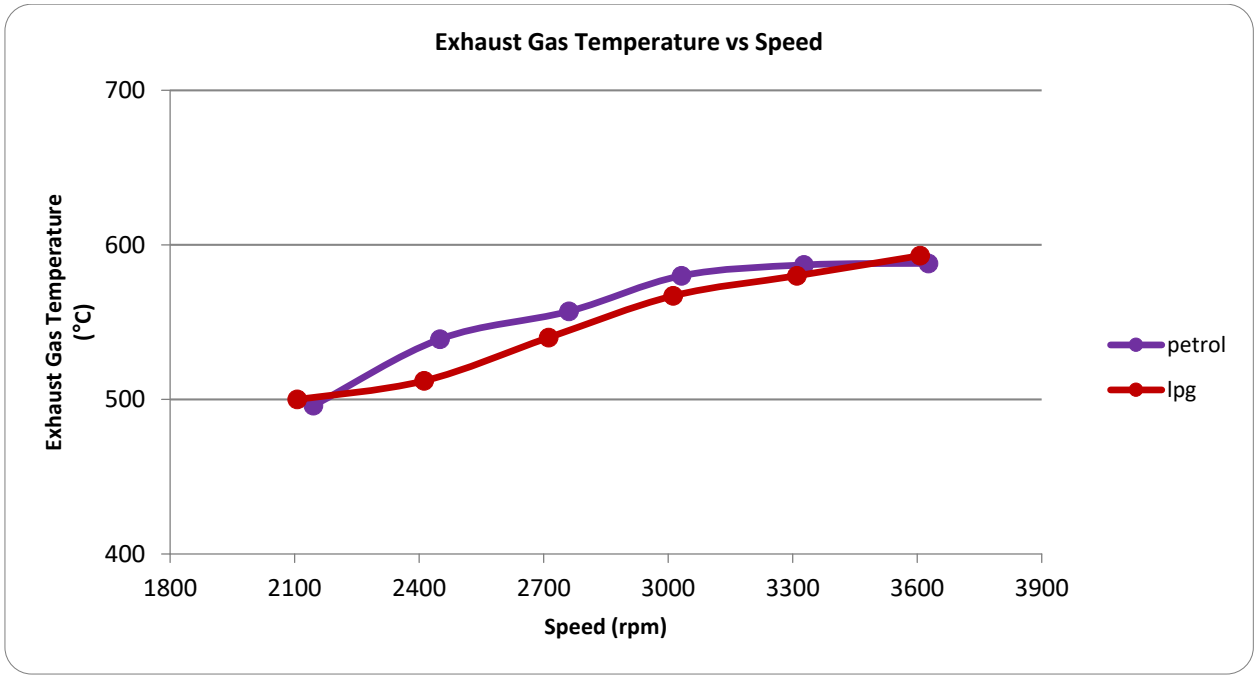

Figure 0.4 - Exhaust gas temperature against speed

Table 0.7 - LPG's exhaust gas temperature deviation from petrol value

Speed (rpm)	2100	2400	2700	3000	3300	3600
% Change	1	-5	-3	-2	-1	1

LPG resulted in a lower exhaust temperature in all the experimental speeds except at 2100 rpm and at 3600 rpm.

At 2100 rpm, exhaust gas temperature increased by 1%.

As speed increased to 2400 rpm, to 2700 rpm, to 3000 rpm and to 3300 rpm: exhaust gas temperature reduced by 5%, 3%, 2% and 1% respectively.

Then at 3600 rpm, the exhaust temperature increased again by 1%.

The largest decrease in exhaust temperature was at 2400 rpm.

Petrol was observed to possess a higher energy density of 34.2 MJ/L compared to LPG's energy density of 26 MJ/L.

During each intake stroke, LPG displaced 15-20% more air than petrol.

If the volume of air displaced by petrol was taken to be 'V' litres, then the maximum volume of air displaced by LPG would be '1.2V' litres.

The heat value of petrol in such a scenario would be expressed as:

$$(34.2 \times V)\ MJ = (34.2V)\ MJ$$

And the heat value of LPG would be expressed as:

$$(26 \times 1.2V)\ MJ = (31.2V)\ MJ$$

The above illustration shows that petrol combustion yielded more heat energy than LPG combustion, despite LPG having displaced a greater volume of air than petrol during the intake stroke. The higher heat energy produced from combustion of petrol gave rise to higher exhaust temperatures as compared to LPG.

Also, the air-fuel ratio could not be controlled directly in this instance of LPG introduction at the carburettor's throat. There was a possibility of oversupply of LPG that made the air-fuel mixture drawn into the combustion chamber too rich. Lesser air, which meant lesser oxygen in the combustion chamber might have led to incomplete combustion of the charge, hence lesser heat energy production and reduced maximum in-cylinder temperature.

This also, could explain the lower exhaust gas temperature recorded with LPG as fuel in comparison with that recorded with petrol as fuel.

1.11 Brake mean effective pressure (BMEP)

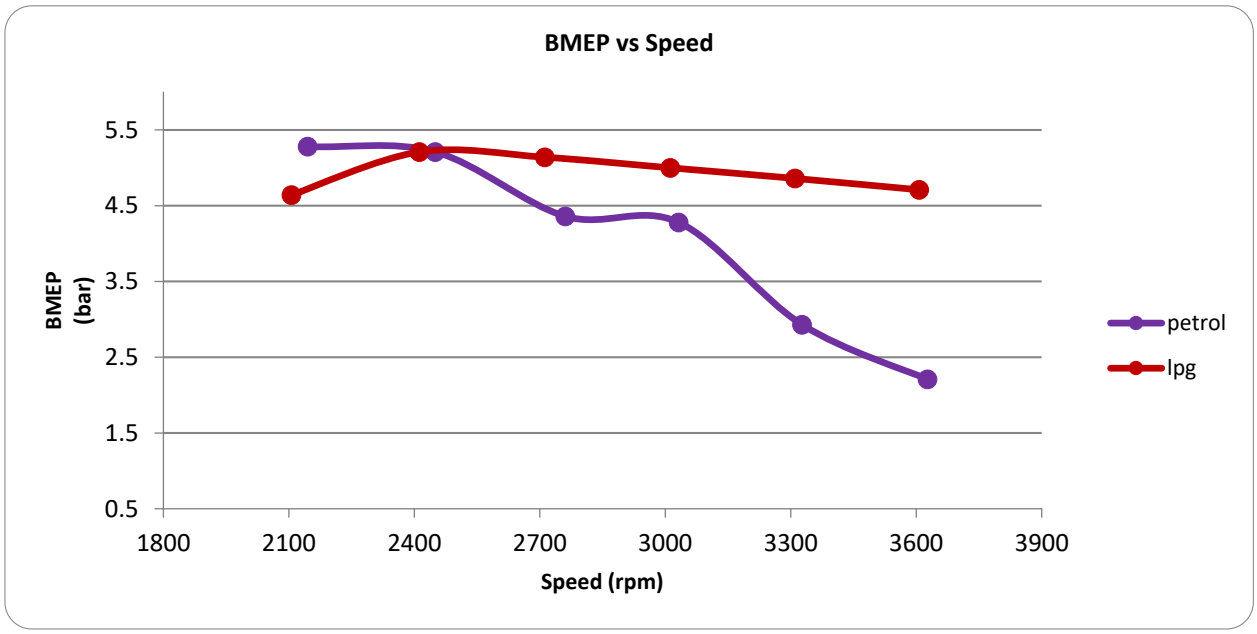

Figure 0.5 - BMEP against speed

Table 0.8 - LPG's BMEP deviation from petrol value

Speed (rpm)	2100	2400	2700	3000	3300	3600
% Change	-12	0	18	17	66	113

LPG resulted in a higher BMEP in all the experimental speeds except at 2100 rpm and at 2400 rpm.

At 2100 rpm, BMEP decreased by 12%.

At 2400 rpm, BMEP value was the same for both petrol and LPG.

As speed increased to 2700 rpm, to 3000 rpm, to 3300 rpm and to 3600 rpm; BMEP increased by 18%, 17%, 66% and 113% respectively.

At 2700 rpm and at 3000 rpm, the increase in BMEP was relatively small when compared to the increase observed at speeds exceeding 3000 rpm.

Beyond 3000 rpm, BMEP increase was very rapid: and at 3600 rpm, BMEP for LPG was more than double that of petrol.
For the case of LPG, volume of air displaced by the fuel was 15-20% greater than that displaced by petrol during suction. This resulted in a greater volume of LPG in the combustion chamber as compared to the volume of petrol in the combustion chamber. In addition to LPG having a greater volume than petrol, it also had a higher heating value of 46.67 MJ/kg compared to petrol's heating value of 43.44 MJ/kg. The outcome of this was a higher in-cylinder temperature in the case of LPG upon ignition.

The higher temperatures caused much more increased kinetic energy of molecules hitting the walls of the combustion chamber; thus giving rise to higher in-cylinder pressure in the LPG-fuelled engine.

1.12 Volumetric efficiency

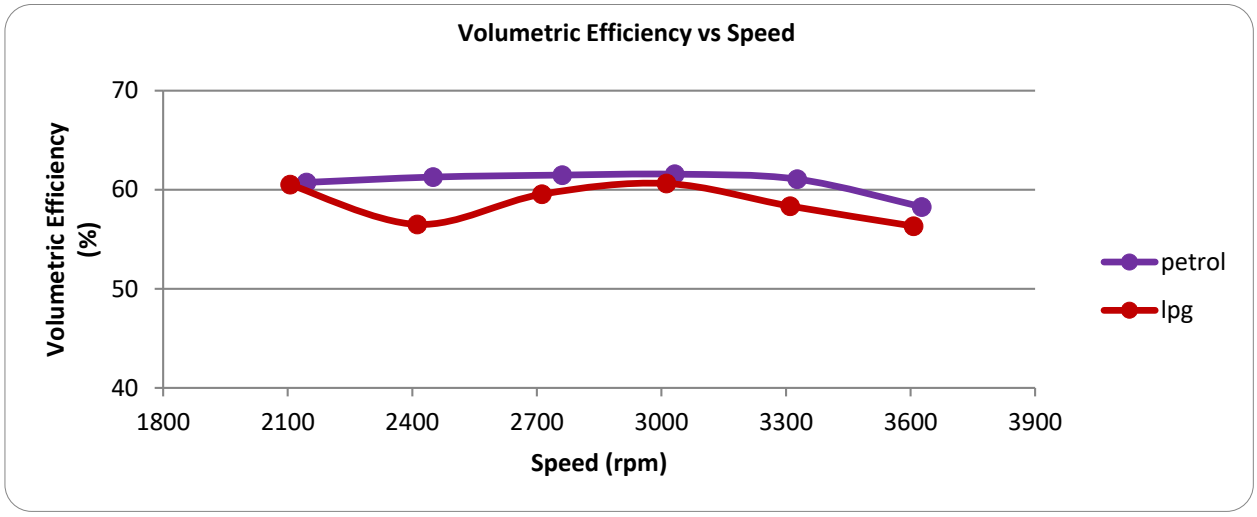

Figure 0.6 - Volumetric efficiency against speed

Table 0.9 - LPG's volumetric efficiency deviation from petrol value

Speed (rpm)	2100	2400	2700	3000	3300	3600
% Change	0	-8	-3	-2	-4	-3

LPG resulted in a lower volumetric efficiency in all the experimental speeds: only that at 2100 rpm, the reduction was so minimal, and the petrol and LPG efficiencies were very close to each other.

At 2400 rpm, the largest decrease in volumetric efficiency was observed at 8% reduction.

At 2700 rpm, 3000 rpm, 3300 rpm and 3600 rpm, the percentage reduction in volumetric efficiency was similar.

These reductions were due to absence of intake charge cooling due to vaporization. Petrol being a liquid fuel, underwent vaporization at the carburettor throat, at the throttle, at the intake manifold and at the inlet valve. The result of this vaporization was increased density of the fuel-air mixture entering the combustion chamber – an occurrence that did not take place in the case of LPG as it was already in a gaseous form.

This meant that LPG-air mixture inducted into the combustion chamber had a lower mass density as compared to petrol-air mixture taken in during a similar suction process.

Since volumetric efficiency is the ratio of the mass density of the fuel-air mixture drawn into the cylinder at ambient pressure (during intake) to the mass density of the same volume of air in the intake manifold; then LPG with its less dense charge was sure to yield lower values of volumetric efficiency in comparison with petrol.

Also, LPG being in a gaseous state at ambient pressure and temperature conditions meant that fuel occupied a larger volume in the fuel-air mixture. This caused displacement of more fresh air and a further reduction in volumetric efficiency.

Conclusion

Modern technology has proved a useful addition in the study of engine parameters. Sensors, thermocouples and the VDAS software enabled efficient data acquisition, analysis and storage with a low-level skill requirement; as evidenced by the matching results obtained from manual computation of air mass flow rate, and from the computer's calculation of the same.

Liquefied petroleum gas is a viable alternative to petrol in SI engine operations as it generated greater power and higher torque in comparison with petrol. It also exhibited higher BMEP than petrol. This study may pave the path for LPG incorporation in domestic machines such as lawnmowers and power saws.

LPG is a stable fuel as shown by its power plot which evinces a steady combustion throughout the entire experimental speed range. This contributes directly to reduced vibrations during engine operation; and from a commercial perspective, this reduces on maintenance cost.

Recommendations

For exhaust gases, only temperature was measured. It may be suggested that future investigations on petrol and LPG engine operations include emission tests; in line with the growing awareness on effects climate change.

Maximum cylinder temperature and pressure under LPG operation can damage the engine's structural components; because the engine was designed to run on petrol, which has a lower heating value as compared to LPG. It is therefore advisable that similar tests be carried out at low to moderate speeds.

In this study, petrol and LPG were investigated separately; and were both found to be useful. This should spur further research, and a look into LPG-Petrol blends; as a basis for dual fuel operation.

LPG passed the test as a useful gaseous fuel in powering SI engines. Further tests involving other gaseous fuels e.g. biogas or Compressed Natural Gas (CNG) may be encouraged to ease overreliance on petrol.

With gaseous LPG's introduction at the carburettor's throat, a decrease in volumetric efficiency was observed. A system for liquid LPG's direct injection into the intake manifold may be incorporated: as the resultant cooling effect from vaporization of LPG would increase the density of charge entering the cylinder; hence improved volumetric efficiency.

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Dermatophytoses Features in HIV/AIDS Patients at Haji Adam Malik General Hospital Medan

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***Abstract*- Introduction:** Dermatophytosis are superficial fungal infection of the hair, nail and skin. Causative organisms include fungi in the *Trichophyton, Microsporum*, dan *Epidermophyton.* Fungal infections can occur in all immune statuses, both in immunocompetents and immunocompromaise condition such as in patients with HIV/AIDS.

Objectives: To determine dermatophytosis features in HIV/AIDS Patients

Methods: It was a descriptive study with cross-sectional design which involved 32 dermatophytosis in HIV/AIDS patients from June to August 2019 at Pusyansus in H. Adam Malik General Hospital Medan. Diagnosis was made based on history, clinical examination, and a direct microscopic examination using 10%-20% KOH solution of scraping skin, hair and nails.

Results: : HIV/AIDS patients most dermatophytosis are found mostly in man 24 people (75%), in the group of age 36-45 years (40,63%), senior high school (50%), the most diagnosis is tinea pedis, level $CD4^+$ 200-400 cells/mm^3 are 14 people (43,8%). The duration of 1 – 3 years suffering from HIV/AIDS is 10 people (31,3%)

Conclusion: : Tinea pedis is the most common type of dermatophytosis found in this study, followed by tinea corporis and tinea facialis. The incidence of dermatophytosis is not significantly affected by HIV / AIDS status.

***Index Terms*-** dermatophytosis, human immunodeficiency virus, tinea pedis

I. Introduction

Human immunodeficiency virus (HIV) is a virus that attacks the body's immune system, CD4+. Acquired-immunodeficiency syndrome (AIDS) is an immunosuppressive condition (syndrome) that is closely related to various opportunistic infections, neoplasms, and certain neurogenic manifestations due to HIV infection.[1,2]

Dermatophytosis often occurs in HIV / AIDS patients where fungal growth is associated with an imbalance in the host immune system. Some fungal infections, such as dermatophytosis, give nonspecific symptoms that require a more thorough examination. Dermatophytosis which attacks the skin, nails and hair keratin, is a fungus that is often found in HIV disease.[3,4] Tinea pedis, tinea cruris, tinea corporis and onychomycosis show a prevalence rate four times higher in HIV / AIDS patients than in the normal population. The complaints and clinical features of dermatophytosis are highly variable in HIV patients.[5,6]

According to Lemak et al that the incidence of dermatophytosis in HIV patients is recorded at 15–40%.[7] The most common clinical form of this disorder is proximal subungual onychomycosis (PSO).[6,7] From the annual report in the Mycology Division of dermatovenereology department Dr. Soetomo Surabaya in 2012 found that 2.9% of dermatophytosis cases in non-HIV patients, and 3.0% of dermatophytosis cases is founded in non-HIV patients in 2013.[9]

Some predisposing factors for dermatophytosis such as hot climate, high humidity, poor hygiene, contact with animals, obesity, and immunocompromised conditions caused by HIV / AIDS, long-term use of corticosteroids, and diabetes mellitus.[10,11]

The clinical features of dermatophytosis in HIV patients is not specific, it is not always itchy, but it can spread throughout the body and often recurrent. At the AIDS stage, there is no inflammatory reaction or central clearing (tinea anergic). This situation can be the basic for knowing the clinical sign of dermatophytosis at $CD4^+$ levels at examination.

II. METHODS

This study is a descriptive study with cross-sectional design, that involved 32 HIV / AIDS patients who had been diagnosed with dermatophytosis from June 2019 to August 2019. The basic data of all patients were recorded such as patient identity, history taking, physical examination and dermatology examination by researchers at Pusyansus H. Adam Malik General Hospital Medan. Sampling of skin scrapings is done by microbiology laboratory staff of RSUP HAM.

This study has been approved by Health Research Ethics Commission of the Faculty of Medicine, Universitas Sumatera Utara/ H. Adam Malik General Hospital Medan.

III. RESULTS

Characteristics of the study subjects were the number of subjects suffering from dermatophytosis with HIV / AIDS, there 24 men (75%) and 8 women (35.0%), most in the 36-45 years age group, there 13 people (40.63%), senior high school is 16 people (50%) and self employment is 14 people (43.8%), the proportion of the duration of HIV / AIDS is 1 - 3 years, found 10 people (31.3%). $CD4^+$ T-cells counts of dermatophytosis patients with

HIV / AIDS are $CD4^+$ T-cells ranging from 200-400 cells/mm^3, there 14 people (43.8%). The most clinical type of dermatophytosis in HIV / AIDS patients is tinea pedis, found 16 people (50, 0%). (Table 1)

In this study that the clinical manifestation of dermatophytosis based on $CD4^+$ levels showed > 400 cells/mm^3 found 9 people followed by $CD4^+$ level 200-400 cells/mm^3 is 7 people in case of tinea pedis, whereas at $CD4^+$ levels <200 cells/mm^3 obtained some cases of tinea corporis dan tinea facialis are 3 people. (Table 2)

Table 1. Dermatophytoses Features in HIV/AIDS Patients

Characteristic		Number of cases	Percentage of cases
Gender	Male	24	75.0
	Female	8	35.0
Age	17 – 25 years	0	0
	26 – 35 years	9	28.13
	36 – 45 years	13	40.63
	46 – 55 years	3	9.38
	>55 years	7	21.86
Education level	Elementary school	3	9.4
	Junior highschool	7	21.9
	Senior highschool	16	50.0
	University	6	18.8
Occupation	Unemployed	1	3.1
	Civil service	4	12.5
	Office worker	3	9.4
	Self employment	14	43.8
	Farmer	4	12.5
	Housewife	6	18.7
Duration of HIV disease	< 6 months	5	15.6
	6 months – 1 year	4	12.5
	1 – 3 years	10	31.3
	3 – 5 years	8	25.0
	>5 years	5	15.6
$CD4^+$ T-lymphocyte count	< 200 cells/mm^3	9	28.1
	200-400 cells/ mm^3	14	43.8
	>400 cells/ mm^3	9	28.1
Type of Dermatofitosis	Tinea capitis	1	3.1
	Tinea corporis	5	15.6
	Tinea facialis	5	15.6
	Tinea pedis	16	50.0
	Onichomycosis	1	3.1
	Tinea corporis + Tinea pedis	1	3.1
	Tinea pedis + Onichomycosis	3	9.4

Table 2. Distribution of dermatopythoses types based on $CD4^+$ levels (n=32)

Clinical variant of dermatophytoses	$CD4^+$ T-lymphocyte count			Total
	< 200 cells/mm^3	200-400 cells/ mm^3	>400 cells/ mm^3	
Tinea capitis	0	1	0	1
Tinea corporis	3	2	0	5
Tinea facialis	3	2	0	5
Tinea pedis	0	7	9	16
Onichomycosis	1	0	0	1
Tinea corporis + Tinea pedis	1	0	0	1
Tinea pedis + Onichomycosis	1	2	0	3
Total	**9**	**14**	**9**	**32**

IV. DISCUSSION

In this study, it was found that from 32 samples of HIV / AIDS patients with dermatophytosis, there were 24 male (75%) and 8 female (35.0%).

The study of Hanum et al. at Pusyansus H. Adam Malik General Hospital found that most of superficial fungal infections patients with HIV/AIDS were male (67.1%) and female (32.9%).[12] This is according to Costa et al. found in men (61%) and women (24%).[13] Study by Kaviarasan et al. found that dermatophytosis with HIV/AIDS was 22% where male and female ratio is 3: 1.[14]
The most of HIV/AIDS patients in this study was male, in the heterosexual group and injection drug using as risk factor. This is consistent with data from the Ministry of Health of the Republic of Indonesia in 2018, where HIV/AIDS infection predominantly occurs in heterosexual and injecting drug users groups and an increase in the number of HIV/AIDS infections in the "Men having Sex with Men" group (MLM).[15]

The most subjects in this study is in the age group 36-45 years were 13 people (40.63%). Which Rosvanti et al. in Surabaya get the result that the youngest patient is 23 years old and the oldest is 38 years old with the age range of patients in 25-54 years is 5 people (100%).[6] This is consistent with data from the Ministry of Health PP&PL of the Republic of Indonesia in 2018, where HIV infection tends to increase and most occurs in the productive age group, there the age group 25-49 years (69.9%) and followed by the age group 20-24 years (15.6%).[15]

Kaviarsan et al. found that the most age group in dermatophytosis with HIV / AIDS is 21-30 years by 50%.[14]

Based on the level of education of HIV/AIDS sufferers, most are middle-high, there 16 people (50%). In accordance with the results of study conducted by Hanum in Pusyansus H. Adam Malik Hospital, most dermatophytosis sufferers at the senior high school education 57 people (78.1%) followed by elementary school education 12 people (16.4%).[12] while Rosvanti et al in Surabaya also found the most sufferers at the senior high school, 3 people (60%) and the junior high school, 2 people (40%).[6]

According to the job of patients who come for treatment, most of them work as entrepreneurs, there 14 people (43.8%). In accordance with study conducted by Hanum et al. where the most kind of job in patients with superficial fungal infections with HIV/AIDS is 29 entrepreneurs (39.7%).[12]

Rajesh et al. in India (2006) most HIV/AIDS sufferers with dermatophytosis have jobs that do not require expertise or semi expertise, followed by the work as a farmers and drivers. Women are mostly housewives so that the tendency for HIV disease can occur in all community groups.[16]

In this study that the length of suffering from HIV / AIDS with dermatophytosis is 1-3 years as many as 10 people (31.3%). Rajesh et al. get ≥ 6 months is 38 people (67.86%) and ≤6 months is 18 people (32.14%)[16] and Costa et al get ≥ 1 year (41%), ≤ 2 months (35%) and 2 months - 1 year (23%).[13]

Based on $CD4^+$ cells counts, most subjects suffered from dermatophytosis in the group of CD4 T-cells counts ranging from 200-400 cells / mm^3, is 14 people (43.8%). This is not in accordance with Rosvanti et al study of HIV/AIDS patients suffering from dermatophytosis in dr. Soetomo General hospitals, where the most subjects in the group with a $CD4^+$ T-cells count of ≤200 cells / mm^3.[6]

Gniadek et al in Brazil got CD4 T-cells results of ≤ 199 cells/mm^3 of 60 people (14.3%), followed by 200 - 499 cells/mm^3 of 35 people (10%)[17] and Zewdu et al in Ethiopia got results the highest $CD4^+$ T-cells count with a $CD4^+$ count of ≤ 200 cells/mm^3 is 11%.[18]

The pathogenic mechanisms for the occurrence of anergic, extensive or multiple lesions of dermatophytosis in HIV patients are not yet clear. Some authors hypothesized that loss of function in $CD4^+$ T lymphocytes, changes in the balance between Th1 and Th2 immune responses and damage to cellular immunity, which occur in the progression of HIV infection, could explain the occurrence of these peculiar clinical presentations. The degree of inflammation at the site of fungal infection is one of the determinants of the clinical expression, and is dependent on the predominance of humoral or cellular immune response. This hypothesis are supported by the fact that, although dermatophytosis can occur throughout the HIV infection, most of the reported cases of extensive or atypical lesions have occurred in patients with compromised immunological status, with $CD4^+$ T lymphocyte count below 100 cells/mm3 or with opportunistic diseases which characterize the AIDS stage of the HIV infection.[13]
The clinical signs of dermatophytosis with HIV/AIDS was tinea pedis, 16 people (50.0%) followed by tinea corporis and tinea pedis, each 5 people (15.6%).

Study by Ali et al in India found the most cases of dermatopythosis 42% with tinea cruris followed by tinea corporis in 18% of the cases.[19]

Study by Kaviarsan et al. get the most cases of dermatophytosis, 22 (53.7%) cases with tinea corporis, followed by tinea cruris in 18(49.9%), tinea pedis in 7 (17.1%), tinea facialis in 6 (14.7%) and 1 patient with tinea manum.[14] Whereas the study of Zewdu et al obtained the highest number of types of dermatophytosis with HIV / AIDS, is tinea capitis (19.6%), onychomycosis (23.5%), and tinea corporis (12.5%).[18]

The study by Kheira et al in Aljazair (2007) which obtained a higher frequency of dermatophytosis, is tinea pedis as much as 45.25%.[20] Moya-Salajar et al got the most results is tinea pedis as much as 70.6%.[21]

According to research reports Kumarasamy et al. there were no clinical differences in HIV patients compared to the non HIV patients.[22]

The clinical variant of dermatophytosis based on $CD4^+$ levels showed >400 cells/mm^3 found 9 people followed by $CD4^+$ levels 200-400 cells/mm^3 is 7 people in tinea pedis cases.
The study by Ali et al which obtained at the clinical materials to mycological examination, the number of $CD4^+$ varied from 100 to 1015 cells/mm^3. Patients with $CD4^+$ cell count between 200-499 dominanted. It was also found that the number of $CD4^+$ T-cells does not influence the occurrence of dermatophytosis.[19]

V. CONCLUSION

Tinea pedis is the most common type of dermatophytosis found in this study, followed by corporis tinea and facialis tinea, with a $CD4^+$ T-cells count of 200-400 cells/mm^3. The incidence of dermatophytosis was significantly unaffected by HIV / AIDS status.

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AWARENESS, UTILIZATION AND IMPACT OF VIRAL MARKETING ON THE PERFORMANCE RATE AND GLOBAL COMPETITIVENESS OF MSMEs IN SUB-URBAN AREA OF EDO STATE, (EKPOMA AND UROMI)

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Abstract

This research examined the awareness, utilization and impact of viral marketing on the performance rate and global competitiveness of MSMEs in sub-urban area of Edo State, (Ekpoma and Uromi). Three research questions were raised in this study to investigate the awareness, utilization and impact of viral marketing on the performance rate and global competitiveness of MSMEs in sub-urban area of Edo State. The study adopted the survey research design. 200 registered MSMEs were purposively selected for the study. Data were collected using person to person interview and a structured questionnaire which was developed by the researcher for the purpose of the study. The data collected were analyzed using descriptive statistics of means and simple percentages. The findings of this study revealed that awareness and utilization of viral marketing is low in the study area (36.4%), which implies impact on marketing performance was also very low. However, the advantage of viral marketing was very conspicuous among MSMEs who knew and made used of viral marketing as this brought about competitive advantage, broad customer base, larger market, varied marketing opportunities, low cost and/or even no cost advertisement rate and profit enhancement. Whatsapp, Email and Facebook were the major platforms used for viral marketing in the study area. MSMEs in the study area have very low awareness and utilization of viral marketing, the major platform for viral marketing were Whatsapp, Email and Facebook and Viral Marketing has the potential to improve and enhance business through larger market, broad customer base and profit enhancement. Recommendations made are 1. government should carryout enlightenment and sensitization campaign on viral marketing among MSMEs in the study area, 2. MSMEs should be organized into groups on social networks to attract them to the platform and 3. Policy makers should encourage MSMEs to own smart devices as part of informing technological innovations into their businesses.

Key words: Viral marketing, Awareness, Utilization, MSMEs

Introduction

In recent times, technologies have changed the traditional ways of almost everything from education to business, provoking rapid globalization, economic growth, business opportunities and promoting the ease of doing business. These advancements in technology have opened up huge opportunities for businesses to appeal to much larger markets than ever before creating and developing new companies purely working in the online area; new marketing strategies; market shifts, and therefore new customers and ways of behaving (Abed Abedniya & Sahar Sabbaghi Mahmouei, 2010).

Marketing is a management tool that focuses on identifying the needs, wants, and demands of customers and developing products to meet those needs (Neighbors, 2002). Marketing is seen as the management process involves in moving goods and services concept to the customer. (allbusiness.com) It involves the coordination of four elements identified as the 4 P's of marketing. These 4Ps include (1) identifying, selecting and developing a product, (2) determine its price, (3) choosing a distribution channel to reach the customer's, and (4) evolving and implementing a promotional method. According to Awan and Hushmi (2014) SME marketers may consider marketing as a synonym of either advertising or selling basic marketing concepts such as segmentation, targeting, positioning, customer orientation and seeking for competitive advantage apply to small as well as large ones. The onus lies on entrepreneurs to always seek avenue to improve their marketing performance, broaden their customer base and efficiently sell their products and services.

According to (Mills, 2012) Viral marketing as a term was first used by Draper, Fisher, and Jurveston in 1996. They coined it to explain Hotmail's idea of using advertising on the bottom of users' outgoing emails to advertise their free email service. This was an earliest form of Electronic-marketing strategy (E-marketing). Today, E- marketing which is a digital

marketing innovative technology used to market goods and services online by business firm and enhance performance is seamlessly blending into viral marketing.

Viral marketing is a necessity for modern day SMEs to enhance performance, improve on profitability, widen marketing scope and foster sustainability. Viral Marketing is able to provoke interest, demand attention, lure customers, promote impulsive buying and remain a potential sale promoter of any brand or product when it goes viral on the internet and invade the most popular social media, thus, rapidly spreading from person to person. Social networks have been come virtual communities without boundaries. This virtuality gives them unimaginable speed and ease to share and disenminate information almost without hindrance to unlimited number of persons by continuously adding people to their networks. The most popular and prolific in this act of sharing are YouTube, Facebook, Twitters, Wechat, Whatsapp, Palmchat and Insagram. Other channels include emails, Play Stores, Googles and IOS Markets. Sometimes, virality may be accidental, from a video uploaded by a private user (whose intention was not to market or advertise) suddenly becomes popular and spread like wild fire all around the Internet, (Cyberclick, 2019)

Small and Medium Enterprises (SMEs) are important to almost all economies in the world, especially to those in the developing countries with major employment and income distribution challenges. SMEs contributes to the creation of jobs and are nursery for the larger firms. they further averred that SMEs contribute directly and significantly to aggregate savings and investments and are involved in the development of appropriate technology for production of goods. in Nigeria, SMEs contribute significantly to economic development, and the performance and effectiveness as an instrument of economic growth and development in Nigeria has long been under investigation since 1970s (Ihua 2009).

SMEs have a big potential to bring about social and economic development, by contributing significantly in employment generation, income generation and catalyzing development in urban and rural areas (Hallberg, 2000; Olutunla, 2001; OECD, 2004; Williams, 2006; Olutunla and Obamuyi, 2008 and Chukwuemeka and Ifechukwude, (2013). Small and Medium Enterprises (SMEs), are the driving force of most economics of the world. They represent the hinge on which global economic activity hang and rotate if their performance, sustainability and growth are improved upon in developing countries like Nigeria, local entrepreneurs will inevitably achieve not only personal growth but on the overall reduce unemployment and integrate economic growth. This however depends on robust marketing of products and services created by the SMEs. It is this wise that viral marketing becomes the unavoidable option.

Factors of viral marketing

Certain factors must be in place for viral marketing to take place. These factors are the blocks which viral marketing exploits to achieve its virality goal. These factors include messenger, Message Content and the environment platform (interne/social network), Baskool (2019).

1. **Messenger-** This is the source (may be person or company) of the message. The most critical factor in viral marketing is the source (messenger). The more popular the messenger is, the higher the chances for the message to go viral. Therefore, world renown celebrities irrespective of field of popularity are the best bet to viral a message. Funny and interesting catching comics (cartoon characters) as add-ons to messages are also potentials for virality.

2. **Message content:** - Ability to create a viral content is a huge advantage in this world of "do not disturb". Thus, Attractive, attention-holding, thrilling and even humorous sensitive contents which target children have the best chances of going viral.
3. **Environment**- Environment plays a vital role in determining whether a content will go viral on not. Environment with the target market population has the higher chance of virality. Timing, campaign pattern, format type (audio, Visual, or Audio-visual). For instance, a Facebook content is likely to go more viral than an e-mail content due to ease of share.

Types of Viral Marketing

There are various types or forms of viral marketing. (Reedfloren 2019) Viz:
pass-along (comes with the instruction "Please pass to everyone on your contact"),
incentive attached (you win or get stuff for sharing) viral marketing,
gossip (unauthorized/formal/casual word of mouth from person to person) marketing,
undercover marketing (quietly popping up without serious distraction or just an add-on that looks not like marketing but passes information about a brand or product of an individual or company), **Wooing others viral marketing:** This is an organized sophisticated form of viral marketing in which users are encouraged to woo and win more members to the online community. This involves the users creating and managing their own contacts list via a provided database system. Thus, creating a viral, spontaneous long chain of contacts that increase tremendously on daily basis as more and more members joined by invitation and both new old members continue to sends out invitation.

Problem Statement

Governments in both industrialized and developing countries provide a wide variety of programs to assist micro, small and medium-scale enterprises (MSMEs). Nigeria not left out. Despite the success of MSMEs strategies in a few countries, the majority of developing countries like Nigeria have found that the impact of their MSMEs development programs on enterprise performance has been less than satisfactory. For instance, various agencies were created to do the job of stimulating the development of the small business sector of the Nigerian economy by various government. Among these are Small and Medium Enterprises Development Agency of Nigeria, (SMEDAN), YOUWIN, NPOWER on federal government level while EDOJOBS was recently established on State level in Edo State. Others are National Directorate of Employment (NDE), Peoples Bank of Nigeria (PBN), Microfinance Banks, National Economic Reconstruction Fund (NERFUND), Bank of Agriculture (BOA) and National Bank of Commerce and Industry. All these are the agencies with the mandate to develop the MSMEs sector in Nigeria. The Nigeria government keep searching for more effective ways of assisting MSMEs, the recent controversial Traders Money that was personally distributed from State to State of the Federation by the Vice President Prof. Yemi Osibajo may not be far from this.

Objective of the study

The objective of this study is to examine the awareness, utilization and impact of viral marketing on the performance rate and global competitiveness of MSMEs in Ekpoma and Uromi Metropolis a Sub-Urban area of Edo State

Research Questions

1. What is the level of awareness and utilization of viral marketing among MSMEs in the study area?
2. What are the internet and social media platform used for viral marketing by MSMEs in the study area?
3. How has viral market enhanced the performance and sustainability of MSMEs in the study area?

Literature Review

Viral marketing is a form of online marketing strategy that depends on existing social networks to promote, propagate and market a brand. Its name is akin to the mode of spread of virus from person to person as related to how consumers spread information about a particular brand or product with other people in their contacts list or social networks.

Rapid information dissemination and sharing is the essence of viral marketing. This may be by word-of-mouth or use of modern technology which has allowed the viral effect to include many Internet-based platforms as well. (Marketing-schools, 2019). The viral effect can spread through many different networks, including: Word-of-mouth, Email, Social networking sites (Facebook, Twitter, LinkedIn, etc), Video sharing sites (Youtube, Vimeo, etc) and Web forums.

Viral marketing provides its intended customers valuable services at low or no cost. Viral marketing can be used to target customers as a stand-alone marketing tool or in conjunction with a larger campaign that applies multiple kinds of marketing techniques and platforms to provide the require marketing needs of a brand. It is very attractive to small businesses or companies due to its cheap cost, ease of usage and convenient content creation than the highly stressful and limited traditional marketing efforts. Viral marketing has many advantages which MSMEs can exploit for global competitiveness. These are minimal cost, it far cheaper and less rigorous than the usual mass media (Magazines, gazette, TV and Radio), it has a far reach Potential**,** it can transcend the immediate local community into global platform. Most interesting is the ability of the network environment to identify people near your location and share the content of your message with them or suggest them to you as well as suggest you to them to add as a contact in your contact list. Viral marketing is invasive it is the responsibility of the user to decide to participate and share or not. Therefore, it never unnoticed or invasive. Hence, the perception of the brand and the interaction are significantly better, compared to more classical forms of advertising (Marketing-schools, 2019.

Dietmar (2018) in his work, Exploring the Concept of Mobile Viral Marketing through Case Study Research reported that Mobile viral marketing has a tremendous potential for communication and distribution purposes. Although seen as an important issue from the viewpoint of practitioners there has been little research on the phenomenon so far. This paper represents a first step in filling this void. We examine 34 case studies in order to identify relevant characteristics of mobile viral marketing. The outcome of the paper is a description model of mobile viral marketing as well as a derivation of four mobile viral marketing standard types. The proposed scheme allows unambiguously characterizing any given mobile viral marketing strategy and providing recommendations for designing new mobile viral strategies.

Also, Eze and Obikeze (2017) shows the need for small and medium scale enterprises to utilize information and communication technology (ICT) applications to boost their business. They found out tha SMES in South Eastern Nigeria utilize e-commerce and e-invoicing marketing applications in their operations to a low extent. Their findings result also showed that there was a significant difference in the mean ratings of SMEs managers on the extent they utilize e-commerce and e-invoicing marketing applications in their business operations based on years of experience.

In line with the foregoing Reijonen (2009) discovered that SME marketers perceive marketing through concrete practices that often relate to promotion, selling and customer relationships. They do not seem to have adopted a single business philosophy

but rather features of several philosophies that they estimate to best fit their business operations. The focus was on customer information gathering, but to act in a truly market-oriented way would require paying more attention to the dissemination and responsiveness of market intelligence. Viral marketing remains a tremendous market opening for MSMEs to maximize their potentials, enhance their performance and increase their marketability for an increase profit.

Methodology

This study is a survey research design, this research design allows the researcher to interacts with the participants using interviews and or structured questionnaires to collect the necessary information. This is suitable because there is no manipulation of the environment. Snowball sampling was used to select 220 MSMEs from registered MSMEs (110 from each locality of Ekpoma and Uromi) in sub-urban area of Edo State, Nigeria. Snowball sampling is preferred because it is practically impossible to gather all the registered MSMEs in the study areas in one place. Therefore, the sample for this study was 220 registered Micro, Small and Medium Enterprises (MSMEs). The instrument for this study was scheduled interviews and a self-developed questionnaire by the researcher titled "Awareness and Utilization of Viral Marketing by MSMEs". It was developed by the researcher after an elaborate literature review on the research topic to elicit information from the affected group. The questionnaire adopted the 4-points ratio scale with summated rating scale with values strongly Agree (SA) = 4; Agree (A) = 3; Disagree (D) = 2; Strongly Disagree (SD) = 1. Pearson Product Moment Correlation Coefficient was used to determine the reliability of the instrument. This yielded a coefficient of 0.71 which validates the reliability of the instrument. The questionnaires were given to the respondents and retrieved by the researcher, after the respondents have filled the instruments. The responses based on the 4-point ratio scale was analyzed using descriptive statistics and presented in table and charts.

Results and Discussion

Research question one

What is the level of awareness and utilization of viral marketing among MSMEs in the study area?

Table 1: Awareness and utilization of viral marketing by MSMEs in the study area

S/N	Item statement	SA	A	%	F	Mean	Decision
1	I have not heard of viral marketing	148	30	9.09	744	3.38	Agree
2	I have heard of the term viral marketing but I don't know what it is all about	32	32	25.45	436	1.98	Disagrees
3	I know what viral marketing is but I have never used it anyway	34	30	25.45	438	1.99	Disagrees
4	I used viral marketing to promote my business	15	65	118	520	2.36	Disagrees

Table 1 shows that majority of the respondents agreed that were ignorant of viral marketing (3.38) a high mean score. while majority also disagreed to items 2, 3 and 4 with low mean sores of 1.98, 1.99 and 2.36 respectively. Indicating that they have heard of the term viral marketing but do not know what it is all about, know what viral marketing is but have never used it for their business and do not use viral marketing to promote their business.

The result showed that there is low awareness and utilization of viral marketing among entrepreneurs in the study area as majority of the business owners do not even have idea what viral marketing is all about.

Research Question 2

What are the internet and social media platform used for viral marketing by MSMEs in the study area?

Table 2: Platforms used by MSMEs for viral marketing in the study area

Internet and Social network Platform	Responses			
	Yes	Percentage (%)	No	Percentage (%)
Whatsapp	80	36.4	140	63.6
Youtube	30	13.6	190	86.4
Email	77	35	143	65

Instagram	12	5.5	108	94.5
LinkedIn	5	2.3	225	97.7
Vimeo	-	-	-	-
Twitters	60	27.3	160	72.7
Palmchat	-		-	-
2go	-	-	-	-
Facebook	79	35.9	141	64.1

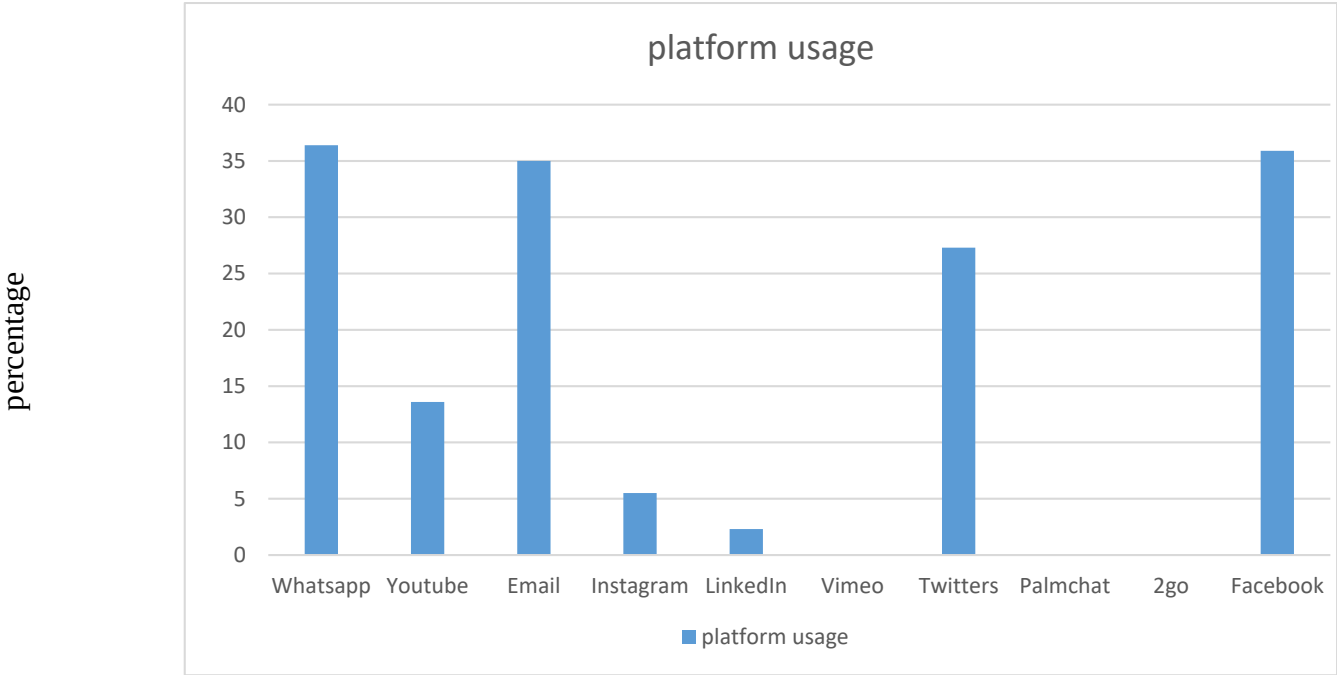

Figure 1: Percentage usage of Internet and social network for viral marketing

Table 2 and figure 1 above Whatsapp (36.4%), Facebook (35.9%) and Email (35%) are the most frequently used platform for viral marketing in the study area. The least used was LinkedIn (2.3) while Palmchat and 2go were not used at all. From the information gathered from the respondents during the one on one interview scheduled, the prolific used of Whatsapp, Facebook and Email is due to their popularity, wider coverage and simplicity, low data consumption coupled with the fact that almost all smart phones and communication devices come with theses app pre-installed. Thus indicating that easy accessibility and low data usage contributed to their choice of plate form

Research Question 3

4. How has viral marketing enhanced the performance and sustainability of MSMEs in the study area?

Table 3:

S/N	Item statement	SA	A	D	SD	F	Mean	Decision
1	viral marketing has enhanced my daily sales	65	10	3	2	298	3.73	Agree
2	I now have a large number of customer due to use of social networking to promote my business	55	15	4	6	279	3.5	Agree
3	My business has gain more footing in terms	30	30	15	5	245	3.06	Agrees

	of competition and profit making since I took my business online							

Table 3 shows that out of 220 respondents only 80 (36.4%) made use of viral marketing in the study area and out of these majority of the respondents indicated that viral marketing has enhanced their daily sales, they now have a large number of customer due to use of social networking to promote their business and their business has gain more footing in terms of competition and profit making since they took to vial marketing online.

The finding s of this study showed that awareness and usage of viral marketing is low in the study area. However, the gains of viral marketing were evident among MSMEs who knew and made used of viral marketing as this brought about competitive advantage, broad customer base, larger market and profit enhancement. Whatsapp, Email and Facebook were the major platforms used for viral marketing in the study area.

Conclusion

The study concluded that:

1. MSMEs in the study area have very low awareness and utilization of viral marketing.
2. The major platform for viral marketing were Whatsapp, Email and Facebook
3. Viral Marketing has the potential to improve and enhance business through larger market, broad customer base and profit enhancement.

Recommendations

Based on the findings, this study recommended that:

1. There is need for the government to carryout enlightenment campaign on viral marketing among MSMEs in the study area.
2. MSMEs should be organized into groups on social networks to attract them to the platform
3. Policy Makers should encourage MSMEs to own smart devices as part of informing technological innovations into their businesses.

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Determinants of Loan Repayment Performance: Evidence from in Small and Medium Enterprises: In Case of Gurage Zone: Ethiopia

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Abstract- *Micro finance institutions have a significant role for the development of one's country economic development by providing a credit and also a saving service for those productive clients. This study was conducted with the aim of analyzing the factors that influence micro-finance loan repayment practice using primary data collected through self-administered questionnaire. The researcher used both primary and secondary sources of information to gather relevant data. Questionnaires are distributed to the employees of the organization and the information gathered is analyzed accordingly. A total of 7 employees were taken by using judgmental/purposive sampling method to select sample respondents from the total populations. The primary data were collected through interview and questionnaires because they are most appropriate instrument to collect relevant data and to identify major problems that affect loan repayment practice of the institution, the secondary data were collected by reviewing different literatures regarding the research subject. The Researcher used descriptive type of analysis with the help of graph, chart, tables and percentage to analyze the necessary data that was collected from the organization for both primary and secondary method of data collection. Based on the findings of the study, the study revealed that the credit term, credit monitoring, collateralized loan and loan supervision by the institution assign as the causes of nonperforming loan.*

Key Terms: Micro-Finance; Loan Repayment Practice; Economic Development And Micro Finance Institutions

I. Introduction

Micro-finance institutions (MFIs) are those institutions which provide micro credit, saving and other services for those who are productive borrowers. The formal and informal sectors are the principal sources of finance for any investment or business that can be under taken at micro, small-scale and large-scale level in an economy. The major financial institutions in the formal financial sector in Ethiopia are commercial bank of Ethiopia (CBE) and development bank of Ethiopia (DBE).

Solomon (2006) noted that the banks serve big businessmen and disregard poor households and bankable many small-scale credit-worthy businessmen with their viable investment ventures are denied access to institutional credit because they couldn't afford the required collateral. He also indicated that," over all; the prevailing operation of the formal financial institution in many low income countries such as Ethiopia is inefficient in providing sustainable credit facilities to the poor. Regarding delivery of financial services

access to institutional credit was very limited in Ethiopia. Because of this limited access the majority of the poor get financial services through informal sources like money lenders, Iqub, Idder, merchants' friends and relatives etc. The formal financial sources have not interested in delivering credit to the poor. Micro finance such like Gurage credit and saving institution play an important role to equally serve the poor borrowers as when they purposely need to be productive.

Gurage credit and saving institution was initially established in October 1995 by getting license from National Bank of Ethiopia as a micro finance intermediary share company and began its work by providing micro-credit services for those poor's who are biased by the major financial institutions . A loan is a debit evidence by which specifies among other things the principal amount and interest rate and the date of repayment. In it loan entails the revocation subject aspects for a period of time between the lender and the borrower. In practice any material object may be lent. Acting as loan is one of the principal tasks of financial institutions issuing of debt contract such as bond is typical source of fund.

Credit is recognized as the important financial services that contribute to the success of business venture. This success intern believes to contribute towards economic development. However existence of credit facility alone not necessarily result in supporting of economic development unless and other ways it would be accumulated by the existence of conductive to the efficient utilization of credit fund. Loan recover is the main factor to determine the quality of loan assets of financial institutions. Lower recovery indicates erosion of the institution effectiveness to provide the expected services.

Repayment practice is a critical feature of credit, because persistent or continuous poor payment ultimately leads to financial failure in any hand or financial institution. Different factors can hinder the loan estimated recovery practice of Gurage credit and saving institution that should be investigated for the precaution of the institution.

II. Justification and likely benefits of the study

Lending represents the typical services of micro-finance institutions provide for the productive borrowers. Loans are the dominant asset and represents 50-75% of the total amount at most micro-finance institutions, generate the largest share of operating income and represent the institutions greater risk exposure. Moreover its contribution to the growth of any country is huge in that they are the main intermediaries between depositors and those in need of fund for their variable projects thereby ensure that the money available in economy is always put to good use. Therefore, managing loan in a proper way not only has positive effect on the micro-finance institutions practice but also on the borrower firms and a country as a whole. (Mac Donald & Koch, 2006).

Failure to manage loans, which make up the largest share of the institutions asset, would likely lead to the way of high level of non-performing loans. As whole credit is generally accepted, that is put to productive use, results in a good return. But credit provision is such a risky business that, in addition to other reasons of varied nature it may involve fraudulent and opportunistic behavior. The practice of Gurage credit and saving institution has been impressive since there establishment they are expressing default problems that can be observe from the financing loan report.

In 2006 Gurage credit and saving institution provides a loan services for about 1970 borrowers. The amount of total disbursement is Birr37,158,457.20. Among the total amount of disbursements about Birr37,158,457.20 17,932,126 is repaid and the rest 21,169,593.18 is (i.e. about 42.34% of the loan is not repaid on time (financial report of 2006).

Brhanu(2001) argues that default problems destroy lending capacity as the flow of repayment declines transferring lenders into welfare agencies, instead of a viable financial institution, it incorrectly penalize credit-worthy borrowers whenever the screening mechanism is not efficient. Loan default may also deny new applicants access to credit as the micro-finance institution cash flow management problems arguments in direct proportion to the increasing default problems.

Many studies find out different factors that determine loan repayment practice among micro-finance institution's borrowers give mixed and overlapping results. External factors such as the economic, political and business environment in which the borrower

operates are important determinants of loan repayment (Dereje etal*;* 2005, Belayneh, 2006). Moreover, in exploring micro-finance repayment problems in the informal sector in (Addisu, 2006) found that repayment capacity increased with education level. Addisu also found that borrowers who planned their business activities in advance or who had prior experience were least likely to default in their loan repayment. In contrast, they found that the levels of monthly sales were directly related to non-repayment of loans. Efrem and Ibrahim (2003) in their study on determinants of loan repayment practice in Bahirdar town identifies loan size, age of beneficiaries, household size, and number of years of formal education and occupation as the key predictors of loan repayment.

Therefore, these situations triggered the researcher to look at the issues in the area closely and deeply in order to give clear description of the problems from various conditions of the institution. Thus, the study was aimed to assess the factors affecting loan repayment practice of Gurage credit and saving institution, Emdebir branch.

III. Significance of the study

This study would provide benefits for the following concerning bodies. It provides relevant information and suggestion about loan repayment practices. It is also important for the top level managers of GurageSaving and Credit Institution to recognize the loan granting procedures that they shall acquire from the program for their efficiency. It also helps future researchers by serving as a reference. It is particularly important for Gurage Saving and Credit Institution and there by improve its future loan repayment practice.

IV. RESEARCH METHODOLOGY

The researcher used descriptive type of research design, the reason behind is that the research intention is concerned with arranging, summarizing, and presenting numerical data in the form of table with percentage and frequency that the reader understands easily. It is expected to be suitable in order to assess the factors affecting loan repayment practice of Gurage saving and credit institution Emdebir branch.

Target Population

The target population for this study is employees of Gurage saving and credit institution Emdebir branch. The total number of employees in this local micro finance institution is 15. Among them 10 are males and 5 are females.

Sample Size and Sampling Technique

The target population for this study was employees of Gurage saving and credit institution Emdebir branch and they are 15 in total. Therefore, the research has used purposive or judgmental sampling technique and approach managers and all loan officers working in these institutions. The reason behind the selection of these two categories is that because they are working at front line and have expertise knowledge and experience in the area more than other staffs.In addition, there are a total of 5 loan officers working in the MFIs. Therefore, the participants of this study were 2 Branch Managers and 5 Loan Officers. Therefore, the total numbers of participants of the study were 7 in number.

Data Type and Source

The researcher used both quantitative and qualitative types of data. The reason for using both quantitative and qualitative is that to better understand the research problem by combining both numeric value from quantitative research and the detail of qualitative research.The researcher used both primary and secondary source of data to assess the factors affecting loan repayment practice of Gurage saving and credit institution Emdebir branch. Primary sources were collected from sample respondents through questionnaire and interview and secondary sources were obtained from different literature reviews, Gurage saving and credit institution, Internets, and other published and unpublished documents.

Method of Data Collection

The researcher prepared both questionnaires and interviews in order to collect sufficient and relevant data from employees of Gurage saving and credit institution. Questionnaires are prepared to employees of the Gurage saving and credit institution in order to gather relevant information and it includes both open-ended and close-ended questions. Unstructured interviews prepared to gather additional information from the top level management of Gurage saving and credit institution Emdebir branch.

Data processing and Analysis

After all the data were collected the researcher organize the necessary data by using tabulation and percentage method to evaluate the various data obtained during the data collection period. The necessary data were gathered, analyzed, processed and interpreted made and finally the recommendation is forwarded.

Ethical Considerations

Educational researchers, as well as researchers from all other domains, must consider the ethical principles of right and wrong in relation to their researcher study. Different research bodies have developed ethical standards in conducting research. From these, the researcher must consider the following in terms of ethics

- ✓ The data to be collected would be kept confidential data exclusively used for academic purpose only
- ✓ Treatment of participants
- ✓ Responsibility to society
- ✓ Kept confidential government offices sensitive information

V. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This section deals with the presentation, analysis, and interpretation of data gathered through questionnaire and interview. The first part of this chapter deals with the characteristics of the respondents. The remaining part deals with presenting, analyzing and interpreting data of the problems under the study.

Characteristics of the Respondents

Based on the information obtained from the respondents self report in the questionnaire, the bio-data of the study group was examined in terms of sex, age, educational level (qualification), year of experience and position in the organization. Table 1 below summarizes the data about the research subjects.

Table 1: Characteristics of the Respondents

No	Item	Category	Frequency	Percentage (%)
1	**Sex**	Male	5	71.4
		Female	2	28.6
2	**Age**	Below 25	2	28.6
		25-30	4	57.1
		31-40	1	14.3
		Above 40	0	0
3	**Educational level**	12 Grade complete	0	0
		Certificate	0	0
		Diploma	2	28.6
		Degree	5	71.4

		Masters and above	0	0
4	**Service Year**	< 1Years	1	14.4
		2-5 Years	3	42.8
		5-10 Years	3	42.8
		Above 10 Years	0	0
5	**Position in the organization**	Credit manager	1	14.3
		Loan officer	4	57.1
		Auditor	1	14.3
		Officer	1	14.3

Source: Own survey, 2018

Answering the sex of research participants out of the total respondents, the majority 5(71.4%) of the respondents are male where as 2(28.6%) of them are females. This indicates that the institutions credit department is male dominated.

Regarding respondents` age, the majority 2(34.6%) and 4(27%) was in the age group of above 40 and 31-40 years respectively. In addition, 1(23%) fall in the range between 25-30 and below 25 years age interval. Thus, this implies that under normal circumstances, they were matured enough and can express ideas related to the study consistently and with better understanding. Therefore, their judgments and opinions can be taken as acceptable to the study.

In item 3 of the same table, credit officers were requested to respond about their educational qualification. According to the response, the majority 5(71.4%) of credit officers were first degree holder and the rest 2(28.6%)were diploma holders. There is no second degree and certificate in the organization according to the respondents. Therefore, since the respondents are educated enough, the organization is more productive by its employees.

As indicated in the above table according to the respondents' year of service in the organization, 1(14.4%) of the respondents are experienced less than one year, 3(42.8%) of them are experienced 2-5 years, 3(42.8%) of them are experienced 5-10 year in the organization. This indicates that most of credit officers are worked in the organization for relatively long time and few of them are fresh or new for the organization. Therefore, since most of credit officers are experienced in the organization and they have adopted any conditions in the organization, they work properly for the productivity of the organization.

Regarding credit officers position in the organization, the majority 4(57.1%) of them are loan officers and the rest credit manager, auditor and officers accounts 42.9% of the total employees.

Table 2: The role of collateralized loan and nonperforming loan

The role of collateralized loan and nonperforming loan	**Strongly agree**		**Agree**		**Neutral**		**Disagree**		**Strongly disagree**	
		%		**%**		**%**		**%**		**%**
Collateralized loans perform well in the institution	2	28.6	3	42.5	1	14.3	1	14.3	0	0

Collateralizing loans help to protect loan default	3	42.5	2	28.6	1	14.3	1	14.3	0	0
Most of the time non collateralized loans are defaulted	3	42.5	2	28.6	1	14.3	1	14.3	0	0

Source: ***Own Survey, 2018***

Collateral (also known as warranty) is the asset that borrowers pledged for the institution to compensate the institution's risk in the time of loan default (Sinkey, 2002), and it is considered as a secondary source of repayment (MacDonald, 2003).

In the table 2 above we have observed that 3(42.5%) of respondents were agreed that collateralized loan is performed well in the institution. As a result this study has got knowledge that institutions are not granting loan without any collateral. Besides 2(28.6%) of the respondents are strongly agreed that collateralized loan is performed well in the institution and only 1(14.3%) of the population disagrees on that and no respondents strongly disagree in the issue.

In the same table of item 2, out of the total respondents the majority42.5% of credit officers are strongly agreed that collateralized loan is help to protect loan from default. As a result, the study reaches on an understanding that since the properties of the borrower's such as home, automobile and other furniture are behind them as collateral and become sold if they default to repay the loan and have no any other way to repay the lender, they repay the loan with compliance to the agreement. So collateral (warranty) is used to reduce the risk of granting a loan by increasing the chance of the creditor recovering the amounts that become due to the borrower. Moreover, 2(28.6%),1(14.3%) and 1(14.3%) of the respondents are agree, neutral and disagree respectively that collateralized loan helps to protect loan default. Similarly, in item 3 of the same table the majority of respondents 3(42.5%) strongly agreed on non collateralized loans are defaulted.

Table 3: The relevant of credit term on loan repayment practice

The relevant of credit term on loan repayment practice	**Strongly agree**		**Agree**		**Neutral**		**Disagree**		**Strongly disagree**	
		%		**%**		**%**		**%**		**%**
Credit term is significant to determine loan repayment practice in the institution	3	42.5	2	28.6	1	14.3	1	14.3	0	0
With growth in credit term comes growth on loan default.	4	57.2	1	14.3	1	14.3	1	14.3	0	0
Borrowers default because they don't understand credit terms well.	1	14.3	2	28.6	1	14.3	3	42.5	0	0
Poorly negotiated credit terms lead to loan non practice	4	57.2	2	28.6	0	0	1	14.3	0	0

Source: ***Own Survey, 2018***

In financial institutions credit term has a significant effect for the occurrence of nonperforming loan (Abreham, 2002). In the table 3 above our survey result indicates 3(42.5%) of the respondents are strongly agreed that credit term is significant to determine loan

repayment practice in the institution. In addition to this 28.6%, 14.3%, 14.3% of the respondents are agree, neutral and disagree respectively.

Regarding growth of credit the majority of credit officers of the institution which is4(57.2%) of them strongly agreed that when the credit term becomes growth the chance of loan default is highly increased. As a result, the study got knowledge that credit term is one of the main determinants for the repayment practice of the institution's loan, and the credit term grows the chance of loan default becomes increase. On the other hand, only one respondent for eachwhich is 28.6% of the total respondents responded agree, neutral and disagree respectively that with the growth of credit term the chance of loan default becomes increased.

In the same table of item 3, most of the respondents i.e. 3(42.5%) are disagreed that borrowers default to repay the loan is not related with the misunderstanding of credit term. This entails that borrowers are clearly understand the credit term.

The last row of the same table entails, poorly negotiated credit term leads to loan nonpractice about 4(57.2%) of the respondents are strongly agreed. Accordingly, if the lenders have a good deal about the credit term for the borrowers, the borrowers are in a better position to pay the debt.

Table 4: Significance of loan supervision

The significance of loan supervision on repayment practice	**Strongly agree**		**Agree**		**Neutral**		**Disagree**		**Strongly disagree**	
		%		**%**		**%**		**%**		**%**
The institution supervises the borrowers after loan granting	2	28.6	4	57.2	0	0	1	14.3	0	0
The institution supervises the borrowers before granting loan	1	14.3	3	42.5	1	14.3	1	14.3	1	14.3
Loan supervision is relevant for the repayment practice	5	71.4	2	28.6	0	0	0	0	0	0
A borrower without loan supervision become defaulted for repayment	4	57.2	2	28.6	1	14.3	0	0	0	0
Institutions with high supervision faces little nonperforming loan	3	42.5	2	28.6	1	14.3	1	14.3	0	0

Source: ***Own Survey, 2018***

Loan supervision is the follow up of the institution about for what purpose and how the borrowers are used the money they lend from the institution for the best utilization of money provided as a loan (Adisu, 2006).

From the table 4 above it is observed that 4(57.2%) of the respondents are agreed that the institution is supervise the borrowers when the loan is going to granting. From this survey result the study got knowledge that the institution has supervision policy to grant a loan for the creditworthy borrowers. In other ways, 2(28.6%) and 1(14.3%) of the respondents are strongly agreed and disagreed the institution supervises the borrowers to grant a loan.Moreover, 4(57.2%) of the respondents are strongly agreed that a borrowers without any supervision becomes defaulted for repayment and 3(42.5%) of the respondents also strongly agreed that the institutions with higher loan supervision faces a little non-performing loan. As a result, the knowledge that the study got from this survey result is

if the institution provides a great supervision for the borrowers when they decide to grant loan they have a better practice for the repayment of loan wisely.

Difficulties that faces during the repayment period

As the respondents tell there are different difficulties that face during the period of repayment. Those are borrowers used the loan they get from the institution for unintended purposes such as ceremony, wedding clothing and others. Due to this they cannot be profitable rather than being the owner of much accrued debts and they cannot pay the loan properly based on the agreement. And other difficulties that face during the repayment the repayment period are

- ✓ Unwillingness of borrowers to pay their loan.
- ✓ Due to little knowledge of borrowers about the amount interest paid they are not good to repay the principal with its interest.
- ✓ They have bad feelings with the institutions during the due date of the loan.
- ✓ Generally borrowers are not good to repay their loan timely.

Incentives made by the institution for those who are creditworthy borrowers

Respondents say different things about the incentives made by their institutions for those creditworthy borrowers. Some of these are:

- ✓ Getting a trust by the institution.
- ✓ Granting a loan as the amount they want.
- ✓ Get a loan at any time they want.
- ✓ Provide a loan by grouping collateral and also without any collateral.
- ✓ Appreciating them by different awards and so on.

To sum up, all the respondents says about the institution's loan system it is a poor oriented to make the productive borrowers being achievable and self reliant. It is also backed by collateral for the warranty of institution's risk due to the borrowers default to repay their loan. The respondents also say that the institution is the cornerstone for the development of the country's economy by providing a loan service for any intelligent and productive borrow

VI. .CONCLUSION AND RECOMMENDATION

Conclusion

The general objective of this research is identifying the factors that affect loan repayment practice of Gurage credit and saving institution, Emdeber branch. A number of specific research questions are developed based up on the general objective of the research. A self administered questionnaire for the purpose of obtains a primary data from the targeted respondents. According to the respondents view the result of the study showed that there are most likely occurrence of effects that affect loan repayment practice of Gurage credit and saving institution, Emdeber branch. It is presented bellow.

- ❖ This study find out collateral is one among the main requirements for assuring the lending institution's repayment practice of loan provided for the clients. Due to this most of the time financial institutions did not grant a loan without any collateral. When the institution have done so it is helpful to ensure the borrowers full commitment, provide as a security if the borrowers are defaulted for repayment, protect the borrowers deviation from performing the planned action at the time of credit extension. Since bounding the borrower with high valuable collateral make a feeling for them not to lose the property due to defaulting to repay their loan. Therefore borrowers become in a good position to repay the debt.
- ❖ The institution made a strong negotiation with the borrowers about the credit term since it is one of the possible determinants for the repayment practice of loan. But the borrower's knowledge about the credit term is not the cause for loan default. So as the

credit term becomes long it is not the borrower's poor knowledge about credit term rather it is the negligence of the borrowers so, the institution is cautious when there is a growth of credit term since it approaches to loan default.

- In addition, the institution made a strict monitoring to ensure the practice of loan. The institution monitors the borrower's property and gives an attention what the borrowers have been made by the money they lend from the institution. The institutions have many possible alternatives to monitor the borrowers. Amongst this one of the best methods is visiting to understand the progress of the borrower's business operation and giving an advice as necessarily important, and encouraging the repayment practice.
- Besides, the institution made loan supervision about for what purpose the borrowers need a loan, how they are going to use the loan and also their productiveness of using a loan. Such supervisions are a key factor for the clients better productivity and the assurance of repayment practice of the institution since the borrowers achievement is also great for little occurrence of nonperforming loan in the institution.
- Finally the study investigate that even if there are some difficulties faced at the time of loan repayment with the borrowers there is also an interesting condition with those credit worthy borrowers who are really productive and achievable and the institution have an incentive mechanisms for such borrowers. Among the incentives some of them are provide a loan without collateral, granting a loan as the amount they want and at any time they want, giving different awards, getting a trust by the institution and so on.

Recommendation

Based on the above the research findings and conclusion the following recommendation are suggested.

- The institution should made an assessment on the loan's normality periodically so as to know the indicators of loan practice including profitability, management's level of activity and this ensures the assets which are utilized effectively and for productive purpose.
- Collateral is decisive for the decision of lenders whether to provide a loan or not the institution is better to continue giving more attention on the property (like house, automobile e.t.c) of borrowers taking it as a collateral since it is used to assure the borrowers commitment to pay the debt.
- The institution is also advised to strengthen their attention on monitoring the borrowers attentively as they have done before to make them productive by assessing the businesses intended to operate by the loan which is provided.
- In making the negotiation about the credit term the institution should not be shallow rather it is expected to be strong. Because poorly negotiated credit term leads to the growth of credit term even if the borrowers have knowledge about the credit term which is the indicator of loan default as investigated in the analysis of the research.
- Loan supervision is has a key role for the practice of the institution. This because if the institution supervises the borrower it is easy to know what the borrower intends to operate, and give an advice how to utilize the money they borrowed. By doing so since the credit is invested on the outlined purpose the borrowers become achievable and there will not be nonperforming. As a result, the institution is ought to strengthen their supervision system than what they have been made before at the time of deciding to provide a loan for the borrowers.

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Calculation of Properties of Phenobarbital an Antiepileptic Drug Using Chemcalise Software

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Abstract: Medications of barbiturate class are used in the treatment of certain types of diseases like insomnia (difficulty sleeping), and for controlling certain seizures. One such type of medicinally important compound is Phenobarbital. It is also known for its activities .as anticonvulsant, antidepressant and antihypnotic. In view of medicinal importance of Phenobarbital its structure and properties were studied by using chemcalise software of Chemaxon and data obtained is interpreted.

Keywords*:* Phenobarbital, Properties, pka, Isoelectric Point, logP, logD, Solubility, Geometry, HNMR

I. INTRODUCTION

A compound Phenobarbital is well known medications of barbiturate class which is used in treating insomnia (difficulty sleeping). It is also used for controlling seizures caused due to Epilepsy [1-3].

By the use of Chemaxon's cutting edge technology , a powerful online facility of chemcalize was developed. In this it is possible to peform the chemical calculations , name-structure conversion , search etc. We can draw the chemical structure as an input and the calculation view gives the structure, structure-based calculations , its 3D view , the molar and exact mass. Structural properties (like atom count, Hydrogen bond acceptor count , polar surface area, polarizability are given by the calculation view. pKa, isoelectric point ,logP, logD ,solubility,H-NMR spectral data were also obtained in the chemcalise software.

In the present paper the structure of chemical compound Phenobarbital is drawn by using the chemicalise software and all the results obtained were presented in detail. The particulars of basic properties, structural properties, names and identifiers like IUPAC name, Traditional name, Common names, SMILES, InChI, CAS Registry numbers of Phenobarbital are provided in this paper. pKa,isoelectric point, logP. logD, Solubility, Geometry and ^{1}HNMR spectrum of Phenobarbital were analysed in detail as given in this manuscript.

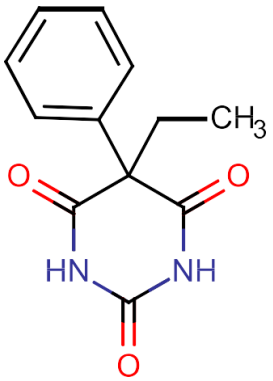


Fig 1. Structure of Phenobarbital

Basic properties of Phenobarbital

The structure of Phenobarbital is drawn as the input and from the data[4,5] given **(Table 1)** it is clearly evident that the formula of phenobarbital is $C_{12}H_{12}N_2O_3$ and its composition is C=69.06 % ,H=5.21 %,N=12.06 %, O=20.67% .The molar mass of Phenobarbital is 239.239 g/mol and its exact mass is 232.084792254 Da.

Table 1. Data of mass and composition of Phenobarbital

Input	Phenobarbital
Molar mass	239.239 g/mol
Exact mass	232.084792254 Da
Formula	$C_{12}H_{12}N_2O_3$
Composition	C=69.06 % H=5.21 % N=12.06 % O= 20.67%

II. STRUCTURAL PROPERTIES OF PHENOBARBITAL

Data of structural properties of Phenobarbital were presented in Table.2. The atom count of 29 of Phenobarbital is in agreement with the number of atoms as given in chemical formula of $C_{12}H_{12}N_2O_3$. In this there are 12 carbons , 2 nitrogens and 3 oxygens which are the heavy atoms and the sum of these is in agreement with the total heavy atom count of 17 atoms. There is no asymmetric atom and Phenobarbital has two rotatable bonds [6-8]. It has two rings among which one is aromatic ring and one is hetero ring. It has two H bond donor(two –NH sites) and 3 H bond acceptors(three =O sites) as evident from the structure of Phenobarbital [9-10] (fig 1). The topological polar surface area[11] is Phenobarbital is75.27 A^2. Molar refractivity of Phenobarbital is indicated to be 59.75 cm^3/mol.

Table 2. Data of structural properties of Phenobarbital

Atom count	29
Heavy Atom count	17
Asymmetric Atom count	0
Rotatable bond count	2
Ring count	2
Aromatic Ring count	1
Hetero Ring count	1
FSP3	0.25
Hydrogen bond donor count	2
Hydrogen bond acceptor count	3
Formal charge	0
Topological polar surface area	75.27 A^2
Polarizability	23.18 A^3
Molar Refractivity	59.75 cm^3/mol

Names and Identifiers of Phenobarbital

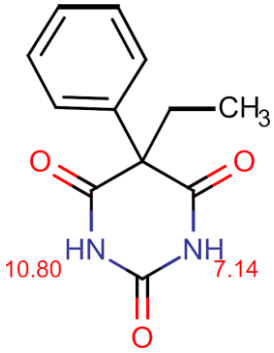
The following names of Phenobarbital were given by the chemcalise software.other details like SMILES, InChI, InChIKey ,CAS Registry numbers of Phenobarbital were also obtained(Table 3)

Table 3. Names and Identifiers of Phenobarbital

IUPAC name	5-ethyl-5-phenyl-1,3-diazinane-2,4,6-trione
Traditional name	Phenobarbital

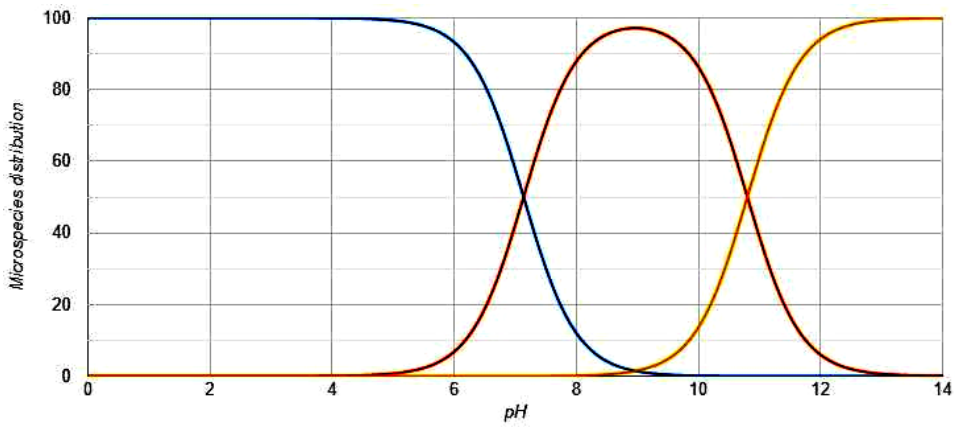
Common names	fenobarbital; luminal; Phenobarbital; Phenobarbitol; phenobarbitone; phenobarbituric acid; phenylethylbarbitursaeure; phenyalethyl barbiturate; phenylethyl barbituricacid; phenylethylbarbitursaeure; phenylethylmalonylurea
SMILES	CCC1(C(=O)NC(=O)NC1=O)C1=CC=CC=C1
InChI	InChI =1S/C12H12N2O3/c1-2-12(8-6-4-3-5-7-8)9(15)13-11(17)14-10(12)16/h3-7H,2H2,1H3,(H2,13,14,15,16,17)
InChIKey	DDBREPKUVSBGFI-UHFFFAOYSA-N
CAS Registry numbers	11097-06-6,46755-67-3,50-06-6

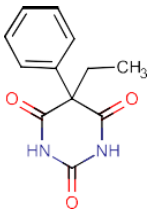
Fig 2. Structure of Phenobarbital with pKa values of 7.14 and 10.80 **indicating strongest acidic nature**



pKa is the measure of the acid dissociation constant given as pKa = - log $_{10}$ (K) and it is a measure of the strength of an acid in solution quantitatively[12-15]. In chemcalise the pKa values of Phenobarbital is found to be 7.14 and 10.80 thereby indicating its strong acidic nature(Fig 2.). This is attributed to the dissociation of protons of amide group (-NH).

The following graph(Fig 3.) shows the distribution of pH for the different microspecies of Phenobarbital





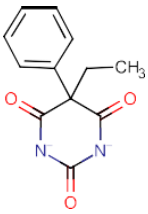


Fig 3. Distribution of pH for the different microspecies of Phenobarbital

Isoelectric Point of Phenobarbital

Isoelectric point is defined as the pH of a solution at which the molecules of a substance remain electrically neutral and do not migrate in an electric field. It is the point at which positively and negatively charged groups are in equal numbers. At this point the substance is neutral and has zero electric potential.

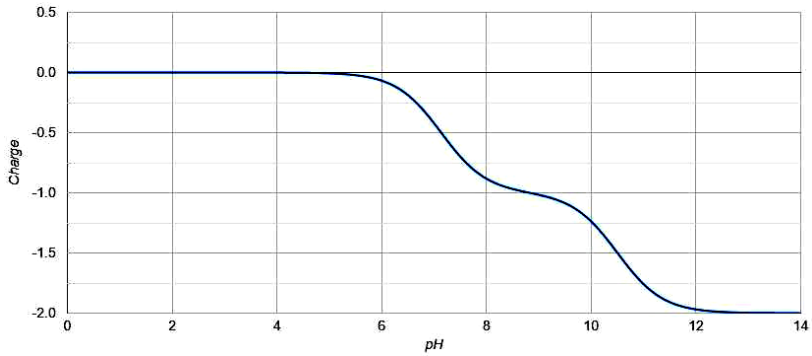


Fig.4 Distribution of charge with pH of Phenobarbital

Table 5. Data of distribution of charge with pH of Phenobarbital

pH	charge
1.7	0.00
4.6	0.00
6.5	-0.19
7.4	-0.65
8	-0.88

The distribution of charge with pH of Phenobarbital is graphically depicted in the fig 4 and the coressponding data is given in the table 5 . From the above graph it is evident that phenobarbital is electrically neutral with zeo electric charge within the pH range of 1.7 to 4.6 indicating the isoelecrtric point.

log P and log D of Phenobarbital

logP is the octanol-water partition for the neutral (un-ionized) form of the compound. logP value of Phenobarbital [16-18] is found to be 1.41

log D is a log of partition of a chemical compound between the lipid and aqueous phases.The following figure shows the variation of the log D value of Phenobarbital [16-18] with pH. It is observed that the log D value is same being 1.41 within the pH range of 1.7 to 4.6 and further log D value decreases as the pH increases.(Fig 5 &Table 6) . The column and the line graph showing variation of log D with pH is given in the figures 6 & 7 respectively

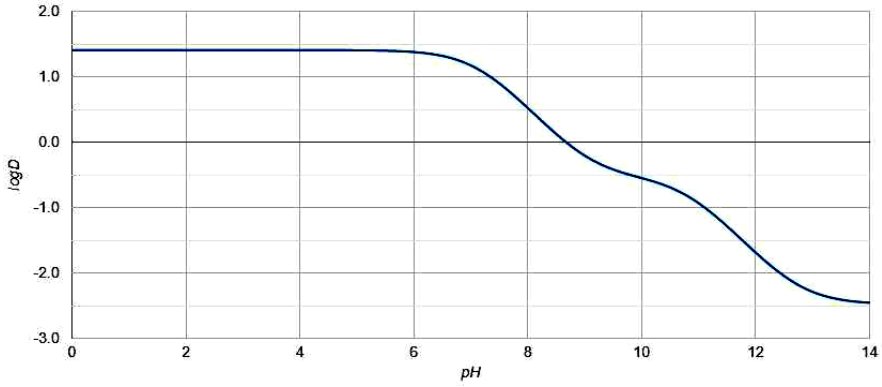
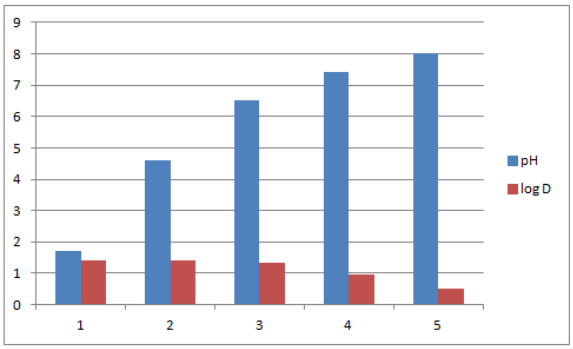


Fig 5. Distribution of log D with pH of Phenobarbital

Table. 6 Data of Distribution of log D with pH of Phenobarbital

pH	log D
1.7	1.41
4.6	1.41
6.5	1.32
7.4	0.96
8	0.52



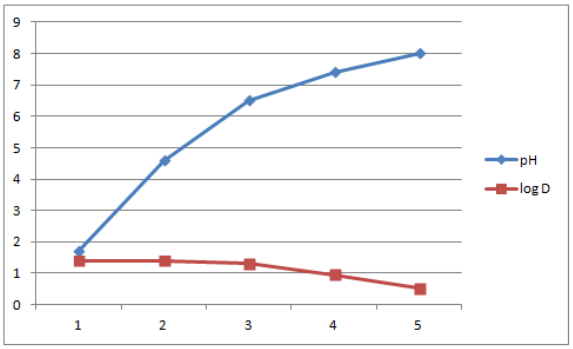


Fig. 6 Column graph of Distribution of log D with pH **Fig.7 Line graph of Distribution of log D with pH**

Solubility of Phenobarbital (log S)

Log S is the unit of expressing solubility and it is the 10 based logarithm of the solubility . It is expressed in three units as log S,mol/l and mg/ml.The following graph shows the distribution of log S with pH (Fig.8) and the data (Table. 7) indicates that Phenobarbital[19-20] is of High solubility category with Intrinsic solubility of -2.23. The column and the line graph showing variation of Solubility of Phenobarbital (log S) with pH is given in the figures 9 &10

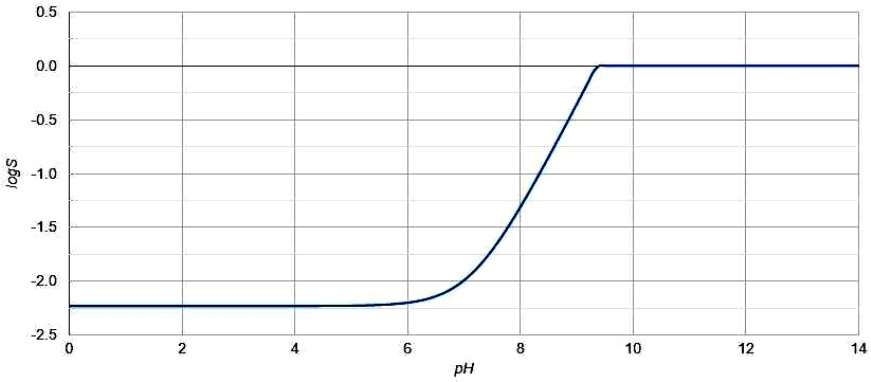
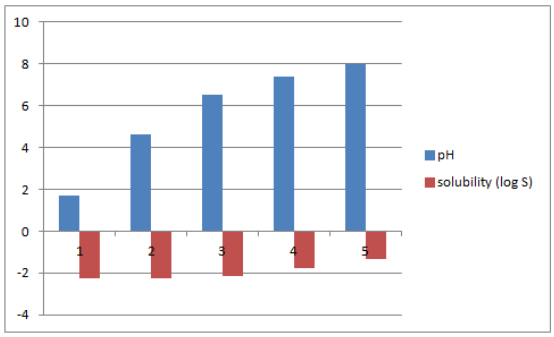


Fig.8 Distribution of log S with pH of Phenobarbital

Table. 7 Data of Distribution of solubility (log S) with pH of Phenobarbital

pH	solubility (log S)
1.7	-2.23
4.6	-2.23
6.5	-2.14
7.4	-1.78
8.0	-1.31



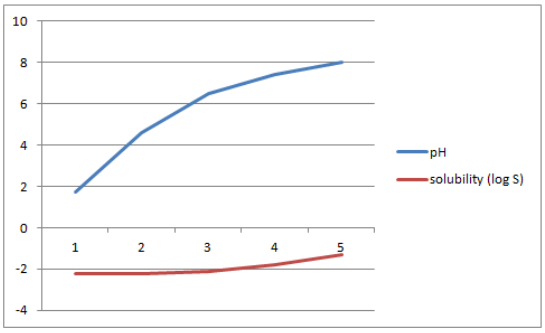


Fig.9 Column graph of Distribution of log D with pH **Fig.10 Line graph of Distribution of log D with pH**

Solubility of Phenobarbital in mg/L

Solubility of an organic compound is affected by the pH of the solution. with the change in the pH there will be change in the charge state of the organic compound.At low pH the molecule carries neutral electric charge due to which the solubility of the compound is minimum and precipitate is formed as the compound comes out of the solution. Table 8 below shows that Phenobarbital[19-20] has low solubility of 1.36 mg/l at pH of 1.7 and can be precipiotated at this pH. with the increase in the pH of the solution, the solubility of Phenobarbital increases to maximum value of 11.32 mg/l at pH of 8 as evident from the following table and graphs. A graph showing the increase in solubility of Phenobarbital with pH is given as following figure 11 .The column and the line graph showing variation of Solubility of Phenobarbital in mg/L with pH is given in the figures 12&13

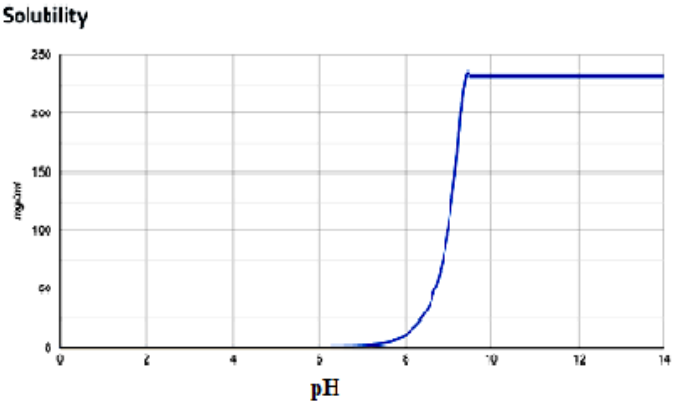


Fig. 11 Distribution Solubility in mg/L of with pH of Phenobarbital

Table. 8 Data of Distribution of solubility in mg/L with pH of Phenobarbital

pH	solubility mg/l
1.7	1.36
4.6	1.37
6.5	1.68
7.4	3.86
8.0	11.32

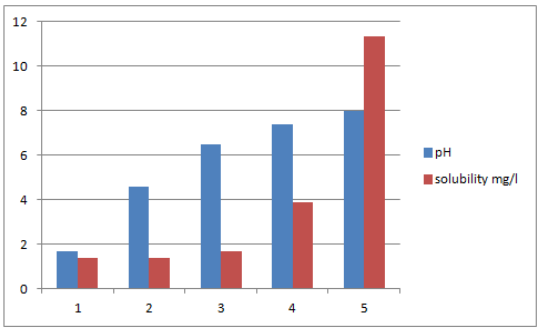


Fig.12 Column graph for Distribution of Solubility in with pH of Phenobarbital

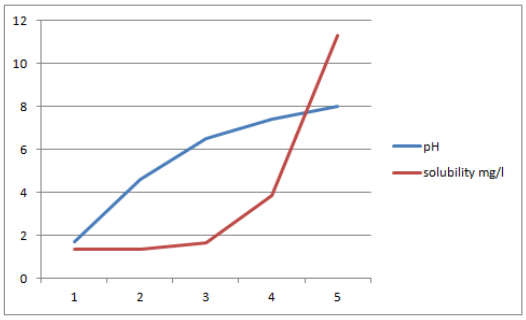
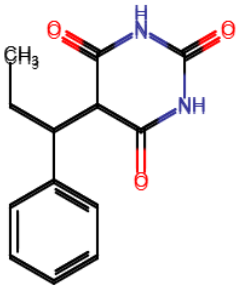


Fig. 13 Line graph for Distribution of solubility in mg/L mg/L with pH of Phenobarbital

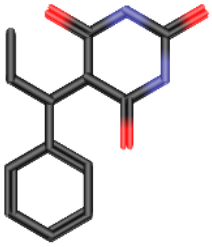
Various forms of Structure of Phenobarbital

The following figures 14a to 14e shows the various forms of structure of Phenobarbital like wire frame model, ball & stick form, stick form, space fill model and structure with with explicit hydrogens added as indicated by the chemcalise software.

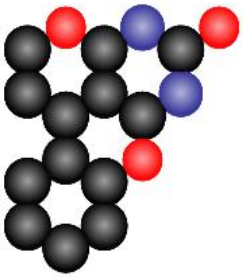


(a) wire frame form

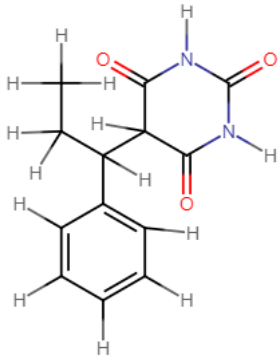
(b) ball & stick form



(c) stick form



(d) spacefill model



(e) with explicit hydrogens added

Fig.14 various forms of structure of Phenobarbital

Geometry of Phenobarbital

By using the chemcalise software the following information of vanderwaals volume, surface area ,projection area projection radius were obtained.(Table. 9)

Table. 9 Data of of volume, surface area , Projection area and Projection radius of Phenobarbital

Vanderwaals volume	**202.91A^3**
Vanderwaals surface area	**322.18 A^2**
Solvent accessible surface area	**358.58 A^2**
Topological polar surface area	**75.27 A^2**
Minimum Projection area	**41.97 A^2**
Maximum Projection area	**60.57 A^2**
Minimum Projection radius	**4.34 A**
Maximum Projection radius	**5.48 A**

^{1}H-NMR spectrum of Phenobarbital

The NMR Predictor in ChemAxon is able to predict NMR spectra for standard organic molecules containing most frequent atoms.(molecules with H,C,N,O,F,Cl,Br,I,P,S,Si, Se,B, Sn,Ge,Te andAs atoms). The chemical shifts are estimated by a mixed HOSE and linear model based on topological description scheme and are in relation to the chemical shift of tetra methylsilane (TMS = 0ppm).H Chemical shift training data were retrived for training from the NMR Shift Database. H-NMR spectrum of Phenobarbital[21] is given in the figure 15.

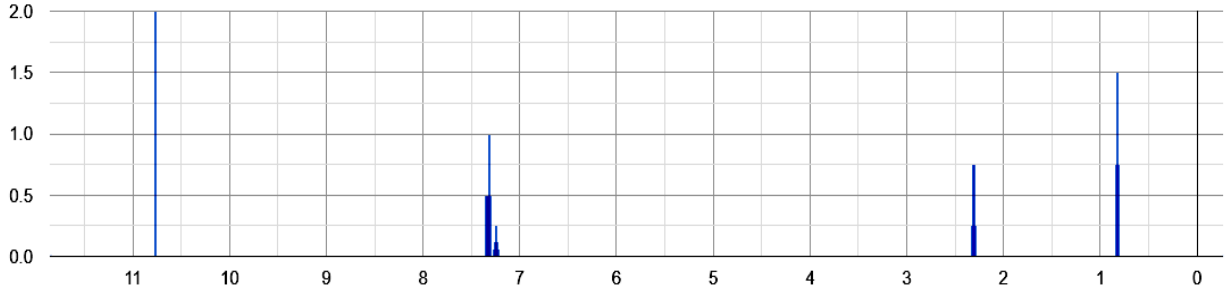
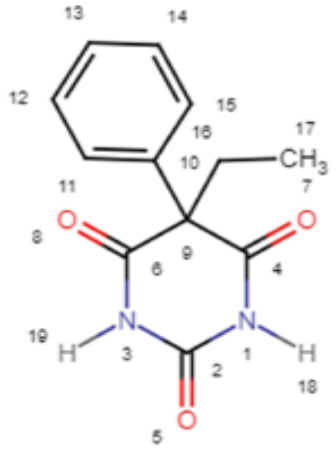


Fig.15 ^{1}HNMR spectrum of Phenobarbital

Table 10. shifts caused by the protons of Phenobarbital and the intensity and quality for each shift and corresponding protons are shown in the figure



Atoms	shift		Intensity	multiplet	Quality
17,17,17	0.83 ppm	Methyl protons	3	t	good
16,16	2.308 ppm	Aromatic protons	2	q	medium
13	7.248 ppm	Aromatic protons	1	n	good
12,14	7.320 ppm	Aromatic protons	2	t	good
11,15	7.340 ppm	Aromatic protons	2	q	good
18,19	10.772 ppm	-NH	2	s	rough

The above table 10 shows the shifts caused by the protons of Phenobarbital and it also indicates the intensity and quality for each shift. A multiplet observed at 10.772 ppm corresponds to protons of -CONH(amide groups). Multiplets observed in the range of 2.308 ppm to 7.340 ppm indicates the aromatic protons and the shift at 0.83 ppm coressponds to protons of methyl group.

CONCLUSIONS

From the chemcalise software data of pKa values and ^{1}HNMR spectral data it is clear that Phenobarbital is a strongly acidic compound with two dissociable protons. Distribution of log D, log S, solubility in mg/L with pH of Phenobarbital were intrepreted graphically and were studied in detail. The structure of Pheniobarbital in various forms is also representated and this enabled the proper intrepretation of structural features. As indicated by the geometry all the features like vanderwaals area,vanderwaals volume, projection area projection radius were obtained.

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Crime Occurrence, Prevention and Community Resilience in Rumuolumeni Community, Obio/Akpor LGA, Rivers State, Nigeria

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Abstract
This study examined the crime occurrence, prevention and community resilience in Rumuolumeni Community in Obio/Akpor LGA. Rivers State, Nigeria. One hundred and ten copies of questionnaire were administered on the residents using random sampling technique. Archived crime data were from 2011 to 2017 were also used for the study. Descripitve statistics were used for the data analysis. Findings revealed that The yearly frequency of occurrence showed that there were 1295 cases of crime in total and the highest was recorded in 2015 with 236 cases (18.2%), followed by 2017 having 231 cases (17.8%) and the next is 2016 having 210 cases (16.2%). Findings also revealed that majority of respondents were males (57.2%) and within the age brackets of 21-32 years (54.1%). The dominating contributing factor for the occurrence of crime was unemployment (44%) while age group of 21-26 years (32.3%). However, 35% agreed that crime occurred in the study area frequently, 42% agreed on the presence of gated street while 55% agreed on maintaining one entrance and exit is a major reason for the establishment of the gated street. In addition, the major security agencies in the study area remained police patrol (32%) and local vigilante (29%) while the operation was seen to be effective (66%). Crime strategies to reduce the frequency of crime can be achieved by creating employment (35%), improved police patrol (24%) and common security awareness programmes (26%). The study concluded that that the level of crime occurrence in Rumuolumeni Community is frequent and mostly committed by young unemployed people. Moreso, the crime was higher between 2015 and 2017; and it was predominated by robbery, stealing, armed robbery and assault. The study recommended that the physical environment should be provided with functional street lights; and social crime prevention programmes should be carried out to increase awareness and resilience. Re-integration programmes should also be introduced to individuals involved with criminal justice system.

Introduction
Crime is a threat to the economic, political and social security of a region, settlement, community or a nation, and a major factor associated with underdevelopment (United Nations Handbook on Planning and Action for Crime Prevention in Africa, 2008). Crime is defined as an act punishable by law as forbidden by statute or injurious to public welfare, it can be seen as an act or omission defined by the validly passed laws of a nation state in which it is occurrence attracts punishment (United Nations Office on Drugs and Crime and World Bank 2007). Crime is a demoralizing problem which affects all of us presently. Crime discourages both local and foreign investments, reduces the quality of life of its citizens, and damages relationship between citizens and states, thus undermining democracy, the rule of law and the ability of the country to promote sustainable development and peace (Abayomi, 2013). The victims of crime often suffer intimidation, injury, financial loss and so on. Those who live or work in high crime areas can be deprived of opportunities by the social and economic impact of crime. There are various forms of crimes that exit in the

world today such as arm robbery, murder, rape, kidnapping, shoplifting, assault, vehicular crime, etc. All crimes are not of the same magnitude nor attracts the same penalty, for instance, an offense of illegal parking though a crime is different compared to a crime of murder, illegal parking will attract a small fine while murder will incur a term of imprisonment. (Ekblom, 1995), explains that crime has two major elements; criminal act which is either of commission or an omission and mental element which is called the criminal intent or committed. This therefore explains that the type of crime determines the level or degree of punishment attached. Crimes inhibit the processes of planning and the ability of the government to promote development of any community, state, country or nation. Thus, it is important to note that, if planning is about making places better for people, then it has to address those elements that make places problematic for people, and crime and the fear of crime are high up in this list (Schneider & Kitchen, 2002).

Several factors that influence the incidence of crime and violence include, poverty, unemployment, inequality, intergenerational transmission of violence as reflected in the continuous witnessing of parental abuse during childhood, the rapid rate of urbanization, poor urban planning, design and management, growth in youthful population etc. (Cozens, Hillier & Prescott, 1999). In some areas, crime may be seen as a survival alternative in the face of grinding poverty, however, there are poor communities where crime levels are low because behaviour is constrained by informal social and cultural values (Farrington 1993). Although poverty is a contributing factor to crime, records and research has shown that inequality is an important underlying factor in the perpetration of crime and violence than poverty, most research has also shown that unemployed youths tend to be more involved in criminal activities, as well as being the victims of crime and violence (Cozens 2008). Poor urban planning, design and management have also play a significant role in the shaping of urban environments that put citizens and property at risk (Brantingham, 1998). Thus, the physical fabric and layout of cities have a bearing on the routine movements of offenders and victims and on opportunities for crime.

In Nigeria, the level of crime offences has been on the increase, this is caused by a host of factors. Crime rates in different states are not on the same level, there are areas where the level of crime is higher than others. Urban crime and violence are among the most significant challenges in the society today. On a daily basis violence and crime have an impact on the quality of life of individuals and communities, as well as their chances of development and the development of their potential. Crime affects human rights, stability, social relations and sustainable economic development. Can we hope to eliminate the problem of crime? Probably not, but it is rather possible to believe that crime can be controlled or prevented.

United Nations Guidelines for the Prevention of Crime, (2002) defined Crime prevention as strategies and measures that seek to reduce the risk of crimes occurring, and their potential harmful effects on individuals and society by intervening to influence their multiple causes. United Nations Office on Drugs and Crime (2011) further defines Crime prevention as any action or policy designed to influence the underlying or contributing factors that increase the risk of crime or victimisation occurring or improve actual or perceived safety. Crime prevention can also be said to be an attempt to reduce and deter crime and criminal behaviour in partnership with the community, it contributes to community safety as one part of the government's principal approach to reducing crime (Onoge, 1988). Crime prevention attempts to identify and understand why crime occurs and then addresses these causes with appropriate preventative measures.

Crime prevention is not a new idea, for as long as people have been victimized there has been attempts to protect oneself, it can be seen as a set of ideas for combating crime. Ekblom (2005) stated that crime prevention is intervention in the causes of criminal and disorderly events to reduce the risks of their occurrence and/or the potential seriousness of their consequences, it addresses both crime and its impacts on

individuals and the society. Crime prevention requires understanding and responding to both the cause of the crime and the crime itself, thus, the role of the government and the community residents are very crucial. Community crime prevention often involves the active participation of local residents and organizations in those communities and neighbourhoods. The term Community can be referred to as small neighbourhoods, areas within a city or towns or in some cases groups of citizens with particular concerns (Tilley and Laylock 2002). Community participation is essential in community crime prevention because crime and community safety issues emerge from local contexts (Goodchild, 1994). Local residents tend to experience crime problems first hand and have valuable knowledge that may be critical to the success of any crime prevention strategy. Most community crime prevention activities can be identified and driven by communities, rather than the government through community resilience.

Community resilience is defined as the ability to withstand an extreme event without suffering devastating losses, damage, diminished productivity, or quality of life without a large amount of assistance from outside the community (Gottfredson and Hirschi 1990). Resilience is a system's capacity to absorb and recover from the occurrence of a hazardous event; reflective of a society's ability to cope and to continue to cope in the future (Timmerman, 1981). Resilience factors, therefore, are those factors that diminish the potential to engage in particular behaviours. More specifically, these factors provide a buffer against exposure to risk factors and the onset of delinquent and criminal involvement. Some factors which can help to enhance the resilience of young people to engage in crime includes education, non-violent family environment, non-exposure to criminal role models, life-skills training, apprenticeship programmes, job creation schemes, good support and housing in the community (Johnson, 2005). Resilience factors interact with each other to increase resilience to criminal behaviour. The attempt to enhance the school environment as a context for fostering youth resilience to crime, this will have a diminishing effect on youth's tendency to engage with deviant peers, use and abuse alcohol and other illegal substances, as well as reduce involvement in violent and other antisocial behaviours. Similarly, when intervention strategies are geared toward reducing the levels of violence within the community, this reduction will decrease youths' susceptibility to subsequent criminal victimisation and hence provide a buffer against the onset of criminal involvement. Furthermore, nonviolent environments will also influence the development of attitudes intolerant of violence and antisocial behaviour. Crime causative factors are not only the source of crime and violence but careful understanding of these factors can also be a tool in crime prevention and the prospective for development to benefit individuals and communities.

Cities are faced with crime and the problem of insecurity cannot be overemphasized, crime is attributed to the increase in growth rate of urban population and has the ability to significantly affect the social and environmental quality and life of city dwellers. In Nigeria, Rivers State in particular, crime has wreaked havoc in the environment which has led to obstruction of development within the state. Crimes such as armed robbery, kidnapping, cultism, rape, domestic violence, pick pocketing, phone theft and many others are being committed in newer and improved means and patterns, and these criminals have also devised various ways of avoiding the watchful eyes of the security operatives. Crime portrays the inability of government to provide a safe and secure environment for lives, properties and the conduct of economic activities considering the alarming increase in criminal activities (Someren, 2013). The efficiency of urban settlements depends upon how well they are planned, how economically they are developed and how efficiently they are managed. Can we confidently say that the Government and its security institutions are doing a good job in regards to crime? Have government being committed to positively carrying out crime prevention? This has led to this research work, to examine crime prevention and resilience by discovering the prominent crimes in Rumuolumeni, analysing the causative factors and suggesting community resilience

methods aimed at reducing or preventing criminal activities in Rumuolumeni community in Obio/Akpor Local Government Area of Rivers State.

Material and Methods

The study was carried out in Rumuolumeni community in Obio/Akpor LGA, Rivers State, Nigeria. Rumuolumeni is bounded in the North by Egbelu and Diobu and Rumueme to the South West. Rumuolumeni consists of 5 host settlements namely Azumini, Minikpiti, Mgbuosimini, Mgbuodohia, and Nkpor. Much of the land is suitable for agricultural purposes and the major crops include palm oil, cassava, vegetable, maize, cocoyam, citrus, plantain, okra, yam and so on. The soil is relatively rich due to the type of soil and organic matter contents. The population of Rumuolumeni gotten from the 1991 population census statistics from the Ministry of Budget and Economic Planning Statistics of the Rivers State Government 2003 and projected to 2018 using the exponential method with a growth rate of 5.0 percent to 22,072 persons. The population is made up of 5 settlement areas which are Azumini, Minikpiti, Mgbuosimini, Mgbuodohia, and Nkpor. There is tremendous population growth as a result of migration. Rumuolumeni displays climatic characteristics that could be classified as Humid, Semi-Hot equatorial type (Gobo 1999). Generally, the state is characterized by high rainfall which decreases from South to North. Total annual rainfall decreases from about 4,700mm on the coast to about 1,700mm in extreme North of the city. The study area experience heavy rainfall from March to October and even the dry months between November to February are not free from occasional rainfall (Gobo 1999). The mean rainfall is about 2,500mm (Akintola 2000), with the extensive rainfall and the consequent reduction in the infiltration capacity of the soil due to its low permeability, flooding is commonly experienced in most homes during the rainy season which wash the soil below the earth into the drainage system.

The study area has a flat topography with inadequate drainage facility in some parts. Its elevation varies between 3m and over 15m above mean sea level (Abam, 1996). The low relief of the area is gently inclined towards the sea; thus discharges into the major natural drainages, through the Bonny river. The drainage network of rivers, streams and creeks of the study area include Bonny river, the New Calabar river and Okpokar rivers while the creeks are Elechi, Woji, Amadi and Dockyard (Ukpaka, 2016) The streams are south flowing, which are turbid during the wet season due to the discharge of clay and silt into the drainage channels. In the dry season however, the discharge and turbidity are highly reduced (Abam 1996). The study area lies on the recent coastal plain of the Eastern Niger Delta. Its surface geology consists of fluvial sediments which include the recent sediments transported by Niger river distributaries and other rivers, such as Andoni, Bonny and New Calabar rivers. These materials deposited as sediments of 30m thickness are clays, peat, silts, sands and gravels (Abam, 1996). The depositional sequence exhibits massive continental sand stones overlying an alternation of sandstones and clays of marginally marine origin, but eventually grading downwards into marine clays (Abam, 1996). Most of the activities in the study area are oil and gas due to the various companies located within the study area such as Frigate Upstream and Energy services limited, Pelfaco Jetty, Aveon Offshore limited, Saipem Contracting Nigeria limited, Master Energy, Liquid Bulk company limited, Moriban Sand mining company limited, Eastern Bulkcem company limited which involves building materials, cement manufacturing and so on. The study area also contains Delmar Marine Company Limited which is the first indigenous tank farm in the State. The study area is also a mix used residential area with a significant amount of local businesses and informal sector activities. The population of Rumuolumeni was 9027 (1991 population census statistics from the National Population Commission (2003) and projected to 2018 using the exponential method with a growth rate of 5.0 percent to 22,072 persons. The population was made up of 5 settlement areas (Azumini, Minikpiti, Mgbuosimini, Mgbuodohia, and Nkpor). To ensure that each settlement is fully represented in the sample size, the researcher used the formula of Taro Yamane to determine the number of questionnaires to be allocated to

each sampled settlement i.e. Azumini, Minikpiti, Mgbuosimini, Mgbuodohia and Nkpor. Secondary data on frequency and types of crime from 2011 to 2017 were collected from Rumuolumeni District Police Station. Copies of questionnaire were administered using a random sampling technique. Descriptive in form of frequency and percentages were used for data analysis and findings are presented in tables and charts. All data were analysed using Statistical Package for Social Sciences (SPSS 20.0).

Results and Discussions

Temporal Analysis of Crime in Rumuolumeni from 2011 to 2017

Table 1 presents the types and frequency of occurrence of crime in Rumuolumeni Community from 2011 to 2017. Ten types of crime were identified over time with stealing, armed robbery, assault and robbery dominating (Figure 1). The yearly frequency of occurrence showed that there were 1295 cases of crime in total and the highest was recorded in 2015 with 236 cases (18.2%), followed by 2017 having 231 cases (17.8%) and the next is 2016 having 210 cases (16.2%) (Figure 2).

Table 1. Types and Frequency of Crime in Rumuolumeni from 2011 to 2017

CRIME TYPE	2011	2012	2013	2014	2015	2016	2017	Total	Percentage (%)
Armed Robbery	19	22	27	42	38	50	42	240	18.5
Assault	22	19	24	31	27	33	41	197	15.2
Cultism	13	21	18	13	28	15	19	127	9.8
Forgery & Altering	9	6	12	15	13	11	16	82	6.3
Kidnapping	3	6	7	5	9	8	6	44	3.4
Murder	3	5	9	6	10	7	8	48	3.7
Robbery	11	15	13	18	26	23	28	134	10.3
Sex Offences	10	13	6	11	14	8	9	71	5.5
Stealing	25	30	36	32	50	42	46	261	20.2
Vehicular Crime	8	11	9	13	21	13	16	91	7.0
Total	123	148	161	186	236	210	231	**1295**	100.0
Percentage (%)	9.5	11.4	12.4	14.4	18.2	16.2	17.8	100.0	

Source: Rumuolumeni Divisional Police Crime Records (2018)

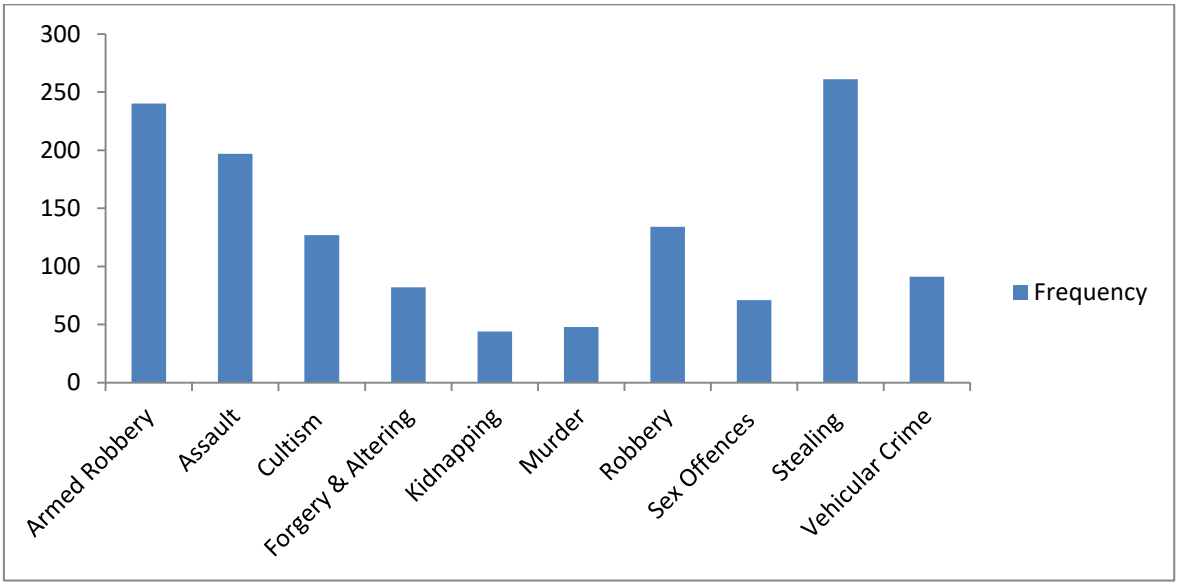

Figure 1. Total Frequency of the Types of Crime from 2011 to 2017

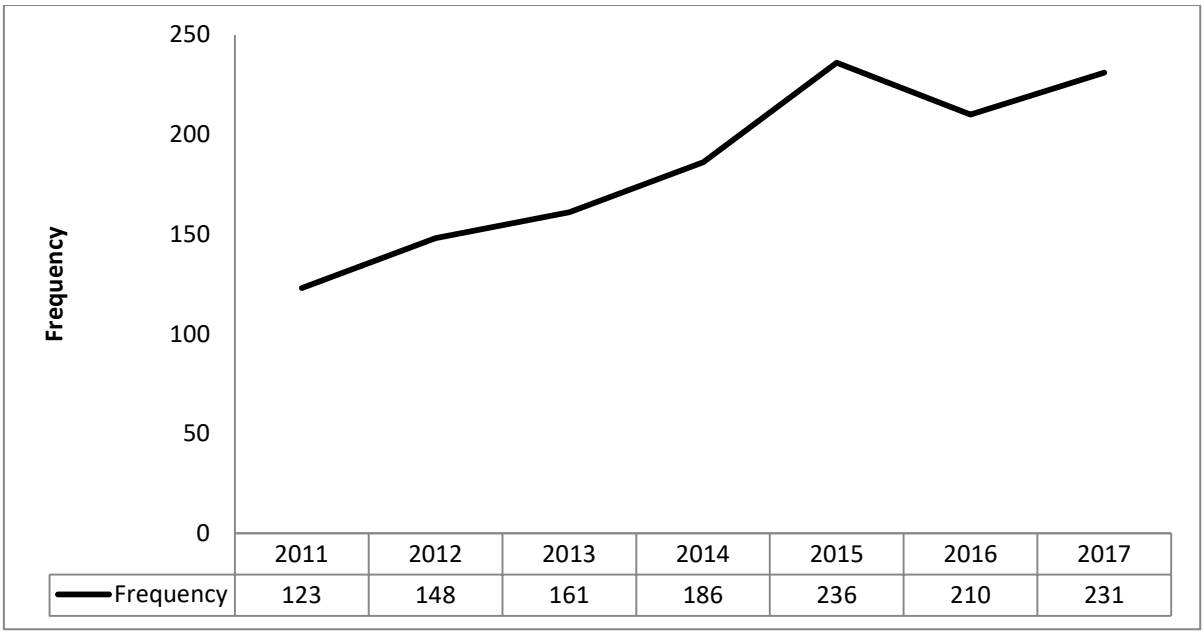

Figure 2. Temporal Frequency of Crimes in Rumuolumeni from 2011 to 2017

Socio-economic Characteristics of Respondents

Table 2 shows that 57% of the respondents were male while 43% of the respondents were female which means more responses was gotten from the male gender, the marital status showed that that 44% of the sample population consisted of married individuals while and 40% of the respondents were still single. Findings also indicated the various age groups of the sample population 29 respondents were within the ages of 27-32 years of age which was the highest in ranking followed by those within 21-26 years of age, the least was those within the age group of 52 years and above which constituted 3 respondents. The sample

population comprises of individuals with various occupations such as Businessmen/women (34%) which was the highest followed closely by Artisans (26%), students were the least with 18% of total respondents. Lastly, the table shows the level of income of respondents 27% of the respondents earned within₦100,000 & above and the least were those within the ₦61,000-₦70,000 range (6.2%). In other words, the fact is that the study area was dominated by employed and self-employed persons which confirm the statement that the neighbourhoods are mainly populated by people of medium income category.

Table 2. Demographic Analysis of Respondents

Demographic	**Frequency**	**Percentage (%)**
Sex		
Males	55	57.2
Females	41	42.7
Total	96	100.0
Marital Status		
Single	38	39.5
Married	44	45.8
Divorced/ Separated	8	8.3
Widowed	6	6.3
Total	96	100.0
Age (Years)		
15-20	12	12.5
21-26	23	23.9
27-32	29	30.2
33-38	11	11.4
39-45	13	13.5
46-51	5	5.2
52 & Above	3	3.1
Total	96	100.0
Occupation		
Businessman/ Woman	33	34.4
Civil servant	21	21.9
Students	17	17.7
Artisan	25	26.0
Total	96	100.0
Monthly Income		
Less than ₦20,000	-	-
₦21,000 - ₦40,000	11	11.4
₦41,000 - ₦60,000	19	19.7
₦61,000 - ₦70,000	6	6.2
₦71,000 - ₦80,000	10	10.4
₦81,000 - ₦90,000	19	19.7
₦91,000 - ₦100,000	5	5.2
₦100,000 & Above	26	27.1
Total	96	100.0
Level of Education		
Non Formal Education	5	5.2
Primary Education	2	2.1
Secondary Education	26	27.2
Tertiary Institution	63	65.6
Total	96	100.0

Length of Living Crimes committed in Rumuolumeni community

Figure 3 shows the length of period the respondents have lived in Rumuolumeni community. 32.2% of the respondents had lived within the study area for 7 years and above, it was followed closely by 28.1% who affirmed to have lived within a period of 3-4 years and the least was 15.6% who had lived in Rumuolumeni community within a period of 1-2 years.

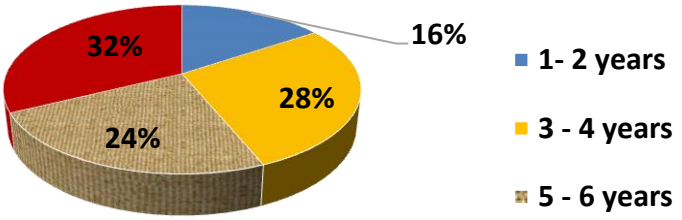

Figure 3: Length of Living Period of Respondents

Indigenous Status of Respondents

Figure 4 shows the numbers of respondent that are from the community, 63.5% of the sample population were not indigenes of the community while the remaining 36.4% of the respondents were indigenes of Rumuolumeni community.

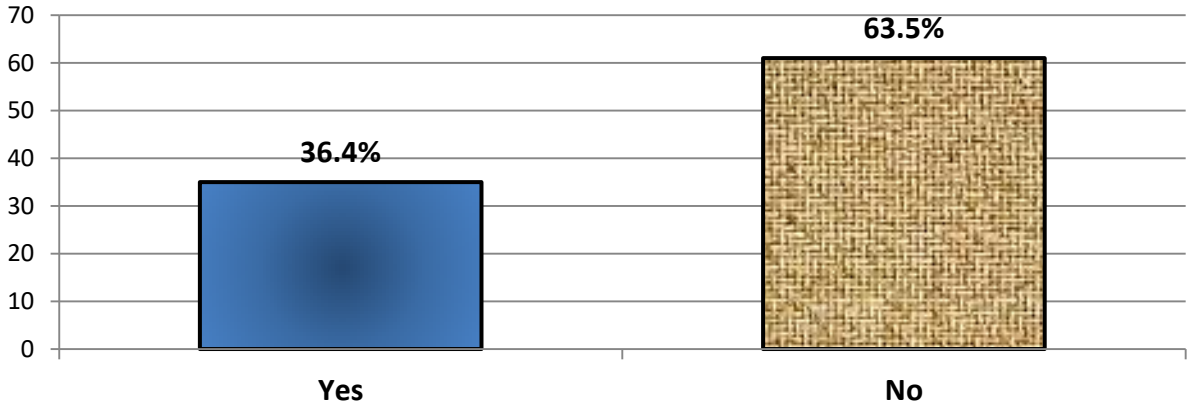

Figure 4. Indigenous Status

Safe Neighbourhood

Figure 5 shows the perception rating of safety of neighbourhood, 67.7% agreed that their neighbourhood was safe while the remaining 32.3% respondents disagreed on the safety of their neighbourhood. This means that most of the settlements in Rumuolumeni community is safe based on the perception of the respondents.

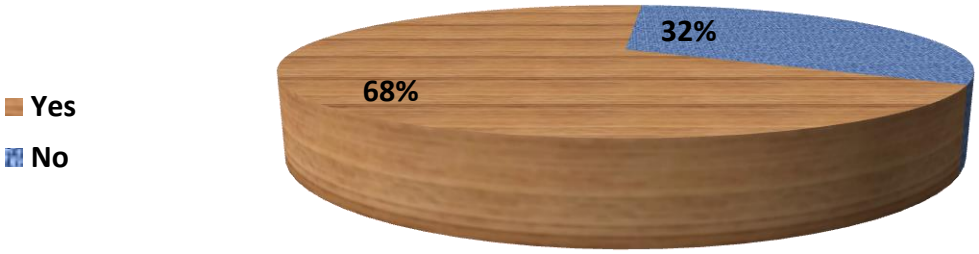

Figure 5. Safe Neighbourhood

Predominant Crime in the area

Figure 6 reveals the various crimes committed in Rumuolumeni community. 31% of the respondents stated that domestic violence was the most frequent form of crime. In the same manner, 21.8% agreed that armed robbery was the second most occurring crime in the area; while very few, 7.2% ticked kidnapping which had the least occurrence. This observation implies that the form of crime with the most occurrence are domestic violence and armed robbery respectively

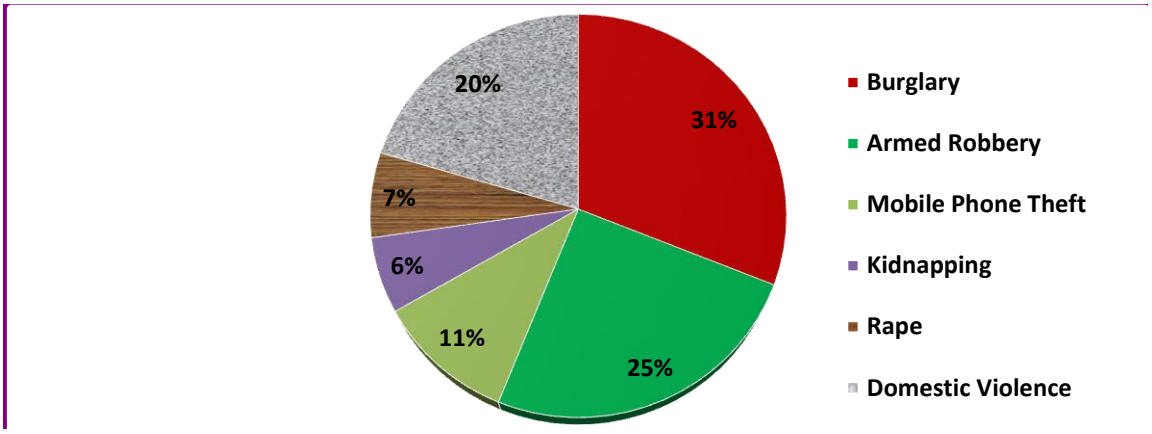

Figure 6. Dominating Type of Crime

Contributing Factors to Crime in Rumuolumeni Community

Figure 7 shows the responses given by the respondents as regards the various factors that led to crime in the study area and it was indicated that 44% agreed on unemployment, 20% affirmed to peer pressure, 12% selected hard drugs and the least was political influence with 7%. This shows that unemployment is a major cause of crime in Rumuolumeni community which implies that there is the dire need for the creation of employment opportunities for the individuals in Rumuolumeni to prevent them from involving themselves in various criminal activities.

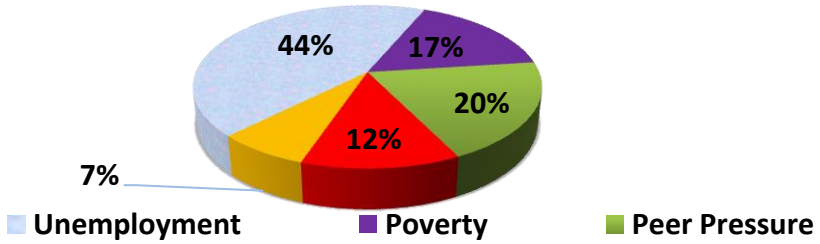

Figure 7. Factors affecting Crime in Rumuolumeni

Availability, Provision and Functionality of Street Lights

Table 3 shows the availability, provision and functionality of street lights in Rumuolumeni. The analysis indicated that a greater number of the sample population lacked street lightings in their various neighbourhoods while the remaining respondents claimed that street lights were present in their neighbourhood although they weren't all in a functional state.

However, the responses given by those who had street lights in their areas of residence and 30% responded that street lights was provided by the government, 19% stated that it was mounted through community effort and the remaining 51% respondents affirmed that it was fixed privately by contributions made in their various streets. Furthermore, 57% of respondents affirmed that the street lights in their neighbourhood was

functional while the remaining 43% responded that the street lights in their neighbourhood was not working properly which made committing crime more efficient and easy within the community.

Table 3. Availability, Provision and Functionality of Street Light

Availability of Street Light	Frequency	Percentage (%)
Yes	37	37
No	59	59
Total	96	100
Provision of Street Light		
Government	29	30
Community Effort	18	19
Private	49	51
Total	96	100
Functionality of Street Light		
Yes	55	57
No	41	43
Total	96	100

Age group of most involved in criminal activities

Figure 8 shows that the 32% of the respondents agreed that the individuals most involved in criminal activities were between 21–26 years of age followed by those within the age group of 15 – 20 years which were involved in petty crimes such as phone theft, gang affiliations, phone theft, shoplifting etc. Those within 27–32 years had 23%, 39–44 years had a total of percentage of 8%, while the least were those within the ages of 45 – 50 years and 51 years & above respectively. This data indicates that age group of 21–26 years make up majority of the age group more inclined to involve in crime when compared to the other age groups in Rumuolumeni community.

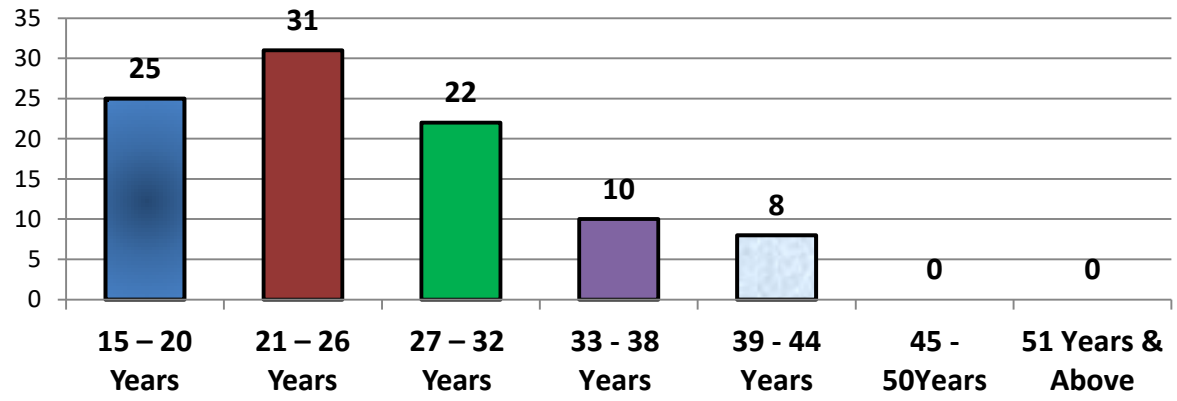

Figure 8. Age group most involved in criminal activities

Occurrence of crime, Presence of Peak Crime Period and Victims of Criminal Activities in Rumuolumeni community

Table 4 shows the respondents' view on how often criminal activities happen, presence of peak crime period and victims of criminal activities in Rumuolumeni community. The analysis shows that 54.1% respondents affirmed crime seldom took place, 26% stated frequently and lastly 19.9% of the sample population indicated very frequently.

Responses were given if there were periods when crime was on the increase in Rumuolumeni community and it shows that 67% agreed that there is always a peak period while the remaining 33% of the sample population disagreed. On the experience of being a victim of criminal activities in the study area, 33% have been victims of these activities while 67% have had no experience of criminal activities in the study area so far.

Table 4. Occurrence of crime, Presence of Peak Crime Period and Victims of Criminal Activities in Rumuolumeni community

Occurrence of Crime	**Frequency**	**Percentage (%)**
Seldom	52	54
Frequently	25	26
Very Frequently	9	9
Total	**96**	**100**
Presence of Peak Crime Period		
Yes	64	67
No	32	33
Total	**96**	**100**
Victims of Criminal Activities		
Yes	32	33
No	64	67
Total	**96**	**100**

Level of Security Consciousness in Rumuolumeni

Gated Street and Reasons for Gated Street

Table 5 shows the neighbourhood street that is gated due to security challenges, 42% claimed that streets were gated while the remaining 58% said their streets were not gated. The analysis in Table 4 also shows that the 55% streets were gated due to burglary activities, 30% to regulate security and 15% to maintain one entrance and exit to enforce curfew within the area.

Table 5. Presence and Reasons for Neighbourhood Gated Street

Presence of Gated Street	**Frequency**	**Percentage (%)**
Yes	40	42
No	56	58
Total	96	100
Reasons for Gated Street		
Burglary Activities	14	15
Regulate security	29	30
Maintain one entrance and exit	53	55
Total	96	100

Security agencies operational and Level of Effectiveness of Security Agency

Table 6 shows the various security agencies present in Rumuolumeni community police patrol occupied 29%, private security 32%, local vigilante 18% and 21% of the respondents has no security whatsoever in their area of residence. This means that the most prominent is police patrol. However, responses when asked to rate the effectiveness of the security agencies in Rumuolumeni community, 42% of the sample population

stated that security agencies were effective, 24% responded that they were very effective while 34% of the sample population stated that they were ineffective due to the fact that they did very little in some specific areas within the community.

Table 6. Operation and Level of Effectiveness of Security Agencies

Security Agencies Operational	**Frequency**	**Percentage (%)**
Police Patrol	31	32
Local Vigilante	28	29
Private Security	20	21
None	17	18
Total	**96**	**100**
Level of Effectiveness		
Effective	41	43
Very Effective	22	23
Not Effective	33	34
Total	**96**	**100**

Availability of Police station and Rating of Police Services

Table 7 presents the analysis on the availability of police station and rating of police services in Rumuolumeni and findings show that 57.2% out of the sample population affirmed that police post was available not far from their residence while the remaining 42.8% responded negatively. Thus, the rating of police services in Rumuolumeni community by the respondents shows that 51% stated police services in the area was average, 31.3% selected good while the remaining 17.7% respondents said police services was poor.

Table 7. Availability of Police Station and Rating of Police Services

Availability of Police Station	**Frequency**	**Percentage (%)**
Yes	55	57.2
No	41	42.8
Total	**96**	**100**
Rating		
Good	30	31.3
Average	49	51
Poor	17	17.7
Total	**96**	**100**

Crime Prevention Measures and Strategies in Rumuolumeni Community

Table 8 shows the crime precaution/ reduction measures taken which includes the use of car alarms/ trackers, burglary proof, metal bars and Electric fence, this means that the sample population has employed various means of protecting themselves against crime. The opinion of residents on how to reduce criminal activities in Rumuolumeni community shows that 35% of the respondents agreed on creation of employment opportunities which will assist in equipping those involved in these criminal activities with alternative ways of fending for themselves which was is the most preferred approach by the sample population in reducing criminal activities, 24% acknowledged that Police patrol at night should be improved or carried out more often in a bid to reduce the continuous occurrence of burglary, armed robbery, rape and

other forms of crime which tends to take place at night in most cases. The chart also indicates that 15% of the sample population opined that the proper planning of the physical environment would also assist in reducing the tendency of engaging criminal activities within the community, lastly 26% affirmed that community security awareness programmes should be carried out to enlighten the residents on crime reduction measures that should be applied to reduce the occurrence of crime in the area.

Table 8. Crime prevention measures and strategies to combat crime occurrence

Measures	**Number**	**Percentage**
Metal Bars	33	34.3
Electric Fence Razer	10	10.4
Car Alarm/ Tracker	14	14.5
Burglary Proof	39	40.8
Total	**96**	**100**
Strategies		
Creation of employment	34	35
Improve Police Patrol	23	24
Proper planning of environment	14	15
Community security awareness programmes	25	26
Total	**96**	**100**

Discussion of Findings

Socio-economic characteristics of respondents were generally in accordance with the data gotten from the field. The monthly income category the bulk of respondents earned ₦100,000 & above which constituted 27% of sample population and the least was a total of 6.2% which fell within the range of ₦61,000-₦70,000. In other words, the fact is that the study area was dominated by employed and self-employed persons. This confirms the statement that the neighbourhoods are mainly populated by people of medium income category. It was evident that burglary associated crime is the most occurring type of crime in Rumuolumeni community as the respondents complained that their houses and shops were constantly under attack. Pertinent data on crime was gotten from respondents 32.3% which had resided in the community for a period of 7 years and above which had a good understanding of crime in the study area. Indigenes constituted 36.4% from the sample population which means that the study area is made up of both indigenes of the community and non-indigenes of Rumuolumeni community.

It was observed that unemployment is the major cause of the increase in crime rate in Rumuolumeni community which implies that there is the dire need for employment opportunities for individuals to prevent them from getting involved in criminal activities. Also, it was observed that most neighbourhoods are not properly planned and the absence of functional street lights at night can also be contributing factors to certain crimes which takes place at night and therefore should also be taken into consideration when carrying out crime prevention in Rumuolumeni community. Findings have indicated that the individuals most involved in criminal activities were within the age group of 21-26 years which involved themselves in petty crimes such as shoplifting, phone theft, gang affiliations and others which happen at peak periods in the community of which 33% of the sample population had been victims of such crimes in the study area. Police patrol should be improved on and carried out more frequently to reduce the continuous occurrence of crime in Rumuolumeni community. Findings show that due to the continuous increase in crime rate the initiation of gated neighbourhoods by residents as a measure to relief the feeling of insecurity by ensuring the control of access within their neighbourhoods and regulate security. Residents have also taken proactive measures such as by the use of electric fence, metal restrictive bar, burglary proof, installing vehicular alarm/ tracker among others in a bid to secure their properties. Irrespective of government efforts in securing life and property, local

residents are involved in ensuring their own security consciousness by engaging in local vigilante groups and private security agencies by the high income earners. The physical environment of the study area reveals that the neighbourhoods is unplanned, characterised by darkness at night owing to the fact that they are few street lights in the area provided by the Government, the community and private individuals contributions in their various streets and most are not functional and the areas without street lights tend to aid the occurrence of crime in the study area. Majority of the sample population agreed that their neighbourhood was safe despite the increase in crime rate in the area. In creating a functional, safe and workable urban environment in Rumuolumeni community capable of preserving lives and properties, the various problems noted during the research such as insecure neighbourhoods should be taken into consideration and addressed through planning and designs capable of dealing with safety issues.

Conclusion and Recommendations

It can be concluded that the level of crime occurrence in Rumuolumeni Community is frequent and mostly committed by young unemployed people. Moreso, the crime was higher between 2015 and 2017; and it was predominated by robbery, stealing, armed robbery and assault. The study recommended that:

- community policing should be taken strictly as a very effective way to regulate the urban environment and to prevent crime as well as to develop a positive interaction with the population and alternative community service can be implemented.
- government should improve on the quality of life of its citizens by creating employment for the youths and unemployed
- the police should take it as a point of duty to prosecute offenders accordingly in line with the law and on time.
- government should equip the police and other security agencies so they can effectively combat crime.
- the issue of crime and crime prevention strategies should be considered in the long term vision and in the integrated development plan of the area
- support should be carried for children, women, youth, the elderly and victims of crime and various initiatives should be set up in this regard which should entail mentoring, training, recreational, cultural and sports activities.
- sustainable community safety and crime prevention should be encouraged in providing a safe and peaceful environment for city dwellers by calling for all stakeholders to contribute to the successful implementation of these crime prevention initiatives.
- small groups constituting of adults and youths, often unemployed usually between 19 and 30 in numbers should undergo training on crime prevention and often given allowance taken from the contributions collected on a monthly basis from the households in the community.
- Gated neighbourhoods should be encouraged as it creates a sense of territory on the parts of the residents
- re-integration programmes should be introduced as it is not functional in this part of the world, re-integration has to do with all programmes that relating with individuals already involved in the criminal justice system, it is concerned with equipping them with various conflict resolution skills, life-skills training, education, apprenticeship programmes, job-creation schemes, good support and housing in the community all in a bid to assist with their recovery and prevent them from involving themselves in crime again.
- the government and planning agencies should work with the community in providing layout plans, this will improve the quality of life of citizens by providing adequate housing, functional street lights in a bid to reduce the opportunities available for individuals to commit crime.

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Scientific Aptitude and Academic Achievement: A Study on Tribal Students

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Abstract- The present study used the descriptive-correlation research design, the study aimed to examine the relationship between the scientific aptitude and academic achievement in science of tribal 12th grade students. The population of the study comprised of 298 class-XII science students from nine Govt higher secondary schools. Out of all the 298 class-XII science students, the researcher selected 221 12th grade science students through random sampling technique. Pearson's product moment were used to treat the data as statistical tool. Finding shows that except for the science vocabulary, all other dimensions of scientific aptitude such as reasoning, numerical ability and scientific vocabulary shows moderate positive correlation with academic achievement in science. Science vocabulary alone showed low but positive correlation. Therefore, pertaining to overall scientific aptitude and science achievement of govt higher secondary school 12th grade student positively co-related to each other.

Index Terms- Scientific Aptitude, Academic Achievement, Tribal Students

I. Introduction

Scientific aptitude plays a vital role in science education and in the lives of students pursuing science education. The first and foremost aspect of the present study is to examine the influence and important of scientific aptitude of students on their achievement in science.

Aptitude is a component of a competency to do a certain kind of work at a certain level. Outstanding aptitude can be considered "talent". Aptitudes may be physical or mental. Aptitude is inborn potential to do certain kinds of work whether developed or undeveloped. Ability is developed knowledge, understanding, learned or acquired abilities (skills) or attitude. The innate nature of aptitude is in contrast to skills and achievement, which represent knowledge or ability that is gained through learning. Aptitude is a special skill or ability in a person to perform a particular task in a better way. It differs from general intelligence.

The aptitude was distinguished from general intelligence and was considered as the capacity to acquire proficiency with the given amount of training, formal or informal, likewise scientific aptitude is concerned with proficiency in science. Scientific aptitude includes curiosity, observation, identification, description, experimental investigation, and theoretical explanation of phenomena. Factors such as creative abilities, capacity for critical thinking, ability to see relationships, open-mindedness, suspended judgment, physical development, social and emotional maturity, moral character, interest, attitudes and skills were also facets of scientific aptitude. And these factors may be immensely responsible for achievement in science which will helps in tracing out the problems concerned in study.

The present study aims to understand scientific aptitude as determinants of achievement in science. There are many studies conducted on science achievement and scientific aptitude. One study conducted by Stanly S. Leo, (2016) on achievement of science shows that the level of scientific aptitude is low of standard ix students in Pondicherry region as their mean score 38.64 is below low average. The study also found that girls and boys differ significantly in their scientific aptitude and achievement. Manichander, T, Brindhamani, M, (2014) on Academic achievement and scientific aptitude among the students of standard X revealed that the aided school students are having higher scientific aptitude as compared to the government school students. The urban school students are having higher scientific aptitude as compared to the rural school students. The female students are having higher scientific aptitude as compared to the rural schools students. The urban school students are having higher academic achievement in science as compared to the rural school students. Rao, Digmurthy Bhaskara, (1990), has also conducted a research study entitle "A comparative study of scientific attitude, scientific aptitude and achievement in biology at secondary school level". The study found that scientific aptitude in secondary school pupils was average. The pupils of private schools, residential schools, English medium schools and urban schools held a bit more scientific aptitude. There was also a highly significant and positive association among scientific aptitude and achievement in biology. The achievement in biology was average. The rural schools, residential schools, English medium schools and government schools were better achievement. As such many studies were conducted on secondary school level thereby few reviewed were conducted on higher secondary level. Therefore, it is very much necessary to look into the various determinants which affect science achievement in higher secondary level.

II. Statement of the Problem

"Scientific Aptitude and Academic Achievement: A Study on Tribal Students".

Operational terms used

1. **Scientific Aptitude:** It refers to the score obtained in SABT manual by the class-XII science students.
2. **Academic Achievement in science:** The term achievement refers to the mark score on final examination of class-XII science students.
3. **Tribal Students:** Students belonging to scheduled tribes of Arunachal Pradesh.

Objectives of the Study: The main objectives of the study are put as under:

1. To find out the relationship between the academic achievement of 12th grade students in science subject and their scientific aptitude.
2. To find out the relationship between academic achievement of 12th grade students in science subject and different variables of scientific aptitude.
3. To find out the relationship between the academic achievement of 12th grade students in different science subject and their scientific aptitude.

Hypotheses of the study

1. There will be no relationship between the academic achievement of 12th grade students in science subject and their scientific aptitude.
2. There will be no relationships between academic achievement of 12th grade students in science subject and different variables of scientific aptitude.
3. There will be no relationships between the academic achievement of12th grade students in different science subject and their scientific aptitude.

Methodology:

The present study adopts descriptive survey method of educational research.

Population: The population of the present study comprised of 229 class-XII science students of Govt higher secondary school.

Sample: Out of all the 229 class-XII science students, the researcher selected 221 science students through random sampling technique.

Tools used:

4. Scientific Aptitude Test Battery (SATB) developed by Agarwal K.K and Aurora, S. (2005)
5. Mark scored on final examination of class-xii science students.

Statistical technique used:

The data obtained were analysed by employing Pearson's Product Moment Method, 'r-technique was used to employ to find out the relationship between the academic achievement of 12th grade students in science and their scientific aptitude.

III. Result and Interpretation:

Objective 1: To find out the relationship between the overall Academic Achievement of 12th Grade Students in Science and their Scientific Aptitude.

Hypothesis 1: There will be no relationship between the Academic Achievement of 12th grade Students in Science Subject and their Scientific Aptitude.

The following table shows the coefficient of correlation between academic achievement of 12th grade students in science subject and their scientific aptitude.

Table 1.1: Correlation between Academic Achievement and Scientific Aptitude

Variables	Mean	SD	df	Computed r	Description
Academic Achievement	208.12	65.95	(2, 219)	0.67	Moderate
Scientific Aptitude	188.36	41.59			

Interpretation of the result

The mean and the standard deviation of academic achievement of 12th grade students in science and their scientific aptitude were calculated as 208.12, (65.95) and 188.36, (41.59) respectively. This indicates that the overall academic achievement and scientific aptitude of 12th grade students fall in average category. A low standard deviation indicates that the marks scored by 221 12th grade students in science subject and scientific aptitude scale tend to be very close to the mean scores.

From the above table **1.1**, it can be clearly observed that there exists moderate positive relationship between overall academic achievement of 12th grade students in science and their scientific aptitude, r =0.66 with df (2, 219). These positive relationships imply that as any of the variables increases, then the 12th grade students' academic achievement in science increases and vice-versa.

Objective 2: To find out the relationship between Academic Achievement of 12th Grade Students in Science Subject and different variables of Scientific Aptitude.

Hypothesis 2: There will be no relationships between Academic Achievement of 12th Grade Students in Science Subject and different variables of Scientific Aptitude.

Table 2.1: correlation between Academic Achievement and different variables of Scientific Aptitude

Variables		Mean	SD	df	Computed r	Description
Academic	Reasoning ability	35.83	12.72	(2,219)	0.67	Moderate
	Numerical ability	22.24	8.14		0.49	Moderate
	Scientific information ability	45.48	14.13		0.47	Moderate

Scientific vocabulary ability	84.81	20.77	0.39	Low

Interpretation of the Result

The mean and the standard deviation of academic achievement of 12th grade students in science and different variables of their scientific aptitude were calculated. The mean of reasoning ability, numerical ability, scientific information ability and scientific vocabulary ability were found as 35.83, 22.24, 45.48 and 84.81 respectively. A low standard deviation indicates that the marks scored by 221 12th grade students in science subject and different variables of scientific aptitude scale tend to be very close to the mean scores.

From the above table **2.1**, it can be clearly observed that academic achievement of 12th grade students in science subject and different variables of scientific aptitude scale shows moderate positive correlation with df (2, 219) except for the scientific vocabulary ability. These positive relationships imply that as reasoning ability, numerical ability and scientific information ability increase then the 12th grade students' academic achievement in science increases and vice-versa. The relationship between academic achievement of 12th grade students in science and scientific vocabulary is low.

Table A: Correlation Matrix between Achievement of 12th Grade Students in Science and Scientific Aptitude

Variables	*Overall Academic Achievement*	*Overall scientific Aptitude*	*Reasoning test*	*Numerical test*	*Science information test*	*Science vocabulary test*
Overall Academic Achievement	1					
Overall scientific Aptitude	**0.6574**	1				
Reasoning ability	**0.6721**	**0.7283**	1			
Numerical ability	0.4987	**0.6321**	0.4389	1		
Science information ability	0.4744	**0.7571**	0.4588	0.4631	1	
Science vocabulary ability	0.3866	**0.7936**	0.3619	0.2898	0.3732	1

Interpretation of the Result:

From the above matrix table **A**, it can be clearly observed that there exists significant positive relationship between overall academic achievement of 12th grade students in science and their scientific aptitude, r =0.66 with df (2, 219). These positive relationships imply that as any of the variables increases, then the 12th grade students' academic achievement in science increases and vice-versa. Except for the science vocabulary all the other variables such as reasoning ability, numerical ability and science information show moderate positive correlation with achievement of 12th grade students in science subject. However, science vocabulary shows low but positive correlation and hence no strong association with academic achievement. Regardless of 12th grade students' science vocabulary, academic achievement may be low, average or high.

Objective 3: To find out the relationship between the academic achievement of 12th grade students in different science subject and their scientific aptitude.

Hypothesis 3: There will be no relationships between the academic achievement of12th grade students in different science subject and their scientific aptitude.

Table 3.1: Correlation between Scientific Aptitude and different Science Subject

Variables		df	Mean	SD	Computed r	Description
Scientific Aptitude	Achievement in Physics	(2,219)	48.36	17.44	0.54	Moderate
	Achievement in Chemistry		51.27	17.59	0.71	High
	Achievement in Biology		57.14	17.71	0.72	High
	Achievement in Maths		50	19.56	0.36	Low

Interpretation of the Result:

From the above table it is observed that:

From the above correlation table **3.1**, it can be clearly observed that there exists significant positive relationship between scientific aptitude and academic achievement of 12th grade students in different science subject. The calculated r value for physics, chemistry, biology and mathematics was found to be 0.54, 0.71, 0.72 and 0.36 respectively at df=(2, 219). These positive relationships imply that as scientific aptitude scores increases, then the 12th grade students' academic achievement in

different science subject such as physics, chemistry, biology and mathematics increases and vice-versa.

Result also indicates that correlation between scientific aptitude and achievement in chemistry and biology subject are high while correlation between physics and mathematics subject showed moderate and low but positive relationship respectively.

IV. Discussion and Conclusion:

The present study was undertaken to analyze the scientific aptitude and science academic achievement of tribal population and also attempt was made to find out any relationship between different science subject such as physics, chemistry, biology and mathematics.

From the above findings, it is evident that the relationship between overall scientific aptitude and academic achievement of tribal students was found to be positive (r-0.67). This shows that higher the scientific aptitude better will be the science achievement. The studies also revealed that the other dimension of scientific aptitude like, reasoning, numerical ability, science information and scientific vocabulary shows positive correlation and affect the students' academic achievement. Therefore, pertaining to overall scientific aptitude and academic achievement among tribal students of 12th grade students showed low to moderate correlation. It means that the student who have high scientific aptitude may achieved higher marks in science subject as the findings of the study revealed that scientific aptitude and academic achievement in science subject are positively correlated to each other. The studies conducted by Synrem E.,and Syiem Ibadani S., (2018), Standly (2016), Hilal A, and Omer E.,(2008), and Esther Sui Chu Ho, (2006) shows positive relationship between scientific aptitude and science achievement.

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Development of Science Learning Based on Pemaknaan Learning Model to Train Moral Sensitivity of Senior High School Students in Genetic Substance.

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Abstract- Research was aimed to developed science learning with pemaknaan learning model on subject matter genetic substance through 4-D models to train moral sensitivity of Senior High School and tested on 15 students of SMAN 10 Samarinda with one group pretest-postest design. Analyzed by descriptive quantitative-qualitative and the result are: (1) Validity of *the syllabus, lesson plans, worksheets, BAS, and THB* very valid category (3,68); (2) practicality based on: a) Feasibility of instruction good category (88,89%), b) The response of students positively (98%); (3) Effectivness based on: a) The students' activities that stand out in the high category are paying attention to explanations, asking questions, holding discussions with groups to make sense, b) Moral sensitivity increase (N-Gain: quite-sensitive category). Conclusion of this research was science learning which developed based on pemaknaan learning model, feasible and can be used to train moral sensitivity of senior high school in genetic substance.

Index Terms*-Science learning, Pemaknaan model, Moral sensitivity, Genetic substance*

I. Introduction

The progress of information technology and globalization is causing rapid changes in human life. Progress in the field of education produces intelligent human beings as indicated by the rapid development of science and technology itself. But on the other hand there is a shift in values, attitudes and morals and national character. The influence of technology easily penetrates into the doors of the family which were originally built with modesty or into family rooms which were originally full of moral norms (Yuliana, 2010). Some negative phenomena that have surfaced today include student fights, drugs, corruption, plagiarism, cheating in examinations and various community upheavals (Kemendikbud, 2013; Oemar, 2013; Rachmawati, 2014). These symptoms are contrary to the ideals of national education in shaping Indonesian people who have personality and noble character.

Education is an effort to anticipate global change and the flow of information towards the negative influence of morals and national character. This is stated in Law number 20 of 2003 concerning the National Education System. According to the 2013 curriculum implementation, character education can be integrated in all learning in each field of study contained in the curriculum. (Mulyasa, 2013). Integration in question includes loading values into substance on all subjects and implementing learning activities in every activity inside and outside the classroom (Marshall and Caldwell, 2011).

Related to moral degradation and its relation to education as an effort to overcome it. Ibrahim (2014) mentions the results of a survey conducted in schools that there are two main issues which are the main issues related to this, namely (1) learning outcomes which include positive attitudes, noble attitudes, and character and skills to live independently have not been taught " deliberately "(by design). Learning outcomes such as this are generally only achieved as a concurrent effect (nuturans effect), (2) the teaching and learning process has not been carried out as expected. Learning is still centered on teachers and students as objects, is passive and lacks motivation.

In connection with the above, the idea arises that the teaching of a positive attitude, noble character, and character can be integrated with science. In this regard researchers are interested in developing learning devices. Learning that is used is not only oriented to academic intelligence alone, but can also be used to teach and develop the positive character of students. The learning tool in question is a Biology learning device model of meaning.

The meaningful learning model is a learning model through examples and examples of the relevance of events, symptoms or phenomena that have the potential to be used as models in learning that aim to teach positive attitudes, noble attitudes, and manners in addition to their academic aspects. Students use a scientific approach through observing a phenomenon to study a content or concept in Biology. Then

students ask questions or problems with the observed phenomena, then proceed with further experiments or observations to solve or find answers to these problems. The phenomenon or findings of students are used by teachers as behavioral models, character analogies or positive attitudes to touch students' hearts. The teacher shows the similarity in the process of meaning to the human model if it has the behavior that will be trained (Ibrahim, 2014).
The material chosen by researchers is genetic substance. In the material there are many concepts that can be interpreted, so that they can be models or examples of positive attitudes and noble character. For example in the concept of the phenotype of an organism it is controlled by genes that are inside the cell nucleus. One gene controls one different nature such as the shape of the face. This can be interpreted if God creates one organism with another that is not similar, different, and specific. The regularity of God's creation should always be admired and grateful as a proof of God's greatness and power.

Examples of these meanings show that Biological genetic substances can be used to develop learning designs that contain ethical values that are integrated in the lesson plan so that it has a companion effect for the development of positive character in students. The process of integrating moral values will occur through seriousness and awareness of the moral values taught. Internalization is the process of displaying the entry of moral values into students and creating moral behavior, which starts from a condition called moral sensitivity.

Moral sensitivity is a sensitivity to the moral impact on all phenomena around it. This is what is called moral sensitivity (Narvaezt and Rest, 1995; Lovett and Jordan, 2010). Someone who has a high sensitivity can feel the existence of certain moral values of each event they experience. But for someone with low sensitivity it will be difficult to experience this, he will be touched if the events that occur really great and occur in front of his own eyes, such as natural disasters and accidents. Moral sensitivity illustrates the tendency for someone to accept or recognize that some aspects of a problem have moral implications (Sadler, 2004). Hoffman in Myyry (2003) states that the important thing about moral sensitivity is sensitivity to the interests and rights of others, especially when there are conflicts with personal interests. Based on these considerations, a study was conducted that aimed to aimed to developed science learning with pemaknaan learning model of senior high school on subject matter genetic substance.

II. METHODS

This research is a developmental research of 4-D model to develop science learning covering Syllabus, Learning Implementation Plan (RPP), Student Textbook (BAS), Student Worksheet (LKS), and Moral Sensitivity Test. Target of the research was 15 senior high school students of class IX on academic year 2017-2018. Research, development and validation of instructional media is done at State University of Surabaya and implemented in SMAN 10 Samarinda, East Borneo, Indonesia.

The variables to be observed in this study are the validity of the science learning tools, practicality of science learning tools which include the implementation of learning and student activities, the effectiveness of the science learning tools which include student response and the ability to moral sensitivity. The data analysis technique uses descriptive quantitative-qualitative. The data obtained were analyzed with an average score of each aspect translated into categories.

III. RESULT AND DISCUSSION

Based on results of data research, application of science learning tools based on pemaknaan learning model to train moral sensitivity of senior high school students indicated that:

A. Validity of The Learning Tools/Devices

Learning tools that have been developed include Syllabus, Learning Implementation Plan (RPP), Student Textbook (BAS), Student Worksheet (LKS), and Moral Sensitivity Test (MST) were validated by three validators. The data analysis techniques of the validation of learning tools use qualitative descriptive. The data obtained were analyzed with an average score of each aspect. The results of the validation can be seen in *Table 1*. below:

Table 1. Validation Result of The Learning Tools/Devices

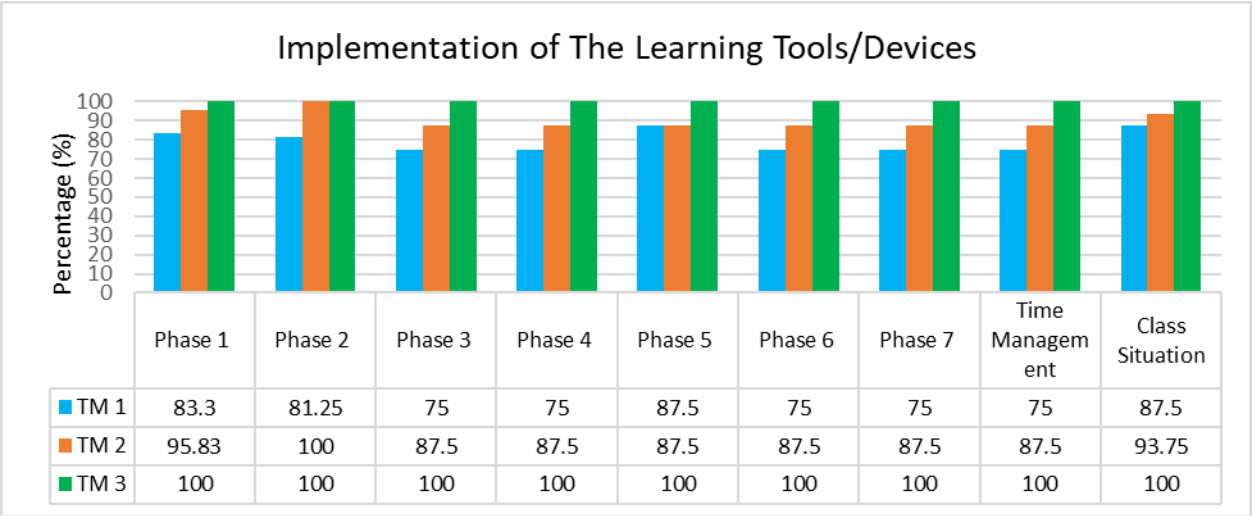
No.	Type of Learning Devices	Average Validation Results	Category
1.	RPP	3,53	Very Valid
2.	BAS	3,71	Very Valid
3.	LKS	3,62	Very Valid
4.	MST	3,86	Very Valid

Based on *Figure 1* above it can be seen that the learning tools developed has obtained very valid results which score 3,68 (Ratumanan & Laurens, 2006). This is because the preparation of learning tools is in accordance with the guidelines given by the government. Learning devices are arranged in a complete and systematic manner so that learning takes place interactively, inspiring, pleasing, challenging, and motivating students to actively participate and provide sufficient space for initiatives, creativity and independence according to the talents, interests and physical and psychological development of students (Narvaezt and Rest, 1995). Learning tools developed by researchers are compiled by studying various supporting literature, including examples of learning tools from several previous researchers and through consultations with counselors (Hergenhahn and Olson, 2010). RPP is designed based on a scientific approach by integrating it into a meaning model that is expected to be a learning that integrates aspects of spiritual attitudes, social

attitudes, aspects of knowledge and aspects of skills so that students have complete Biological competencies. The lesson plan developed by the researcher is adjusted to the steps in the meaningful learning model in which there is a characteristic that is the existence of a meaningful phase and adapted to the needs of the research to practice moral sensitivity. Furthermore, the stages in the RPP are adjusted to BAS, LKS and assessment instruments used.

B. Implementation of The Learning Tools/Devices

The implementation is carried out three times in the same class by using the previously validated Learning Implementation Plan (RPP). In the implementation process there are three observer teachers in three times who will provide an assessment during the learning process. The results of the implementation of the learning tools/devices can be seen in *Figure 1*. below:



	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Time Management	Class Situation
TM 1	83.3	81.25	75	75	87.5	75	75	75	87.5
TM 2	95.83	100	87.5	87.5	87.5	87.5	87.5	87.5	93.75
TM 3	100	100	100	100	100	100	100	100	100

Figure 1. Implementation of The Learning Tools/Devices

The activities and steps listed in the RPP can be implemented in good category with percentage of RPP of 89,97%. This shows that in the implementation of RPP using pemaknanan learning models can be categorized as reliable, because the reliability value 96,67% so that it can be used in the learning process. The high average score and in the excellent category are due to all stages of learning being carried out and several other supporting factors, namely: *First*, in the preliminary activities; The teacher motivates students by orienting students to a problem or question. This is in accordance with the theory of learning discovery by Bruner suggesting that students should learn through active participation so that students gain experience (Slavin, 2009).

Secondly, in the core activities, the teacher gets a score with a very good category. This is because in the second and fifth phases students are asked by the teacher to work on the worksheets in discussion, then negotiations and confirmations are conducted. This aims to provide teacher feedback in the form of reinforcement, correction, or refinement of information presented by students as well as adding to less information. This principle is in line with the theory of learning behavior developed by Skinner (in Budayasa, 1998; Hergenhahn and Olson, 2010), which says that learning is a change in behavior.

Third, in the core activities, the teacher and students also make sense of the subject matter that has been delivered. The meaning is done based on the symptoms or events contained in the genetic substance that is associated with aspects of character, good norms, positive attitude. This is in line with the opinion of Narvaez and Rest (1995) which states that there are four internal psychological processes that must occur before producing moral behavior, namely moral sensitivity which involves the acceptance of receptors, moral considerations that involve the process of deciding moral actions, moral motivation involving intention to do, and implement.

Fourth, in the seventh phase the teacher can guide students to evaluate and reflect. The expected goal is for students to regulate learning outcomes by re-expressing the process of activities, revealing the results of activities. Meaning models can help students understand material, help construct students' understanding, and improve problem solving skills (Miranda, 2010; Martinez, 2006; Flavel, 1976).

Fifth, time management is implemented in the good category. This indicates a significant increase in the aspect of classroom atmosphere. Dewey describes learning as an active individual process, not something done for someone but rather something done by someone and considers that experience and inquiry are very important in meaningful learning (Martinez, 2006).

C. Student Activities

The implementation is carried out three times in the same class by using the previously validated Learning Implementation Plan (RPP),. Same as the implementation process, Student activities observed by three observer teachers in three times who will provide an assessment every 5 minutes during the learning process. The results of the implementation of the learning tools can be seen in *Figure*

2 below:

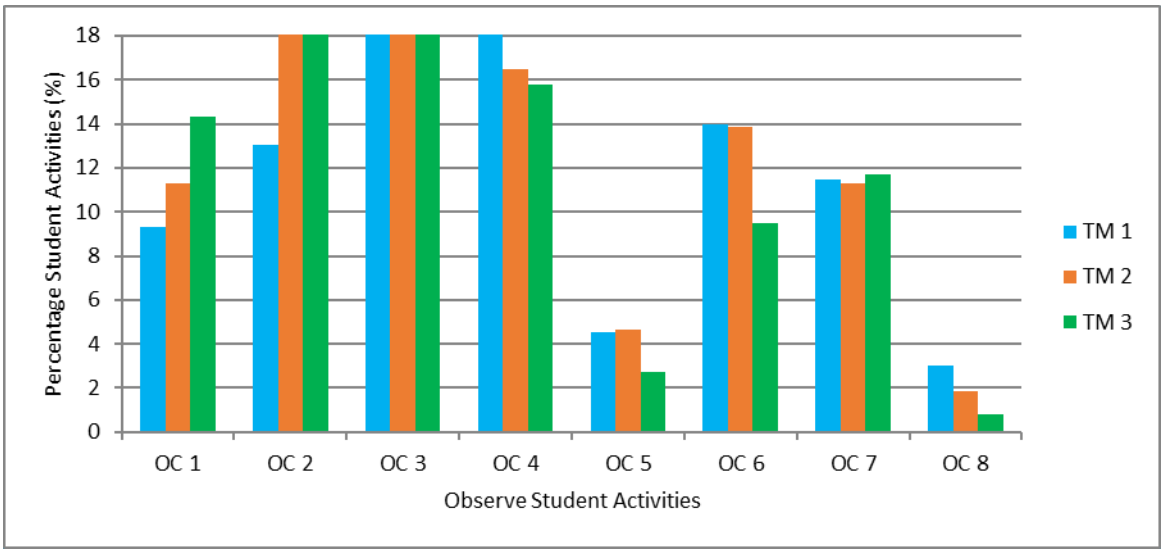


Figure 2. Student Activities

Student activities observed during the learning process which include: OC1) pay attention to the teacher's explanation; OC2) asking questions/answering teacher questions verbally; OC3) conduct observations/discuss with groups; OC4) present observations/discussion; OC5) write down important things when the teacher gives feedback; OC6) discuss the meaning of the concepts that have been submitted; OC7) conclude learning; OC8) irrelevant behavior. The results of observing student activities in the trial can be seen that the activities pay attention to teacher explanations, ask questions / answer the teacher's questions verbally, make observations / discussions with groups, and conclude that learning consistently increases with each meeting. Ibrahim (2000) and Priyono (2013) state that the meaning model used by the teacher can make students more active in learning activities.

Student activities using the model of meaning, there is an increase in three prominent activities, namely: 1) pay attention to the explanation; 2) ask; 3) conduct discussions with groups to make sense. In the core activities in discussion activities students make observations, record the relationship of observations with concepts / theories that already exist from several sources, ask questions about something, and summarize learning material. In the activity of discussing student assignments, they are conditioned to feel challenged to solve problems in worksheets so students do activities in worksheets with full motivation.

Biology learning which is characterized by a meaningful model is learning that studies the knowledge of living things, thinking skills, and enhances the skills to carry out scientific inquiry methods through the steps of the scientific method to grow and develop attitudes (Miranda, 2010). This is in accordance with Ausubel learning theory students must know the meaning of learning and use the knowledge and skills acquired to solve problems in life so that learning activities will lead to meaningful meaning.

Activities that are not relevant to learning from the first meeting to the third experience a significant decrease. The role of the teacher in this metacognitive learning becomes a facilitator and guides students who are still having difficulty in investigating and completing assignments. Taccasu Project (2008) and Ibrahim (2010) in teaching meaningful teacher as a facilitator in developing students' thinking processes through learning activities, by: helping students in developing learning strategies, guiding students in developing good habits from the results of meaning.

D. Moral Sensitivity

Students' moral sensitivity to science learning with a model of meaning in the material of genetic substances is known from the values obtained by students in answering tests of moral sensitivity and self-report moral feelings. Data on moral sensitivity test results in the form of moral sensitivity ratings with scores from 1 to 4 for each question. The percentage level of students' moral sensitivity at the pretest and posttest can be seen in *Table 2.* below:

Table 2. Moral Sensitivity Results

Student	*Pre Test*		*Post Test*	
	Average Score	**Range of Sensitivity Levels**	**Average Score**	**Range of Sensitivity Levels**
B1	1	Less Sensitive	3,2	Quite Sensitive - Sensitive
B2	1,3	Less Sensitive	3,3	Quite Sensitive - Sensitive
B3	1,4	Less Sensitive	3,5	Quite Sensitive - Sensitive
B4	1,3	Less Sensitive	3,7	Quite Sensitive - Sensitive
B5	1,9	Less Sensitive	3,8	Quite Sensitive - Sensitive
B6	1,6	Less Sensitive	3,4	Quite Sensitive - Sensitive
B7	1,8	Less Sensitive	3,5	Quite Sensitive - Sensitive
B8	2,2	Less Sensitive – Quite Sensitive	3,6	Quite Sensitive - Sensitive
B9	1,6	Less Sensitive	3,5	Quite Sensitive - Sensitive
B10	1,4	Less Sensitive	3,5	Quite Sensitive - Sensitive
B11	1,3	Less Sensitive	3,3	Quite Sensitive - Sensitive
B12	1,5	Less Sensitive	3,5	Quite Sensitive - Sensitive
B13	1,4	Less Sensitive	3,6	Quite Sensitive - Sensitive
B14	1,7	Less Sensitive	3,5	Quite Sensitive - Sensitive
B15	1,2	Less Sensitive	3,2	Quite Sensitive - Sensitive
Rerata	1,50	Less Sensitive	3,47	Quite Sensitive - Sensitive

Description of Score:
1: Less Sensitive
2: less sensitive (rational level)
3: quite sensitive (egocentric level)
4: sensitive

The results of data analysis showed that there was an increase in the level of moral sensitivity of students. After being given a meaningful learning model, there was an increase in the sensitive level categories, which meant students were sensitive to the Biological phenomena taught. This indicates that there is a change in moral value after students get the meaning of the concept.

Further analysis on the average score of the pretest of the results of the moral sensitivity test was 1.50 (Less Sensitive) and after the learning process the average score increased to 3.47 (Quite Sensitive - Sensitive). Both of these scores are at the level between quite sensitive and sensitive. These results indicate that most students are already at a sensitive level. As with every other psychological aspect, moral sensitivity in a person is strongly influenced by the environment.

Moral sensitivity can experience natural changes, but can also experience change intentionally through the educational process. For groups of students who are already at a sensitive level, training or activities are needed that can maintain the moral sensitivity they have, while at the same time increasing it to the next stage of the psychological process. For students who are still in an egocentric stage, the thing that should be done is to provide guidance activities to students to interpret each phenomenon that they face as habituation training (Narvaezt and Rest, 1995).

The learning outcomes of moral knowledge tests are not enough as an indicator of the success of character education. Moral knowledge is the initial stage of character building for a person, therefore assessment is continued with moral feelings and moral actions. Assessment of students' moral feelings aims to find out the attitudes, feelings and self-commitment of students related to moral values from the results of meaning. The application of the results of the development of learning devices can train moral sensitivity as well with more than 86.32% of students declared complete. The increase was also shown by n-gain analysis which reached a high category.

The achievement of the test results of learning moral knowledge and self-reports of moral feelings cannot be separated from the use of the results of the development of a meaningful model of learning tools to train moral sensitivity. The validation result of the learning device is categorized as valid so that it is feasible to be used as a learning tool in an effort to practice moral sensitivity. Moral sensitivity includes moral knowledge trained to students with the meaning of concepts such as those found in BAS which are presented in special features, individual columns and presentation with attractive images and colors. Then students are trained to write down the meaning of the concepts they learned in BAS into the LKS.

The average pre-test score of indicators creative thinking (fluency, flexibility, originality and elaboration) obtained by students is quite low with the category of less creative. This condition occurs because students are not accustomed to giving ideas or

reactions in verbal form related to the questions given and the level of originality of ideas and students' elaboration abilities are still low. Students are not accustomed to thinking about things that are outside the general context and thinking in detail and in depth related to learning materials. Most students feel that the creative thinking ability test as tested is new and they have never done it before so that the results obtained are not optimal. The results of the post-test of the four indicators of creative thinking shows that students are included in the Creative category with moderate to high N-gain. These results indicate that the ability of students to think creatively develops after participating in learning by using learning tools that have been developed. The ability to think creatively or divergent thinking is obtained when students are given the opportunity to experiment and explore information and express their opinions.

E. Student Respons

The recapitulation of the results of 15 students' responses to learning activities and learning tools/devices developed with the pemaknaan learning model is presented in *Figure 3* below:

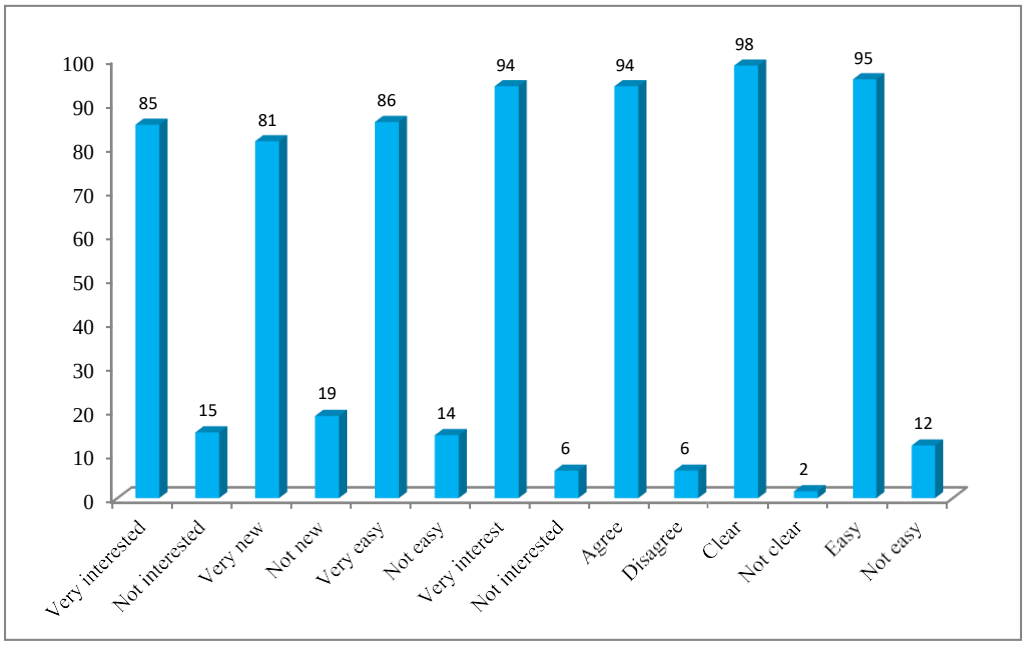


Figure 3. Student Responses

Student responses to the lesson plans that were developed also looked positive by 90% and students' negative responses were 10%. Student responses to the developed moral sensitivity assessment instrument looked positive at 94%. These results are in accordance with the conversion of student response questionnaire data using the Guttman scale ie the interval score of 80% -100% categorized as very strong (Riduwan, 2010).

IV. CONCLUSION

Conclusion of this research was science learning which developed based on pemaknaan learning model, feasible and can be used to train moral sensitivity of senior high school in genetic substance.

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CSMA/CD Variant with Successive Collision Probability Multiplication

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Abstract- CSMA/CD is basically a collision dealing arrangement which comes with a set of predefined persistent methods. It detects these collisions by sensing the medium first before sending the data and if there is collision, it immediately aborts the transmission and then later tries to send the data again according to any of the predefined persistent methods. Though this ensures the proper and safe transfer of data but when there are multiple nodes which have some data to send, it can happen that nodes might have to wait a longer time to transmit their data. Hence, decreasing the efficiency of the overall system. Here I'll be putting forward my approach for dealing with this problem with a tweak of back-off algorithm which overcomes its basic shortcomings and some more general properties of CSMA to design a more efficient system than CSMA/CD.

I. Introduction

CSMA/CD basically deals with the process of transferring data between nodes by sensing the medium before transferring the data. If it receives a signal that the medium is ideal, it sends its data immediately. But, at this time is also sometime happens that the other node also senses the channel ideal and send its data. Hence, this results into a collision and it is detected by the arrangement and the current data transfer is aborted. Now, the data is tried to be resent according to 3 persistent methods

- 1-Persistent Method

The system continuously checks for the medium to be ideal and if it is, it sends the packet with probability of 1.

- Non-Persistent Method

The system checks system after random amounts of time. If the channel is found free, it sends the data immediately.

- p-Persistent Method

The system senses the medium and if found ideal, sends the data with a probability of p and if there is a collision (1-p), it retries after a certain amount of time again with probability p. This goes on till the data is sent properly.

Now, though this system is great, it is inefficient in cases of huge traffic and for this many variants of the CSMA/CD are being proposed to overcome the traffic problems and extra bandwidth usage. Here, I'll be describing my proposed variant for the same.

II. Problem Statement

Though CSMA/CD detects the collisions and deals with it, it is very inefficient when there are many collisions happening in the medium, i.e., the traffic is high. Hence, what happens is there are a lot of collision detections and hence, a lot of time elapses before the required node transmits its data completely and safely. This is because same node can suffer multiple collisions for its data and hence it may take a long while to transmit the data properly to the target node.

III. Related Research

A number of CSMA/CD variants exist but the one I've researched for my proposed variant is the, 'Back-Off Algorithm' for CSMA/CD

1. Back-Off Algorithm

The back-off algorithm basically just associates the nodes with numbers after every collision and then detects the probability of collision on the basis on the assumed inputs. After each successful transmission of data, the probability of collision goes on decreasing which is quite desirable. But, this has two major drawbacks

- If one node wins and transfers its data, then again it is possible that the same node can transfer data. This may result into a collision again.
- This method is only limited to 2 nodes.

I'll be putting forth my variant to basically overcome these drawbacks by some or the other ways.

IV. Solutions & Analysis

If we notice closely, all the penalties of the time elapsed, extra bandwidth usage, etc. is actually caused by the greater probability of collision and the successive collisions between the same nodes. Hence, our goal should be to basically reduce the probability of the collisions with each pass and introduce a token system transmit the data with the proper tokens. Moreover, to ensure maximum transmission of data per pass, we could transfer multiple frames of data together at once by keeping its maximum size as 1500 bytes as this is the defined limit.

To reduce the probability of collisions, we could use some math. We could look to use a function which decreases the probability of collision for each pass of data and at the same time use a token system to ensure that no successive collisions occur and sending as much data as possible in sets of 1500 bytes. Hence, my solution exploits 3 things mainly

- Decreasing P(Collisions/Pass)
- Involving a token system to prevent successive collisions between the same nodes
- Transmitting data in maximum packet sizes

I'll be discussing how we'll accomplish these

- Decreasing Probability of collisions per pass & involving a token system to prevent successive collisions between the same nodes.

1. FIRST PASS

To decrease the probability of collisions, we will associate each node with {0,1}. Note that here, we can associate only two nodes with them. Hence, when there are more than 2 nodes, we can divide it into sets of 2 and then proceed for the individual sets separately.

Now, let there be one collision and after than let the nodes A & B assume 0s and 1s as

A	B
0	0
0	1
1	0
1	1

Here, probability of collision is ½. (When A & B are equal)

Now, let A win. Then it will transfer its data and here a token which is already held by A is passed to B so that now compulsorily B has to transfer its data. This avoids the problem that there may be a subsequent collision after A wins in the previous step and in case A tries to send a packet again.

Now, let B be associated with {0,1} and C be associated with {0,1,2}

Hence, the probability of collision now becomes 1/3. Here, B wins, transfers its data and then passes the token to C.

Now, let C be associated with {0,1,2} and D be associated with {0,1,2,3}.

Hence, the probability now become ¼. This goes on till it reaches its final target node.

Hence, net probability is

P(First Pass Collisions in First Pass) = 1/2 x 1/3 x 1/4 x … (Till the last node)

Now, for the second pass, A is associated with the probability of 1/3, B with 1/4 and so on. Hence. Net probability in this case is

P(Second Pass Collisions in First Pass) = 1/3 x 1/4 x 1/5 x … (Till the last node)

Here we notice that with each transfer of a packet from A to any other node, its probability of collision is decreasing. This aids us in reducing the collision frequency and hence, faster transfer of data.

2. SECOND PASS

Now, for the second pass, the probability of A transmitting the data is already set to 1/3 as the transmitting starts with A being associated with {0,1} and B being associated with {0,1,2} and it goes on in a similar way and the probability of collision goes on decreasing.

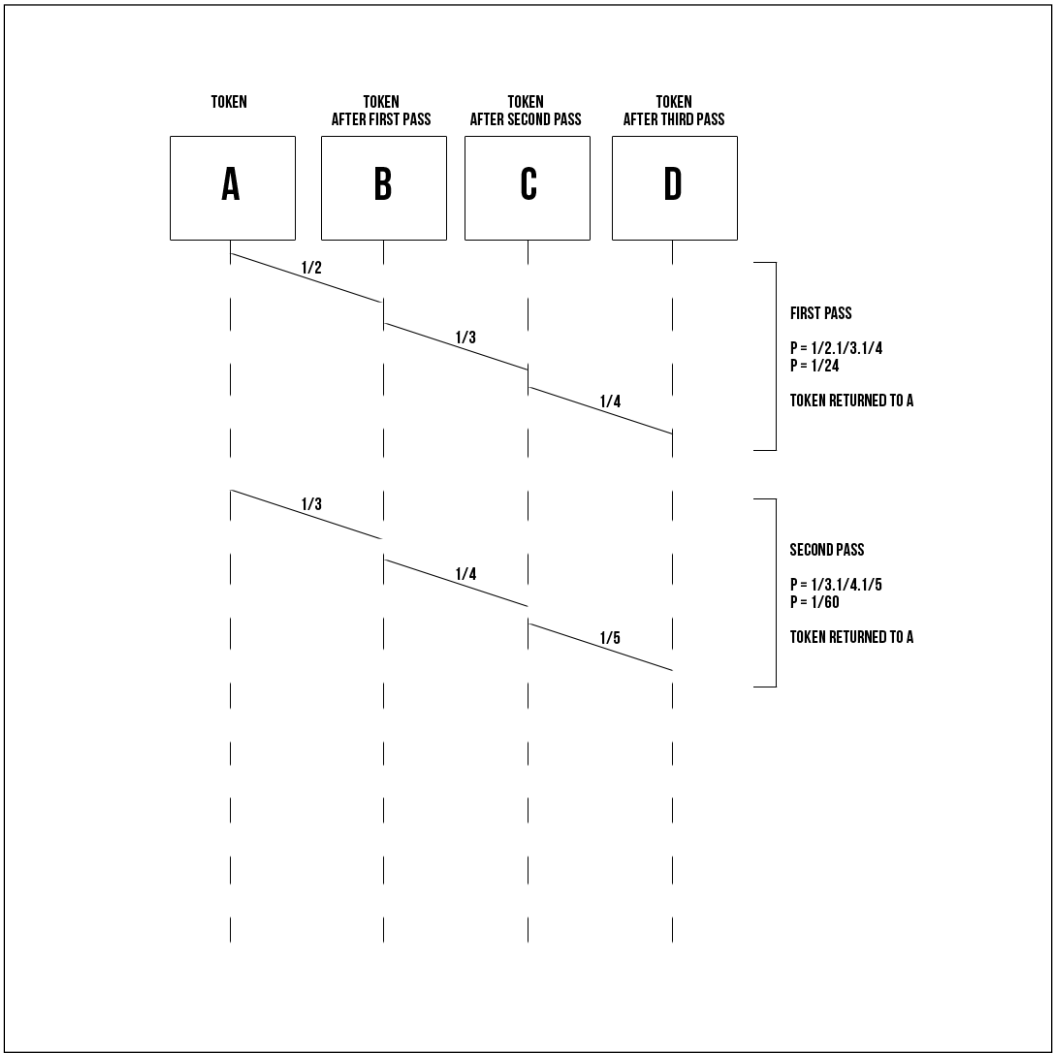
Probability of each node starts from the calculated value of probability and the subsequent probabilities are calculated as specified by the process above.

Hence, for each pass, the probability of collision goes on decreasing and hence, the data is transmitted faster.

- Sending data in maximum packet sizes

I'm exploiting one more point here. The point if that the maximum size of the data that can be transmitted is 1500 bytes. Hence, we can prepare sets of frames which have a net size of <= 1500 bytes and we will transfer these through the channels and not separate frames one by one.

The diagrammatic representation of the process is as follows



For better clarity of the picture, please visit this link.
https://ibb.co/q02L2jG

Comparing with back-off algorithm, my variant, overcomes those by doing the following

- Due to successive introduction of state numbers or alphabets and the concept of probability, the collision probability becomes lesser and lesser in each case.
- Due to introduction of the token system, the possibility of A retransmitting the data after a successful transmission is ruled out as the token is then passed to B. Hence, this reduces the unnecessary collision which may take place.

However, there are also some disadvantages of the proposed variant

- If any of the nodes fail, the whole system may stop working.
- We can't keep on adding the numbers associated with each node as for everything, there is a limit.

V. Summary

Though CSMA/CD is quite useful, it has flaws which my proposed variant is able to resolve to some extent. My proposed variant may prove quite useful if implemented properly.

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Additive Manufacturing/3D in the Optimization of Nigeria Vaccine Supply Chain

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***Abstract*- Introduction**: This study captures the perspectives of stakeholders on optimization of Nigeria vaccine supply chain with 3D printing technology. Temperature excursion, cold chain maintenance and the attendant issues of maintaining vaccine integrity across the supply chain network till the last mile remain a critical bottleneck to immunization and vaccine coverage. This study aimed at taking a pragmatic approach to assessing the awareness, acceptability, feasibility, and preparedness of the Nigerian supply chain professionals to take up the innovation of 3D technology to optimize the vaccine supply chain and immunization coverage in the Nigeria context. Internet-based questionnaire (Google Form) was used to reach different public health supply chain professionals in Nigeria. A community of professionals whose works relates to the supply chain of public health commodity was selected as the sampling frame. This community includes some supply chain professionals in Nigeria who have identified as part of the International Association of Public Health Logisticians, IAPHL. There are 200 valid responses, of which 70.5% were males, and 29.5% were females. The most frequent age group was 31 – 40 (56.5%). 3D printing recorded very high acceptability and feasibility with a minimum of 80.8% and a maximum of 100% among respondents. Similarly, the feasibility of 3D printing in Nigeria vaccine supply chain recorded high ratings ranging from 75.0 % to 100.0% among professionals of various specializations. International political will was rated with the highest (96.0%) preparedness to take up new technologies/innovations in Nigeria vaccine supply chain while the national political will was rated 54.0%. This study found that the majority of participants knew the vaccine supply chain and had relatively adequate knowledge/awareness of 3D printing. The overall acceptability and feasibility of 3D printing were generally high. Preparedness of Nigeria vaccine supply chain to take up 3D printing was rated high for international political will, private sector involvement and collaboration, readiness in regulatory and policy, workforce know-how and national political will. It is therefore concluded that 3D printing can be used to optimizing Nigeria vaccine supply chain due to high acceptability, feasibility, market value, and its economic impact.

Keywords: 3D printing, vaccine, supply chain, acceptability, feasibility, preparedness.

I. Introduction

Exposure to vaccine-preventable diseases, poor sanitation, and inaccessibility to quality health care and clean water all contribute to the high death rate of children worldwide. Vaccines are critical to public health strategy to reduce child morbidity and mortality associated with vaccine-preventable disease such as polio [1]. Vaccines prevent over two million child deaths worldwide annually [2]. Despite the successes achieved with routine immunization (RI) coverage, vaccine-preventable diseases remain the most common cause of childhood mortality, with an estimated 19.4 million infants worldwide not reached with routine immunization services [3].

3D printing also called additive manufacturing (AM), turns digital 3D models into objects by building them up in layers. This technology enables small quantities of customized goods to be produced at relatively low costs [4]. Many sectors such as automotive replacement parts, dental crowns, artificial limbs, aviation industry, clothing and even in foodstuff use 3D printers [5]. Due to its characteristics, the method is seen as a disruptive technology for supply chain management.

II. POTENTIAL OF 3D PRINTING

Cardinal to 3D printing and potential benefits is simplicity [6]. This simplicity involves producing products on-demand and locally and as such, making supply chains to become shorter, leaner, and less complicated [6], [7]. Another key benefit in this era of global warming and advocacy to go green is that 3D printing would win some sustainability marks for any company/society adopting it [8]. The benefits of 3D printing methods over the conventional manufacturing methods as summarized by Özceylan *et al.* [4] include; no need for tooling,

feasibility of producing small production batches economically, possibility for quickly change design, product optimization for function, more economical custom product manufacturing plus the ability to produce complex geometries, potential for more accessible supply chains with shorter lead times and lower inventories.

Generally, a Mckinsey report suggests that 3D printing market would be worth between $180 billion and $490 billion by 2025 [8]. Experts and big industry players in vaccine production and research have shown some interest in 3D printing [8]. A synthetic biological giant, Craig venter had predicted that 3D vaccine printing would be a big thing in the future of public health to fight epidemics [9]. The combination of multiple doses and types of vaccines using 3D printing is also another potential use of disruptive technology. This approach can be beneficial in reducing the strain of intruding new vaccines in the already strained vaccine supply chain.

III. CHALLENGES OF 3-D PRINTING

One of the challenges of 3D printing is how to make a business case that presents it to decision-makers as no threat to the existing infrastructure and process of manufacturing [10]. Another key drawback is the issue around intellectual property rights. That is how digital products would be protected from pirates and counterfeiters [8].

IV. GOING FORWARD

Vaccines must reach the population that needs them for any immunization program to be a success [11]. 3D printing is still novel and growing at a rate that could be disruptive to the supply chain of any industry [12]. It has already gained relevance in healthcare to about 7-9% (Goel & Goel 2015). With the price of personal 3D printer coming down to about $1,000, there seems to be a higher potential for adoption based on cost.

3D printing clearly shows some potential, including making products, in this case, vaccines, just-in-time/on-demand, make the supply chain more agile and leaner and improve quality while reducing the cost of logistics. It is therefore imperative to consider how the developing countries can begin to set the stage for its adoption to effect more extensive vaccine and immunization coverage. It is this agenda that we intend to set in this work.

V. SUPPLY CHAIN AND 3-D PRINTING

In today's competitive market, satisfying the dynamic demands of customers on time has vital importance without budging form quality and profitability. Today, 3D printing has the potential to become the basis for new solutions in supply chain management [14]. 3D printing can take several opportunities instead of conventional manufacturing such as a reduction in lead times, inventories, set up times, safety stocks, some assemblies, wastes; increment in product qualities and ability to produce complex-shaped products. 3D printing can decrease the number of stages in the traditional supply chain because of needing fewer components, and it can manufacture products near the customers [15]. Niaki & Nonino [16] reviewed the literature about 3D printing in eight different categories: technology selection, supply chain, product design and production cost models, environmental aspects, strategic challenges, manufacturing systems, open-source innovation and business models and economics and researched the effectiveness of 3D printing in different environments and industries, business strategies, business models and processes. Besides the above studies considering 3D printing, some studies are investigating the effect of 3D technology on supply chain management. Walter *et al.* [14] presented supply chain solutions made possible by both the centralized and decentralized applications of 3D printing. This study explores the knowledge of 3D printing among supply chain professionals and also determines its acceptability, feasibility as well as preparedness of Nigeria vaccine supply chain to take up this emerging technology.

VI. METHODS

We conducted an electronic survey using an internet-based questionnaire to reach different professionals with experience of Nigeria supply chain of vaccines. The samples cut across different levels of operation, geography, and areas of practice. The population size of professionals in Nigeria's development/health public health was estimated at over 5000. A cluster of professionals whose works relates to the supply chain of public health commodity was selected as the sampling frame [17]. This study used a target sample frame, though growing stands at 1,047 as at the time of this data collection in December 2017 [18]. This involved number of professionals in Nigeria who have identified as part of the International Association of Public Health Logisticians, IAPHL. The IAPHL is an association of public logistician from all over the world coming together to share knowledge, best practices and network. Sample size calculator was used to calculate the expected sample size. At a 95% confidence interval and P-value of 0.05, the estimated sample size was 281.

The questionnaire was shared on the listserv of the IAPHL and other smaller internet-based social network (Whatsapp, Telegram and LinkedIn) and opened for one (1) calendar month after which it was closed to further responses. At the end of one-month time horizon, (December 3, 2017, to January 2, 2018) a total of 200 valid responses were received and the questionnaire closed to further responses using the switch on the Google form. Following this stage, the data were harvested for onward analysis. We improve the response rate by assuring confidentiality and providing a concise introduction to the survey and how responses will affect a smoother supply chain. We also ensured that questionnaires were easy to use and understandable and only took 5-10 minutes of a participant's time. The permission and support of the administrator of the different platforms were also secured to give the process speed and credibility. This approach follows the strategy by Easterby-Smith *et al* [17]. On how to improve the response rate [17]. The data analysis combined SPSS version 25 and Microsoft Excel. With SPSS, we better managed data with case selection, file reshaping, and creating derived data. A metadata dictionary was stored with the data. Statistical analysis tasks performed with the base package include the generation of descriptive statistics, prediction of numerical outcomes, and prediction of identifying groups.

VII. RESULTS

Among the 200 valid respondents, 141 (70.5%) were males, and 59 (29.5%) were females (male: female; 2:1). The most frequent

age group was 31 – 40 (113, 56.5%) followed by 'above 41' (48, 24.0%) while the least value was seen for 21 – 30 (39, 19.5%). The number of respondents who had a maximum of 5 years working experience was 114 (57.0%), 57 (28.5%) had 6 – 10 years' experience while 14.5% had more than 10 years' experience (Table 1).

Majority of respondents were Health/Public health development professional (81, 40.5%) followed by 52 (26.0%) supply chain professional only, 49 (24.5%) were into the supply chain and health/public health development. There were 8 (4.0%) financial/business and project managers, 7 (3.5%) were regulatory and safety professionals while the IT profession had the least number of 3 (1.5%). Respondents were from various specialties including technical/executive officers (82, 41.0%), middle managers (59, 29.5%), consultants (26, 13.0%), senior managers (25, 12.5%) and regulatory/policymakers (8, 4.0%) (Table2).

Table 1: Demographics with years of experience

Parameter	Frequency	Percentage
Gender		
Male	141	70.5%
Female	59	29.5%
Age category		
21 - 30	39	19.5%
31 - 40	113	56.5%
41 and above	48	24.0%
Year of experience		
≤ 5	114	57.0%
6 – 10	57	28.5%
11 – 20	26	13.0%
>20	3	1.5%

Table 2: Respondents' profession and specialization

Parameter	Frequency	Percent
Profession		
Supply Chain Professional Only	52	26.0%
Health/Public Health/Devt Professional Only	81	40.5%
Supply Chain and Health/Public Health/Devt	49	24.5%
IT professionals Only	3	1.5%
Financial/Business and Project Mgt	8	4.0%
Regulatory and Safety Professionals	7	3.5%
Specialization		
Consultant	26	13.0%
Middle Manager	59	29.5%
Regulatory and Policy Maker	8	4.0%
Senior Manager	25	12.5%
Technical/Executive Officer	82	41.0%

A. KNOWLEDGE OF SUPPLY CHAIN WITH AN AWARENESS OF 3D PRINTING

The knowledge of respondents in the vaccine supply chain and level of awareness of 3D printing was examined. All (100.0%) Information Technology (IT) and regulatory and safety professionals had good knowledge of vaccine supply chain, 98.0% of supply chain and health/public health development, 92.3% of supply chain professionals, 91.8% of health/public health/development professional only while the least value of 62.5% was seen among financial/business and project managers. All IT professional had good (100.0%) awareness of 3D printing, 71.4% of regulatory and safety professionals, 67.3% of supply chain and health/public health/development professionals, 53.8% of supply chain professionals and 42.0% of health/public health/development professional only had good awareness of the use 3D printing in vaccine supply chain.

All consultants (100.0%) had good knowledge of the vaccine supply chain, but only 50.0% were aware of 3D printing in the vaccine supply chain. Most middle managers (91.5%) had good knowledge of the vaccine supply chain, and 54.2% had a good awareness of 3D printing. Knowledge and awareness of vaccine supply chain 3D printing were respectively 87.5% and 37.5% for regulators and policymakers; 92.0% and 64.0% for senior managers; and 91.5% and 53.7% for technical/executive officers. Based on the years of working experience, knowledge of vaccine supply chain was 92.1% for those who had a maximum of 5

years working experience, 89.5% for 6 - 10 years and 100% for those who had above 10 years' experience. On the other hand, working experience-based awareness was 55.3% for 5 years' experience, 35.1% for 6 – 10 years, 26.9% for 11 – 20 years and 66.7% for those who had over 20 years' experience (Table 2).

Table 2: Knowledge of supply chain with an awareness of 3D printing

Profession/Experience	Knowledge of Vaccine Supply Chain			Awareness of 3-D printing/Additive Manufacturing		
	Good Knowledge	Poor Knowledge	p	Good Awareness	Poor Awareness	p
Profession						
Supply Chain Professional Only	48 (92.3%)	4 (7.7%)		28 (53.8)	24 (46.2%)	
Health/Public Health/Devt Professional Only	74 (91.8%)	(8.6%)		34 (42.0%)	47 (58.0%)	
Supply Chain and Health/Public Health/Devt	48 (98.0%)	1 (2.0%)	**0.020**	33 (67.3%)	16 (32.7%)	**0.037**
IT professionals Only	3 (100.0)	-		3 (100.0%)	-	
Financial/Business and Project Mgt	5 (62.5%)	3 (37.5%)		5 (62.5)	3 (37.5%)	
Regulatory and Safety Professionals	7 (100.0%)	-		5 (71.4%)	2 (28.6%)	
Specialization						
Consultant	26 (100.0%)	-		13 (50.0%)	13 (50.0%)	
Middle Manager	54 (91.5%)	5 (8.5%)	**0.644**	32 (54.2%)	27 (45.8%)	**0.725**
Regulatory and Policy Maker	7 (87.5%)	1 (12.5%)		3 (37.5%)	5 (62.5%)	
Senior Manager	23 (92.0%)	2 (8.0%)		16 (64.0%)	9 (36.0%)	
Technical/Executive Officer	75 (91.5%)	7 (8.5%)		44 (53.7%)	38 (46.3%)	
Year of experience						
≤ 5	105 (92.1%)	9 (7.9)		51 (44.7%)	63 (55.3%)	
6 – 10	51 (89.5%)	6 (10.5%)	**0.372**	37 (64.9%)	20 (35.1%)	**0.012**
11 – 20	26 (100.0%)	-		19 (73.1%)	7 (26.9%)	
>20	3 (100.0%)	-		1 33.3%)	2 (66.7%)	

B. ACCEPTABILITY AND FEASIBILITY OF 3-D PRINTING/ADDITIVE MANUFACTURING IN NIGERIA VACCINE SUPPLY CHAIN

Participants were surveyed about the acceptability and feasibility of 3D printing in vaccine and supply chain in Nigerian. This survey was conceived to overcome the cold chain challenges in the country. Acceptability and feasibility were rated 86.5% among supply chain professionals only, 82.7% for health/public health/development professional Only, 91.8% for supply chain & health/public health development, 100.0% for IT professionals and regulatory & safety professionals, 87.5% for Financial/business and project managers. 3D printing recorded 80.8% acceptability by middle managers, 93.2 for middle managers, 87.5% for regulatory and policymakers, 92.0% and 89.0% for senior managers and technical/executive officers. Similarly, the feasibility of 3D printing was 100.0% among senior managers and minimum of 75.0% among regulators and policymakers. Among experienced professionals, 3D printing recorded acceptability and feasible (Table 3).

Table 3: Acceptability and Feasibility of 3-D printing/Additive Manufacturing in Nigeria Vaccine Supply Chain

	Parameter	*Acceptability*	*Feasibility*
Profession	**Supply Chain Professional Only**	86.5%	86.5%
	Health/Public Health/Devt Professional Only	82.7%	82.7%
	Supply Chain and Health/Public Health/Devt	91.8%	91.8%
	IT professionals Only	100.0%	100.0%
	Financial/Business and Project Mgt	87.5%	87.5%

	Regulatory and Safety Professionals	100.0%	100.0%
Specialization	**Consultant**	80.8%	92.3%
	Middle Manager	93.2%	88.1%
	Regulatory and Policy Maker	87.5%	75.0%
	Senior Manager	92.0%	100.0%
	Technical/Executive Officer	89.0%	81.7%
Year of experience	**≤ 5**	95.6%	88.6%
	6 – 10	100.0%	89.5%
	11 – 20	100.0%	96.2%
	>20	100.0%	66.7%

C. PREPAREDNESS TO TAKE UP NEW TECHNOLOGICAL INNOVATIONS IN NIGERIA VACCINE SUPPLY CHAIN

International political will was rated with the highest (96.0%) preparedness to take up new technologies/innovations in Nigeria vaccine supply chain followed by private sector involvement and collaboration (82.0%). Readiness in regulatory and policy was rated 76.5%, workforce know-how 73.0% while the national political will was rated 54.0%.

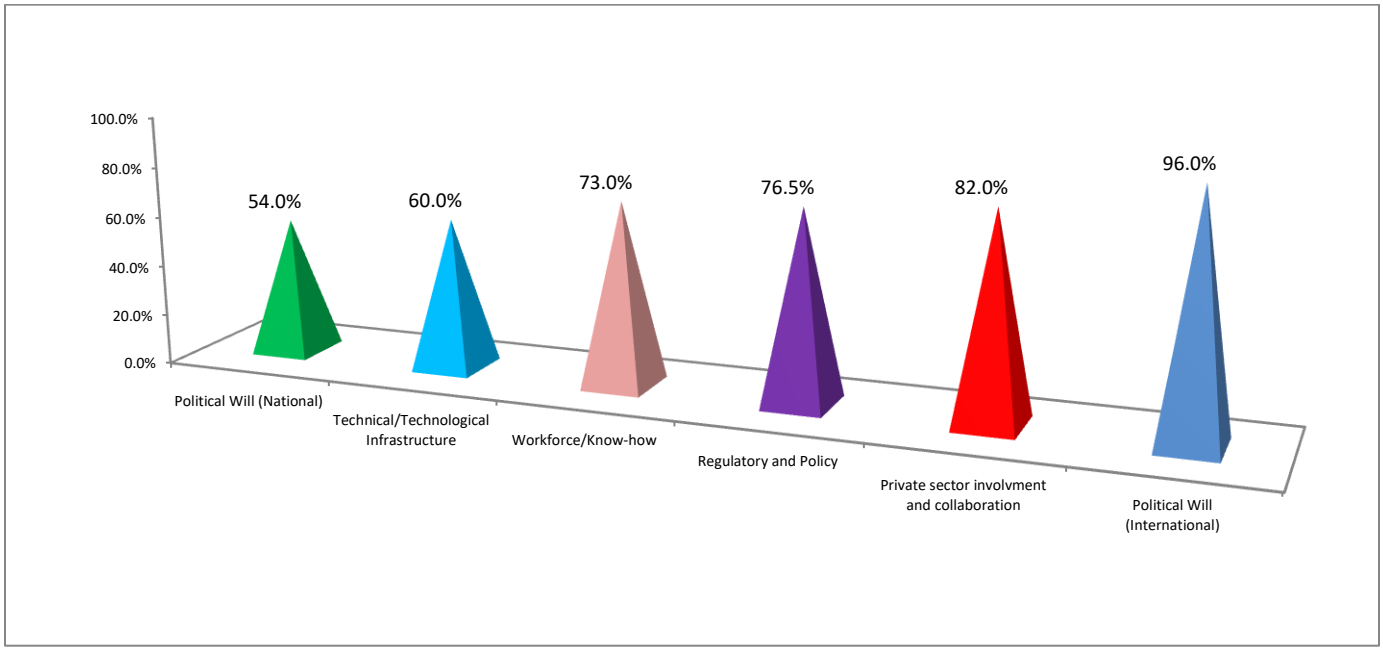

Figure 1: Preparedness to take up new technological innovations in Nigeria vaccine supply chain

VIII. DISCUSSION

The Nigeria vaccine supply chain is faced with critical bottlenecks which include temperature excursion, cold chain maintenance and the attendant issues of maintaining vaccine integrity across the supply chain network till the last mile. The study, therefore, takes a pragmatic approach to understand supply chain professionals' perspective regarding their awareness, acceptability, feasibility, and preparedness to take up innovations like 3D printing to optimize the vaccine supply chain and immunization coverage.

Majority of the respondents were males mostly of age group 31 – 40. Respondents were seen from different health/supply chain-related professions such as supply chain, health/public health,

information technology, financial/business, project management, regulatory and safety professionals. They were of various positions such as senior managers, middle managers, consultants as well as technical officers with work experiences ranging from 0 to above 20 years.

Good knowledge of the vaccine supply chain was recorded among respondents. All, except financial/project managers (62.5%) had over 90% good knowledge of vaccine supply chain. The level of awareness of the use of 3D printing in the vaccine supply chain was slightly high among respondents. Over 50% of respondents from each profession were aware of the use of 3D printing except respondents from financial/project management which only 42.0% were well aware of 3D printing in the vaccine supply chain. This finding can be attributed to the fair knowledge of Nigeria vaccine supply chain seen among them (only 62.5% had good knowledge whereas over 90% of other professions had good knowledge of vaccine supply chain). It was discovered that the knowledge of the vaccine supply chain was generally high, regardless of the number of years in service while 3D printing awareness was not so impressive among respondents. This unawareness might not be unconnected to the fact that the technology is not yet fully adopted in Nigeria vaccine supply chain. So, more awareness/training is needed for Nigerian supply chain professionals.

The level of acceptability of 3D printing into Nigeria vaccine supply chain was discovered to be very high regardless of profession, specialization or years of experience. Nigerian professionals are ready to accept 3D printing with acceptability range of 82.7% - 100.0%. Similarly, the use of 3D printing into the Nigeria vaccine supply chain was also rated very feasible in all specialization and professions. Campbell *et al.* [19] spoke on acceptability of 3D printing in supply chain that mass acceptability/adoption of 3D printing (distributed production model) could have far-reaching effects on the global economy—specifically, on global trade imbalances, as AM technology could enable countries that have traditionally imported most goods to reduce their reliance on foreign production. This outcome shows that Nigeria vaccine supply chain will be a perfect market for investors and manufactures as stated by Joann *et al.* [20] that 3D printing/AM technology represents a potentially valuable area for investigation and investment as companies consider ways to improve supply chain performance. Also, Drews [21] reported that "with today's slow down economic growth, companies' need to find other places to invest. Emerging markets, in the so-called developing countries, are predicted to grow twice to three times faster than countries like Europe or the US. As they are becoming the driver of global growth, they represent an exciting opportunity for investors". This approach will also help in saving lives, reducing stress as well as overcoming the challenges of cold chain and other bottlenecks to efficiency of vaccine supply chain in Nigeria. This finding confirms the report of Campbell *et al.* [19] that "as AM technology improves and becomes more suitable for more types of endues product production, AM may allow for the redesign of supply chains to better meet customer needs. Indeed, this may represent its most dramatic impact on the supply chain".

Respondents rated Nigeria vaccine supply chain politically, private sector involvement and collaboration, regulatory and policy, workforce knowhow and technical/technological infrastructure ready to take up new innovation/technology such as 3D printing.

IX. CONCLUSION

This study found that the majority of the community of experts had knowledge of the vaccine supply chain but had relatively fair knowledge/awareness of 3D printing. The overall acceptability and feasibility of 3D printing were generally high. Preparedness of Nigeria vaccine supply chain to take up 3D printing was rated high for international political will, private sector involvement and collaboration, readiness in regulatory and policy, workforce know-how and national political.

APPENDIX

Nil.

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Environmental Hazards and Health Impacts of Organochlorine Pesticides (OCPs) qua POPs in Benin's Cotton Basin

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Abstract- Organochlorine pesticides (OCPs) are chemical compound classes based on carbon, classified persistent organic pollutants (POPs), and produced for agricultural purposes. OCPs are used in the cotton-growing, which nowadays is one of these compounds attraction mainstays in Benin, although their use has been banned as a result of the 2001 Stockholm Convention. Indeed, OCPs brought up problems including environmental contamination (soils, sediment, water, air, and biota), hazards to organisms and also human health disorders. Due to their fate solubility and persistence, they were detected in Benin food commodities, food chains and webs (vegetables, meat, milk, fish, crabs, amphibians, birds). OCPs exposure is associated with adverse effects in cotton growers including Headache, Dizziness, Seizures, Loss of consciousness, Blurred or dark vision, Weakness, Blood Pressure variation, Skin Irritation, etc. Chronic effects bound to pesticide exposures can lead to cancers, diabetes, reproductive defects, Parkinson's disease, and even death cases (e.g. endosulfan in Benin). OCPs are therefore well-known carcinogens, teratogens, endocrine disruptors, neurotoxins, etc. Although long-term / low-dose exposure to OCPs and POPs in general, have long been suspected of causing adverse health effects, however molecular mechanisms underlying pesticide effects on these diseases in further investigations persist to be elucidated.

Index Terms- Organochlorines Pesticides, Persistent Organic Pollutants, Cotton, environment, health, Benin.

I. Introduction

Organochlorine pesticides (OCPs) are a set of classes of synthetic compounds, ranked as POPs introduced as a result of technological and chemical revolutions leading to remarkable breakthroughs, but also caused an unexpected health issue. A common known OCP, dichlorodiphenyltrichloroethane (DDT) was applied in the period 1942-1960s as malaria control, typhus, and yellow fever diseases [1, 2]. However, their present harmful and serious adverse effects on the biosphere due to their physicochemical nature characterized by high lipophilicity, acute toxicity, persistence in environmental matrices (soils, sediment, air, and biota) classifying them as "long-range". [3-6].

Pesticides are chemicals used to impede, destroy, repel or reduce any harmful organism and are categorized as insecticides, rodenticides, herbicides, algaecides, fungicides or bactericides [7]. According to [8] just only 0.1% of applied pesticides achieve the targeted pests, while the remainder stays in their respective environment matrices through uptake, bio-accumulation and consequent bio-magnification along ecosystems and food chains [9-11]. Most pesticides are known fat-soluble and is able to easily accumulate within human tissues, maternal blood placenta, and breast milk [12-14] which have been described as good biomarkers of human exposure assessment to organic pollutants and reported in myriad studies across the world including Benin [15], China [16], Japan [17], Spain [18], Sweden [19], UK [20].

OCPs qua POPs due to their widespread applications are mainly found to be concentrated in high density populated of subtropical and tropical regions [21] where vulnerability factors such as extreme hot temperatures, galloping annual rainfall are prevalent [22]. Such areas are conducive to cash crops (e.g. cotton), which use invaluable amounts of OCPs. Unsustainable growing cotton i.e. with broad inputs of pesticides are responsible for large-scale ecosystem hazards and local living people's health and livelihood impairments.

Benin is, ranked among the leading cotton producers in Africa, where cotton-growing accounts for up to 75% of export revenues [23] and consumes 90% Beninese's insecticide market [24], compared to 24% world's insecticide market needed to that speculation [25, 26]. For very long some OCPs were broadly used in cotton pests control including DDT, lindane, endosulfan, heptachlor, endrin [27, 28]. Such products now have been banned from use at the Stockholm Convention in 2001 and in Benin.

The widespread use and application of OCPs qua POPs in Benin resulted in the nearly 37 cases of deaths during the 1999-2000 season and 5 deaths out of 105 cases between 2007 and 2008 due to the poisoning of Endosulfan in the Borgou region [29].

In North Benin, which records as the most cotton-growing area, high OCP concentration levels detected in aquatic ecosystems such as rivers of national parks, streams, and other surface waters supporting aquatic life [30]. Aquatic ecosystems are thus the final course of agricultural pesticides [31, 32]. For instance, DDT and dieldrin were detected at high levels in fish species of Oueme river (*Protopterus annectens, Schilbe intermedius, Clarias gariepinus*) [27, 30].

If recurrent cases of OCP residues are still detected despite their ban then there is a problem of their recent use likely in the growth

of cotton in Benin. This current paper affords an overview of the relationship between Organochlorine Pesticides used in the Beninese cotton-growing basin and their effects on the natural environmental matrices and human risks.

II. OCPs/POPs LEGISLATION AND REGULATIONS

Pesticide remanence in food and cash crops has created a host of harmful effects on human and non-human organisms. Given the risks, it is urgent that measures are taken to prevent any further release about these hazardous compounds. Therefore, various international specialized institutions (Secretariat of Stockholm Convention, WHO, World Bank, FAO, UNEP, GEF, UNITAR), government (CCME, EPA) and non-governmental organizations (CIEL, IPEN, IFCS, PANNA), truly concerned by these contaminants, have consented considerable. POP production, use, and release, mostly organochlorine pesticides, implemented at the Stockholm Convention were banned or severely restricted in order to tackle POPs accumulation and biomagnification. From the abovementioned conventions, POPs were regulated and listed in Annex 1-4, [35].

Benin doesn't currently have a pesticide disposal infrastructure. However, the reduction and/or elimination of POPs pesticides is regulated by FAO guidelines and ratified conventions such as

- Stockholm Convention on POPs ratified in January 2004;
- Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, ratified on January 5, 2004. Under PIC, implemented jointly by FAO and the International Register of Potentially Toxic Chemicals (UNEP/IRPTC) in 1994, "*pesticides banned or severely restricted for health reasons or the environment are subject to the Prior Informed Consent procedure. No pesticide in these categories should be exported to an importing country participating in the PIC procedure contrary to that country's decision...*" [33]. For instance, endosulfan in Annex III of the Rotterdam Convention on PIC.
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, accession on December 14, 1997.
- -convention of Viennes, adhered on July 1, 1993, concerning the adjuvants present in the formulation of the molecules of pesticides

Through an investigation in Benin, it has been established a list of sixty-six phytopharmaceutical products whose importation and packaging for the national marketing as well as employment in agriculture are prohibited. From the sixty-six substances, seven of the twelve POPs revealed being listed in the Stockholm Convention. There are OCP such as DDT, heptachlor, dieldrin, aldrin, endrin, chlordane, and Mirex [34]. The review shows that the legislative framework for POPs is recent and is contained in the broader chemicals or poisonous substances. Benin is practically a country essentially consuming POPs that it imports. The lack of coherence of national policies on plant health protection, the sporadic or partial nature of agricultural control and the absence of pest risk analysis are some elements leading to ineffective implementation of the regulation, facilitating the informal. The informal pesticide distribution system has evolved very actively and has grown significantly due to the existence of a local service to the rural world, flexibility towards producers and the practice of costs. This circuit is this path that still encourages the use of OCPs and involves risks related to human, animal and environmental health.

III. OCPs EXPOSURE PATHWAYS

Through various routes, humans can be exposed to OCPs and hazardous substances including diet, occupation, accidents and both indoor and outdoor environments. These routes are easily assimilable to the breathing polluted air, dermal penetration or ingestion of contaminated foods and drinking water [2, 35]. Overall, exposure to pesticides can either be acute or chronic. In fact, acute exposure occurs obviously during pesticide production or chemical accidents [36]. For certain pesticides, point sources (e.g. WWTP) are responsible for high contamination compared to non-point sources. Symptoms of intoxication and exposure mode are closely bound, meaning chronic exposure occurs most commonly via dietary pathways [37]. For instance, chronic exposure recorded about the 12 banned POPs happened mostly through food products. Animal fatty tissues and edible oils especially from cottonseeds are major foods containing the greatest concentrations of pesticides. Food contamination by pesticides is one of worldwide concern [35] and chronic effects of prolonged exposure to pesticides may become important enough to cause clinical symptoms.

Therefore, Maximum Residue Limits (MRLs) is the legally and toxicologically acceptable maximum concentrations used to approve pesticide residues (in mg/kg) on or within foods and feeds [38, 39]. When residue value is higher than the MRL value then the residues are compared with the Acute Reference Dose (ARfD) and/or the Acceptable Daily Intake (ADI) [11, 40].

Survey programs across Benin territory have found pesticide residues in several agricultural products. Traces of organochlorines from DDT and derived groups, heptachlor lindane, dieldrin, and chlordane were reported in 17 fresh products, 7 stored commodities, and 116 plant product samples [41, 42]. Among the various contaminated agricultural products, yam chips, okra, cowpea, tomato were cited. In Benin's river flood plains, grown vegetables contained various concentrations of OCP, including DDTs (1,578 µg / g dw), drins (57 µg / g dw) and lindane (444 µg / g dw) which were above MRLs and safe consumption limits by WHO guidelines [2].

In addition, traces of these same pesticides have been identified in goat and cow's milk [41, 42]. The investigation of OCPs' bioaccumulation and exposure risks in Ivory Coast State reveals general contamination of cow's milk and butter by HCH (hexachlorocyclohexane), DDT and cycloidians groups [43]. The majority of pesticide pollutants introduced into the environment accumulate in livestock through fodder or contaminated water [44]. Water is involved in transporting pesticides from the field to surface or groundwater at the first rainy events after application with the 5% loss due to runoff. Pesticide fate depends on a relationship pesticide-soil properties with meteorological conditions and site characteristics.

Pesticide residues identified in the different samples may, in the long term, because of their tendency to bioaccumulate, have toxic effects to varying degrees on the higher links of food chains (the problem of survival and reproduction). Contamination of water, plants, and insects (e.g. bees) involves the entire food chains. The

man at the top of all food webs is not spared from this threat given his consumption of products contaminated by pesticides.

IV. OCPs Contamination of Natural Environment: Surface & Groundwater, Sediments and Soils

There is recorded evidence of OCP contamination in Benin water resources.

Cotton pesticides are generally soluble in water, ranging between 0.3 and 1000 mg / L [45]. Rapid contamination of aquatic ecosystems by pesticides is facilitated via leaching, runoff, equipment washing, empty container disposal and the vicinity of crop growing field to water bodies. In Benin's cotton zone 46% of cotton and corn producers have a field within 500 m of water bodies or fish ponds. That means agricultural production facilities threaten aquatic life and the neighboring populations who make domestic use of these water bodies [46]. Recently, high concentrations of endosulfan (58–746 .g/L), DDT (6.45–100 g/L), dieldrin (1–48 .g/L) and heptachlor (34–83 .g/L) were detected in freshwaters (Fig.1) including Agbado (Savalou), Atacora, Djona, and W Park Rivers [27, 30] which by far exceed drinking water quality standards in Benin.

In addition, OCP residues including DDT and metabolites, Lindane, Endosulfan, and Aldrin and derivatives have been identified and quantified in sediments in Benin collected in Nokoué Lake [47], along the Ouémé River [48], Agbado River [49], Kiti river [50], Magou river [51], and at the Gogounou-Kandi-Banikoara cotton belt [28]. Sediments in some of these waters show DDT and metabolites residues high relative to detection limits and also compared to sediments in the subregions [30]. The high values of endosulfan reported in the Gogounou-Kandi-Banikoara cotton belt (120-150 mg/kg) were comparatively higher than some other streams. The high endosulfan presence may indicate recent use of this pesticide in cotton-growing regions through its reintroduction with the regional project on the prevention and management of worm cotton resistance *Helicoverpa armigera* [52].

In general, contaminated surface waters can sink to sediments. High values reported in certain sediments in Benin can be explained the belonging and proximity of the to the cotton fields, but also by the low solubility of OCPs settling on sediments when the streams are contaminated [30, 46].

The risks of soil contamination are all the greater as the products are intensively used and have high persistence in the soil. Pesticides joint soil during spraying or cleaning application equipment. These pesticides penetrate the soils where they undergo dispersion phenomena destroying mineral and organic elements and non-target organisms. The rest is infiltrating or draining towards streams.

V. OCPs Effects on Biota, Experimental Animals

Some examples of in vivo studies in human subjects or animal models and animal studies associated with human microbiota using a range of relevant pesticide concentrations were recently conducted.

Biota

Links have been established between POP pesticide exposure and fauna decline, disease or behavioral and congenital anomalies in fish, birds, and mammals, involving human health investigations. Wildlife populations could also be considered a sentinel for human health to sound the alarm bells [53]. Bird communities are a great terrestrial indicator of environmental pollution [44]. More commonly, fish show toxicological effects related to contaminant exposure, making them as well an adequate bioindicator in aquatic ecosystems [54, 55].

On certain adult birds in California, synthetic compounds cause acute mortality rate, sublethal stress, reproductive failure, elimination of egg formation, shell thinning, chick-rearing and behaviors hatching changes [56]. A study conducted in India reported that repetitive use of OCPs leads to a decline in birds' population like the bald eagle, sparrow hawk and peregrine falcon. Therefore, pesticides lead to habitat and population loss, behavioral changes and decline in several birds [57]. Moreover, pesticides act on wildlife endocrine system and disrupt the estrogen receptors (ER) or androgen receptors (AR). Most environmental chemicals are suspected to have anti-estrogenic effects [58] leading to a decrease in prolactin production [59].

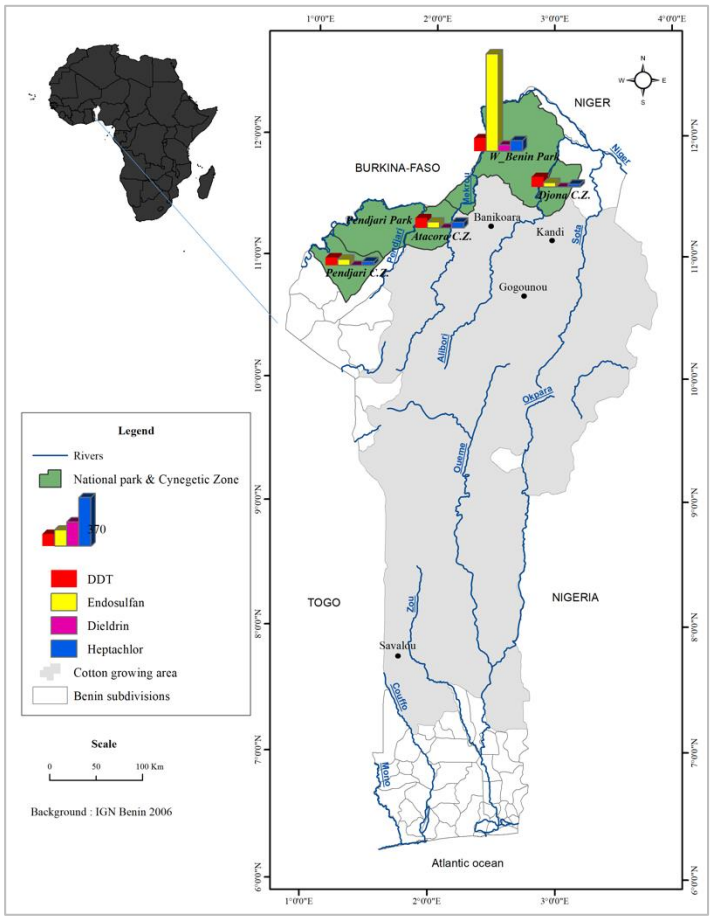

Fig. 1. OCPs occurrence in Benin
Data source: reported by [30]

In Benin, recurrent use of OCPs in cotton growing and in market gardening causes many fish species death including *Clarias gariepinus*, *Tilapia nilotica* and *Polypterus endlicheri*, observed in river systems and other Niger River tributaries [30, 51]. Such species of carnivorous fish, collected in various rivers located either internally or externally protected areas — Pendjari and W-

Benin Park, flora and habitats — contain high concentration levels of DDT, DDE, Endosulfan, Lindane, heptachlor, dieldrin due to high lipophilicity, low water solubility and high persistence, given them bioaccumulation and biomagnification capacity along the trophic chains [30]. In addition, lindane (105 µg / g), dieldrin (75 µg / g), heptachlor (30 µg / g), pp-TDE (28 µg / g) was reported in males *Sarotherodon melanotheron* within the Ouémé River [60] leading to health disruption of fishes due to the high lethal concentration. Recently, OCP residues collected in fish (*Clarias gariepinus*, *Clarias ebriensis*), amphibians (*Bufo regularis*, *Xenopus muelleri*) and crabs (*Cardiosoma aramatum*) in the Kiti River in Benin, were ranged between 23-515 ng / g lipid for ΣDDT and from 27- to 75 ng / g lipid for α-Endosulfan [50]. Contamination levels of residual Organochlorine compound collected were found highly greater to limit of detection fixed to 0.1 ng / g lipid due to cotton-growing activities in the area.

Overall, pesticide toxicity towards wildlife depends on the persistence and chemical degree toxicity. However, dose, time and duration of application are fundamental variables in a pesticide's toxicity. For example, Wildlife is more vulnerable to pesticide effects during nesting, breastfeeding, or in times of low food availability.

Experimental animals

L'application de l'OCP a entraîné une contamination persistante et omniprésente de l'environnement naturel, avec des effets à la fois sur les organismes animaux et humains. Thus, laboratory toxicity tests on animal models have been of unavoidable utility for assessing these effects, or even for detecting fatal cases.

For several years, fruit flies (*Drosophila melanogaster*) have been broadly used for environmental toxicology studies and elucidating human diseases. Therefore, it has been recommended as an alternative animal model for screening the risks caused by environmental chemicals in a study conducted by Sharma and collaborators [61]. Indeed, 0.02 to 2.0 µg /ml endosulfan concentrations exposed in the third instar fruitfly "Oregon R+" larvae diet has resulted in organismal responses such as a fly emergence delay with a remarkable decrease in adult flies' number and locomotor behaviors [61]. Moreover, chlordane exposure to zebrafish larvae (*Danio rerio*) have significantly a lower survival rate, developmental and hatching time delay and decreased embryo productivity. Such results indicated even chlordane at short-term exposure in daily-life acts as an endocrine-disrupting chemical and would result in changes in phenotypes and reproductive development [62]. A recent study has established the link between neurodegenerative risks in zebrafish and dietary exposure to dieldrin. Thus, dieldrin neurotoxicity is explained by the protein alteration related to the mitochondria, immune system, and Parkinson's disease [63]. exposure of heptachlor to mice resulted in movement deficits similar to parkinsonism and nerve dopaminergic neuronal loss [64]. Epidemiological investigations have revealed evidence of an obvious or almost no association with exposure to DDT and tumor development, or even cancer in humans. However, exposure to DDT demonstrated in rats and mice has induced obvious hepatho-carcinogenic tumors in the lungs, the liver and adrenal glands [65]. In addition, daily oral ingestion of 1.10 mg/kg lindane led to changes in gene expression in Rat Liver accounting for carcinogenicity. Recently, exposure of 1000 ug / L lindane to *D. melanogaster* is associated with tumor cell migration and changes in gene expression in Unfolded Protein Response (UPR) and Mitogen-Activated Protein Kinase signaling pathways (MAPK) [66]. Knowing that each type of organochlorine pesticide possesses intrinsic toxicity, it remains important to establish the molecular mechanisms underlying the adverse effects of environmental pollutants no matter they are pesticides, industrials products.

VI. Organochlorine Pesticide (OCP) Exposure and Human Health Effects

A UN report published in 2017 said that although pesticide uses are well-correlated with food production increase, they had catastrophic effects on human health and the environment without ending hunger. it is counted every year, 200,000 individuals on average die as a result of exposure to toxic pesticides around the world [67]. Pesticide adverse effects associated with human health are related to the pesticide individual toxicity. Certain pesticides are nervous system disrupters. Others are the skin or eye irritants. Some are probably or possible carcinogens. And others may act as hormonal or endocrine system disrupting in the body. For instance, WHO states, "*Pesticide toxicity is dependent on its function and other factors. As a result, the herbicide compounds for humans are less toxic than the insecticidal ones*."[68]. OCP exposures at an acute, chronic or lethal dose are associated with diseases that can lead to death. Synergistic effects of pesticides are another phenomenon much less known and studied yet potentially even more dangerous. Also called "cocktail effect" and potentially devastating in the long term, health consequences of a mixture of different chemical pollutants remain severe. Thus, some of the pesticides found alone in water at given doses are considered non-hazardous, sadly the cumulative effects of many are largely unknown. Worse still, there are pesticides spread in natural waters to that point the number of their combinations at various concentrations is virtually impossible to simulate.

Endocrine system

OCPs are known as endocrine-disrupting chemicals (EDCs) since they interfere with the endocrine system function and normal molecular circuitry [44]. They are able to affect hormone signaling-like estrogen, thyroid and androgens, which are an essential part of normal embryonic development [69], mammalian reproduction and neurological function [70]. A study on prenatal exposure of Chinese pregnant mothers to DDT, HCB, b-BHC, and Mirex is associated with a significant birth weight decrease [71]. A similar study conducted previously on Ukrainian subjects showed a weight decrease for the highest levels of OCP exposure [72]. Spanish study revealed that certain OCP exposure to prenatal circumstances could impair the fetus anthropometric development , reduce 0.39 cm in birth length for each 10-unit increase in HCB concentrations, decrease 107 g, 63g,53 g and 79 g in birth weight for each 10-unit increase respectively 4,4-DDE, 4,4'-DDT, b-BCH and HCB concentrations in cord serum, and head circumference of birth is reduced of 0.26 cm [73]. Certain researchers found a bonding between precocious puberty in females and pesticide exposures [74, 75] while others found their association with delayed puberty [76]. Indeed, a study of a group of participants from the Michigan Fishery Cohort revealed an increase of 15 ug / l in utero DDE exposure, reducing the age at menarche by 1 year [77]. Reduced gonadotropic hormones, delayed physical and

sexual developments, delayed puberty and estradiol were associated with increased levels of OCPs in the blood of women living in South Kazakhstan cotton-growing regions [78]. It is even obvious that precocious puberty mechanism is related to previous exposure to estrogenic endocrine disruptors like DDT in immigrants from developing countries to Belgium while native girls showed undetectable concentrations [74].

Neurotoxicity

Certain pesticides due to their toxicity are associated with neuron loss (neuronopathy), oxidative stress, cytoskeleton disruption, calcium overload, or mitochondria damaging, either by necrosis or apoptosis [79]. Lindane and some cycloidians including aldrin, chlordane, heptachlor, and dieldrin, have moderate to high acute oral toxicity with the central nervous system as their primary target [80].

The USA cohorts samples composed of ranchers, farmers and fishermen exposed to pesticides present a 70% higher incidence of Parkinson's disease (PD) [81]. In addition, several studies have recognized that occupational and chronic exposures to pesticides are a potential risk factor for various neurodegenerative diseases including madness and mild cognitive impairments, closely to Alzheimer's disease (AD) [82, 83]. In addition, several studies have recognized that occupational and chronic exposures to pesticides are a potential risk factor for various neurodegenerative diseases including madness and mild cognitive impairments, closely to Alzheimer's disease (AD) [84]. Similarly, in North India population, authors reported a significant association between AD and high levels of dieldrin (OR =2.086, 95% CI = 1.224-3.555) and β-HCH (OR = 2.064, 95% 95% = 1.373-3.102) [85].

It has been recognized that mitochondria have homeostatic functions in ion homeostasis, metabolic cell signaling, in the cell morphology regulation, mobility and multiplication, and in triggering apoptosis. Any events from environmental toxins (e.g. chlorinated cyclodiene: Dieldrin) that significantly alters ATP levels, the universal source of chemical energy in the cell, inhibit of biosynthetic pathways essential for mitochondrial function [86]. Recently, studies shown β-HCH and p'-DDE tend to accumulate in the liver resulting in mitochondrial dysfunction and changes in hepatic metabolite profile [87].

n children, OCP exposures are associated with neuron development problems recognizable by the reduction in mental and psychomotor functions [88], autism spectrum disorder (ASD) and Hyperactivity or not with Attention Deficit Disorder (ADHD) [89].

C***arcinogenicity***

Global cancer 2018 has reported 18.1 million new cases of cancer-related incidence and mortality. In fact, overall cancer cases, 11.6% of lung cancers, 11.6% of breast cancers, 7.1% of prostate cancers, 9.2% of colorectal cancers, 8, 2% of stomach cancers and 8.2% of liver cancers were diagnosed [90]. Moreover, organochlorine pesticides have been reported to increase the risk of hormone-related cancers, including breast, prostate, stomach and lung cancers [44]. The 1999-2004 National Health and Nutrition Examination Study in U.S. adults found a significant association between serum levels and the risk of prostate cancer prevalence [91]. In patients from southeastern Iran, the recording of higher serum levels of certain OCP (HCH, DDE, and DDT) is associated with Colorectal cancer progression (CRC), the third most common cancer-caused worldwide death [92]. In addition, there is ample epidemiological evidence that exposure to endocrine-disrupting chemicals is associated with an increase in the incidence and prevalence of various human diseases, including breast cancer which is highly prevalent in the presence of p,p'-DDE [93]. Therefore, the human burden of carcinogens remains a concern of the world, especially when these cancer tumors migrate to neighboring tissues.

Recently, in the Borgou region, one of the leading departments of the Cotton growing area in Northern-Benin, the highest diabetes prevalence of 4.6% was recorded compared with the national average [94]. Thus, type 2 diabetes was associated with high DDT and other organochlorine pesticide concentrations in diabetic individuals. That means, despite DDT and 6 other OCPs are banned in Benin since 2004, they keep being provided by neighboring countries and national retailers for cotton pests, fishing and food preservation ends [15]. Beninese Organization for the Promotion of Organic Agriculture (OBEPAB) in 2016 conducted a survey with nearly 500 cotton farmers on aspects relating to pesticide use and its impact on human health. In fact, 17% reported signs and symptoms of acute pesticide intoxication more than six times in previous years, while 21% lost 2-5 days of work due to the effects of pesticide exposure [23]. Human health effects are caused by Skin contact (handling of pesticide products), Inhalation (breathing of dust or spray), Ingestion (pesticides consumed as a contaminant on/in food or in water) [33]. Several kinds of affection experienced after pesticide application in Benin were reported for this purpose Fig. 2.

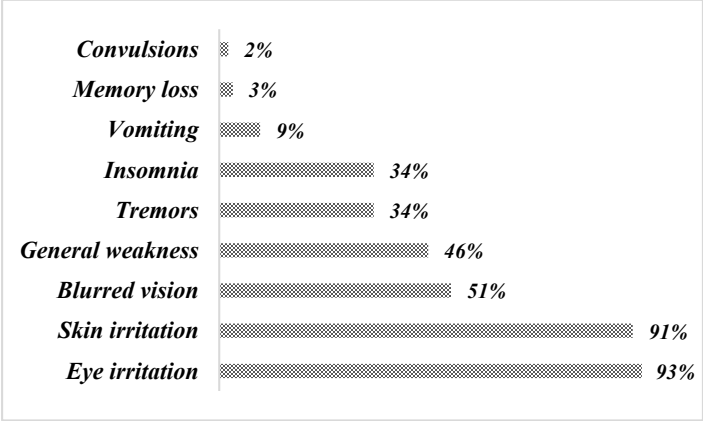

Fig. 2: Various Symptoms due to cotton pesticides reported by farmers in Benin

Data source: reported by [23]

VII. Climate change and pesticides exposures

Overall, Global Climate Change (GCC) was predicted to increase the level of exposure to many environmental pollutants due to direct and indirect effects on the patterns of use, transport, and the fate of chemicals [95]. It might affect the different steps in the pathway from a chemical source in the environment through to an increase in vulnerability on human health.

Climate change including elevated carbon dioxide (CO_2) concentrations, changes in temperature and precipitation probably today increase the frequency and severity of pest outbreaks with high pesticide use, contamination, and concentration of POPs and heavy metals [96-98]. For instance, climate impact projections on

Chinese origin pesticide usage will rise 0.5-1.2%, 1.1-2.5% by 2040, 2.4-9.1% by 2070, and 2.6-18.3% by 2100 [99]. Changes in temperature could act as co-stressors capable of affecting physiological processes in wildlife [69].

In fact, in aquatic species, lipid content is a key biological factor accounting for the concentration of POPs [100]. Within estuarine ecosystems, climate change resulting in variations in temperature and salinity, for example, could affect the susceptibility of marine organisms to pesticide contamination. In Florida, the toxicity DDT tested with Blue Crabs (*Callinectes sapidus*) revealed to be less toxic to these estuarine organisms at high temperatures [101]. Contrariwise, the toxicity of two common other pesticides in estuarine grass shrimp, *Palaemonetes pugio*, increased with temperature and salinity [102]. Therefore, Changes in climate stressors such as temperature and salinity may alter the toxicity of some pesticides and the nature of the effect will depend on both the organism, its stage of development, and the chemical contaminant.

Overall, the fate of pesticides is not sufficiently understood in tropical regions compared to temperate zones. But, the mechanism of tropical climates facilitates the rapid dissipation of pesticides involving increased volatility and improved chemical and microbial degradation [103].

VIII. Conclusion

A growing number of literature provides evidence that organochlorine pesticides act on the natural environment and human health. Cotton growing in Benin, uses a myriad of organochlorine pesticides which give rise to undesirable effects. Despite recurrent cases of recorded diseases and deaths, bonding is almost not made with pesticide exposure effects. As a result, toxicological data related to human health in Benin are almost non-existent. However, for reducing environmental risk by organochlorine pesticides which lead to human health and biota disturbances, it is important to implement certain strategies that are becoming more and more important. It's about: (1) reducing the risk of pesticide transport surface or groundwater, (2) decreasing amount of pesticide used, and (3) reducing the persistence or mobility of active ingredients. It will also be necessary to develop Best Management Practices (BMP) that can reduce runoff, soil erosion or increase the soil organic matter content, which will help limit the transport of pesticides to the environment.

Acronyms

FAO	: Food and Agriculture Organization of the United Nations
UNEP	: United Nations Environment Programme
GEF	: Global Environment Facility
UNITAR	: United Nations Institute for Training & Research
CCME	: Canadian Council of Ministers of the Environment
EPA	: U.S. Environmental Protection Agency
CIEL	: Center for International Environmental Law
IPEN	: International POPs Elimination Network
IFCS	: Intergovernmental Forum on Chemical Safety
PANNA	: Pesticide Action Network North America

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Effect of ethepon on post-harvest characteristics of kiwi (*Actinidia deliciosa* cv. Monty) in Dolakha, Nepal

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Abstract- The experiment was conducted to study the effect of ethephon on post-harvest characteristics of kiwifruit during February to April, 2019 in laboratory of Rural Development Tuki Association, Dolakha, Nepal to address the problem of late and uneven ripening in Kiwi. Monty variety of kiwi was used under study. Laboratory experiment was laid out in Completely Randomized Design (CRD) with five treatments, each replicated four times. This experiment comprised of five treatments with different concentration of ethephon i.e T_1 = Control, T_2 = 100 ppm , T_3 = 300 ppm, T_4 =500 ppm and T_5 = 700 ppm. Parameters like TSS, TA, TSS/TA, pH, physiological weight loss, storage days and sensory evaluation were recorded. The study showed that maximum TSS (16.63^0brix) was observed in the fruits treated with 700 ppm at the end of ripening period which was statistically at par with 500 ppm whereas minimum TSS(12.0^0brix) was observed in control fruits during 30th day after treatment. At the peak period of ripening, fruits treated with 700 ppm led to lowest titratable acidity (0.66%), maximum TSS/TA (25.57), maximum physiological weight loss(17.28%) and highest Ph(4.08) whereas Control fruits showed maximum acid content (1.1%), minimum TSS/TA(12.1), lowest physiological weight loss (11.8%) and lowest Ph (3.5) during $3o^{th}$ day of treatment. The storage life of fruits treated with 700 ppm was minimum (16.25 days) followed by 500 ppm (22.13 days) which was maximum (48.25 days) in case of control fruits. Eating quality declined significantly in highest dose (700ppm) of ethephon at the end of ripening period and on this stage 500 ppm ethephon developed very good edible quality (2.75) followed by 300 ppm (2.25). In a nutshell, considering the post-harvest life and quality attributes, the concentration of ethephon ranging from (500-700) ppm was found appropriate for timely ripening of kiwi.

***Index Terms*:** Kiwifruit, climacteric, ethephon, post-harvest

INTRODUCTION

Kiwi fruit is native to china which is often called as Chinese gooseberry (Abedini, 2004). It belongs to genus Actinidia and family Actinidiaceae. The cultivated kiwifruit species include Actinidia deliciosa, Actinidia chinensis and Actinidia arguta (Sims, 2011). There are different varieties of Kiwi cultivated with green flesh and red flesh. It performs well in sandy loam and loamy soil. It works well in Ph range of 6.5 to 7. In Nepal, Kiwi show better production at an altitude of 1200m to 2400m (Dhakal, 2018). It can grow well in that area where there is fog and frost but not snow.

Kiwi is a climacteric fruit. Generally, kiwi is harvested during November-December when it is still green in colour, hard texture, high acid content, soluble solid content when around 7 and less flavor. Ripening in kiwi is often related with term climacteric rise (MacRae, Lallu, Searle, & Bowen, 1989). Ripening in kiwi has been a topic of discussion as it does not start ripe unless it is detached from tree. Most of the producers and consumers of kiwi are confronted with the problem of late and uneven ripening. Different practices including wrapping of fruits in clothes, papers and jute bag, smoke induction, piling in bag, wounding of fruits, putting fruits in bag containing straw or husk, putting fruits nearby the ethylene producing fruits were made to induce ripening in kiwi. However, none of these methods seem to be producing a significant output and hence people nowadays are searching for new alternatives for ripening kiwi fruits.

Many fruits produce larger quantities of ethylene and respond with uniform ripening when exposed to an external source of ethylene (Sergent, Schaffer, Lara, & Wilis, 2009). Ethephon treatment nowadays can be considered as the best alternative as it induce ethylene hormone and helps in ripening. Ethephon is a name for 2-chloroethylphosphonic acid, a compound that slowly releases ethylene gas. It affects the growth, development, ripening, and senescence (aging) of all plants. The parameters of ripening like TSS , TA , TSS/TA , Ph and storability of fruits are affected based on concentrations of ethephon used. Ethephon when used in proper concentration based on time of demand of consumer will solve the problem of late and uneven ripening of the kiwifruits. The toxicity of ethephon is very low as it gets easily converted to ethylene (Baramati, 2009). Keeping in mind these aspects, this study aims at finding out proper concentration of ethephon that enhance timely and uniform ripening of kiwi with minimum health hazard on consumers.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at lab of Rural Development Tuki Association, Charikot, Dolakha on kiwi (*Actinidia deliciosa* cv. Monty) from January 20, 2019 to March 5, 2019. Monty variety was used under study. Kiwis were harvested from farmer's farm and were taken to lab for experiment. Temperature and RH were recorded on 3 days interval on time of data observation. The data were taken using thermo-hygrometer and on average, the temperature and RH recorded within experimental period were 8.3^0C with standard deviation of 1.206 and 75.2 % with standard deviation of 4.158 respectively.

Experimental design and treatment details

The research was carried out in Completely Randomized Design (CRD) with 5 treatments and 4 replications. The harvested kiwi fruits were treated with different concentrations of ethephon 39% SL (Kripon) i.e control fruits (T1), 100 ppm ethephon(T2), 300 ppm ethephon (T3), 500 ppm ethephon (T4) and 700 ppm ethephon(T5). For the preparation of 100 ppm of ethephon, 5.13 ml of ethephon (kripon) is dissolved in 20 L of water. Similarly, 300 ppm, 500 ppm and 700 ppm ethephon solution were prepared by dissolving 15.4 ml, 25.65 ml and 35.9 ml of ethephon in 20 L of water respectively. Each plots had 14 kiwi fruits, out of them 10 were taken as destructive samples and 4 as non-destructive samples.

Observations taken

Physiological loss in weight (PLW) was determined weighing fruits in respective days using digital sensitive balance. Total soluble solids (^{0}Brix) was determined with the help of hand held refractometer calibrated using distilled water. The titratable acidity (TA) of the fruits (% of citric acid) from each treatment was estimated as per standard procedures of (A.O.A.C, 2005). 10 ml of the clear homogenized juice of a fruit from each treatment was taken and titrated against standard 0.1 N of sodium hydroxide (NaOH) solution using phenolphthalein as an indicator. TSS/TA ratio was calculated dividing TSS value and TA. pH of the juice was measured with the help of pH meter. Storability of the fruits were measured in term of days from the initiation of the experiment up to 50% rotting. A taste panel of 4 persons were evaluated organoleptically-on fruits at different stage at weekly interval i.e at 7 days , 14 days, and 21 days on a scale of 1-3 (1 = poor , 2 = good, 3 = Excellent). The pulp of the fruits treated with different concentration of ethephons were provided to them and they ranked based on taste from scale 1-3.

Data analysis

The collected data was compiled by using the Ms-excel program and subjected to analysis of variance using R-STAT software package. Means of separation was done by LSD analysis at 5% level of significance. Graph and tables were constructed by using the MS-excel.

RESULTS AND DISCUSSIONS

Table 1. Effect of ethephon doses on total soluble solids (º brix) of Kiwifruit (Actinidia deliciosa cv. Monty) at ambient condition at Dolakha, Nepal 2019

Treatments	TSS (º brix)									
	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21	Day 24	Day 27	Day 30
Control	8.3^b	8.65^c	8.30^c	10.55^c	11.30^c	11.03^d	11.68^d	11.20^c	11.89^c	12.0^c
100 ppm	8.98^b	9.70^{bc}	9.83^{bc}	11.95^b	12.35^{bc}	12.20^c	12.88^c	12.67^b	15.20^a	14.4^b
300 ppm	8.77b	10.00^b	11.87^b	11.4^{bc}	12.83^b	13.23^b	14.00^b	14.68^a	13.63^b	14.9^a
500 ppm	9.88^a	11.60^a	14.65^a	16.48^a	16.20^a	15.93^a	15.75^a	-	-	-
700 ppm	9.73^a	12.60^a	16.63^a	16.53^a	15.80^a	-	-	-	-	-
Sem (±)	0.24	0.392	0.714	0.36	0.419	0.310	0.323	0.246	0.203	0.178
LSD (0.05)	0.719	1.18	2.15	1.08	1.26	0.95	0.99	0.78	0.65	0.569
F test	**	***	***	***	***	***	***	***	***	***
CV, %	5.22	7.46	7.83	5.37	6.12	4.7	4.8	3.8	3.0	2.6

*, ** and *** indicate significant at 5 % , 1 % and 0.1% probability level

Table 2. Effect of ethephon doses on Titratable Acidity (% of citric acid) of Kiwifruit (*Actinidia deliciosa* cv. Monty) at ambient condition in Dolakha, Nepal 2019

Treatments	Titrable acidity (TA) (% of citric acid)									
	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21	Day 24	Day 27	Day 30
Control	1.45^{c}	1.32^{c}	1.42^{d}	1.29^{c}	1.26^{c}	1.24^{c}	1.24^{d}	1.20^{c}	1.16^{c}	1.1^{c}
100 ppm	1.41^{bc}	1.23^{bc}	1.34^{d}	1.25^{c}	1.22^{bc}	1.18^{c}	1.15^{cd}	1.05^{b}	0.99^{b}	0.87^{b}
300 ppm	1.35^{abc}	1.20^{b}	1.11^{c}	1.14^{b}	1.14^{b}	1.03^{b}	1.05^{bc}	0.86^{a}	0.79^{a}	0.82^{a}
500 ppm	1.34^{ab}	1.17^{b}	0.88^{b}	0.83^{a}	0.83^{a}	0.83^{a}	0.86^{b}	-	-	-
700 ppm	1.24^{a}	1.06^{a}	0.66^{a}	0.77^{a}	0.73^{a}	-	-	-	-	-
Sem (±)	0.037	0.017	0.007	0.034	0.033	0.033	0.004	0.014	0.015	0.023
LSD (0.05)	0.11	0.10	0.13	0.11	0.10	0.03	0.03	0.04	0.05	0.07
F test	*	**	***	***	***	***	***	***	***	***
CV, %	5.44	5.5	7.83	6.58	6.46	6.1	5.4	2.7	3.1	4.8

*, ** and *** indicate significant at 5 %, 1 % and 0.1% probability level

Table 3. Effect of ethephon doses on TSS/TA ratio of Kiwifruit (*Actinidia deliciosa* cv. Monty) at ambient condition in Dolakha, Nepal 2019

Treatments	TSS/TA									
	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21	Day 24	Day 27	Day 30
Control	5.72^{c}	6.54^{d}	5.83^{d}	8.20^{b}	8.97^{d}	8.51^{d}	9.00^{e}	8.75^{c}	11.6^{c}	12.1^{c}
100 ppm	6.35^{c}	7.89^{cd}	7.35^{cd}	9.58^{b}	10.16^{cd}	9.86^{d}	10.69^{d}	11.70^{b}	14.53^{b}	15.62^{b}
300 ppm	6.55^{bc}	8.35^{c}	10.84^{c}	10.02^{b}	11.25^{c}	12.33^{c}	12.75^{c}	15.30^{a}	14.6^{a}	18.8^{a}
500 ppm	7.39^{ab}	9.92^{b}	16.60^{b}	20.14^{a}	22.02^{a}	18.97^{a}	17.73^{a}	-	-	-
700 ppm	7.89^{a}	11.92^{a}	25.57^{a}	21.39^{a}	19.13^{b}	-	-	-	-	-
Sem (±)	0.341	0.502	1.287	0.66	0.72	0.357	0.49	0.167	0.549	0.196
LSD (0.05)	1.03	1.51	3.88	1.99	2.16	1.10	1.51	0.534	1.76	0.63
F test	**	***	***	***	***	***	***	***	**	***
CV, %	10.1	11.2	19.4	9.51	10.0	5.7	7.8	2.8	8.1	2.5

*, ** and *** indicate significant at 5 %, 1 % and 0.1% probability level

Table 4. Effect of ethephon doses on pH of Kiwifruit (*Actinidia deliciosa* cv. Monty) at ambient condition in Dolakha, Nepal 2019

Treatment	PH									
	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21	Day 24	Day 27	Day 30
Control	3.13^{b}	3.15^{c}	3.08^{d}	3.23^{d}	3.28^{c}	3.33^{c}	3.30^{c}	3.27^{b}	3.39^{b}	3.50^{b}
100 ppm	3.10^{b}	3.28^{c}	3.20^{c}	3.30^{cd}	3.35^{c}	3.45^{b}	3.47^{b}	3.5^{ab}	3.63^{a}	3.70^{a}
300 ppm	3.15^{b}	3.25^{c}	3.35^{b}	3.48^{c}	3.50^{bc}	3.53^{b}	3.60^{ab}	3.73^{a}	3.68^{a}	3.80^{a}
500 ppm	3.13^{b}	3.43^{b}	3.43^{b}	3.73^{b}	3.70^{ab}	3.75^{a}	3.73^{a}	-	-	-
700 ppm	3.33^{a}	3.58^{a}	3.83^{a}	4.08^{a}	3.82^{a}	-	-	-	-	-
Sem (±)	0.047	0.045	0.035	0.014	0.086	0.040	0.049	0.061	0.043	0.047
LSD (0.05)	0.14	0.14	0.11	0.18	0.26	0.12	0.15	0.20	0.14	0.15
F test	*	***	***	***	**	***	***	**	***	**
CV, %	2.97	2.71	2.06	3.32	4.88	2.3	2.8	3.5	2.4	2.6

*, ** and *** indicate significant at 5 %, 1 % and 0.1% probability level

Table 5. Effect of ethephon doses on physiological loss in weight (PLW) of Kiwifruit (*Actinidia deliciosa* cv. Monty) at ambient condition in Dolakha, Nepal, 2019

Treatments	Physiological loss in weight (%)									
	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21	Day 24	Day 27	Day 30
Control	2.20^{b}	3.59^{c}	4.23^{d}	3.94^{c}	5.76^{c}	5.89^{c}	7.12^{b}	9.0^{b}	12.3^{b}	11.8
100 ppm	2.43^{b}	4.52^{bc}	4.94^{cd}	6.21^{c}	7.67^{c}	8.95^{c}	10.26^{a}	15.36^{a}	12.05^{b}	14.35
300 ppm	2.57^{b}	4.88^{bc}	6.34^{c}	6.76^{c}	8.25^{c}	10.29^{c}	13.46^{a}	13.20^{b}	16.43^{a}	15.83
500 ppm	2.93^{b}	6.06^{ab}	8.93^{b}	11.84^{c}	11.57^{b}	12.53^{a}	13.12^{a}	-	-	-
700 ppm	4.76^{a}	7.75^{a}	11.65^{a}	15.39^{a}	17.28^{a}	-	-	-	-	-
Sem (±)	0.37	0.567	0.67	0.954	1.191	1.402	1.70	0.399	0.398	0.344
LSD (0.05)	1.14	1.71	1.77	2.88	3.59	4.32	5.22	1.27	1.27	1.10
F test	**	**	***	***	***	**	***	**	***	***
CV, %	25.3	21.2	18.4	21.6	23.6	27.6	26.8	5.8	4.4	3.8

*, ** and *** indicate significant at 5 %, 1 % and 0.1% probability level

Table 6. Effect of ethephon doses on Storability (Post harvest life) of Kiwifruit (*Actinidia deliciosa* cv. Monty) at ambient condition in Dolakha, Nepal, 2019

Treatments	Storage days
Control	48.25^{a}
100 ppm	32.75^{b}
300 ppm	30.75^{b}
500 ppm	22.13^{c}
700 ppm	16.25^{d}
Sem (±)	1.702
LSD (0.05)	5.13
F test	***
CV, %	11.2

*, ** and *** indicate significant at 5 % , 1 % and 0.1% probability level

Table 7. Effect of ethephon doses on sensory evaluation(Taste) of kiwifruit (*Actinidia deliciosa* cv. Monty) at ambient condition in Dolakha, Nepal 2019

Treatments	Sensory evaluation		
	7 Days	14 Days	21 Days
Control	1.00^{c}	1.00^{c}	1.25^{b}
100 ppm	1.00^{c}	1.25^{bc}	1.50^{b}
300 ppm	1.25^{bc}	2.00^{ab}	2.25^{ab}
500 ppm	1.75^{b}	2.50^{a}	2.75^{a}
700 ppm	2.75^{a}	1.75^{abc}	-
Sem (±)	0.194	0.289	0.260
LSD (0.05)	0.58	0.62	0.80
F test	***	*	**
CV, %	25	22.7	26.9

*, ** and *** indicate significant at 5 % , 1 % and 0.1% probability level

Table 8. Correlation Matrix

	tss7	*ta7*	*ph7*	*se3*	*std*
tss7	1.000				
ta7	-0.894***	1.000			
ph7	0.833***	-0.942***	1.000		
se3	0.683***	-0.614**	0.527**	1.000	

Std	-0.882***	0.907***	-0.914***	-0.587**	1.000

Tss7, ta7, and Ph7 refers to 7th reading taken at 21st day of treatment. Se3 refers to sensory quality testing (taste) at 21st day of treatment and std refers to storage days (Post harvest life)

DISCUSSION

Total Soluble Solids(TSS)

The total soluble solids (TSS) content of kiwis increased almost consistently with advancement of ripening regardless of treatment and all the treatments reached maximum TSS at the end of ripening period as shown in table 1. However, ethephon treated fruits had significantly higher soluble solid content in contrast to control fruits. Fruits treated with 700 ppm showed maximum TSS content throughout its ripening period and ranged from 9.73^{0}brix on 3rd days to 16.63^{0}brix on 9th days of treatment (Peak period of ripening) and decrease in TSS afterward till its storage days. The result was statistically at par with 500 ppm treated fruit where TSS ranged from 9.48 ^{0}brix on 3rd day of treatment to 16.48^{0}brix on 12th day and almost same level of TSS was maintained till 16th day of treatment(its storage day). The TSS content of fruits treated with 100 ppm and 300 ppm ethephon were found statistically at par in most of the reading. The minimum value of TSS content was shown by control fruits throughout ripening period and ranged from 8.3^{0}brix on 3rd day to 12.0^{0}brix on 30th day of treatment.

Fluctuation in temperature might have resulted some deviation in linear increament of TSS change with increasing days of ripening period. Increase in solid content might be the result of metabolic activities due to respiration. Treatment with ethephon excites endogenous ethylene production and finally conversion of starch into sugars resulting increase in TSS. The decrease in TSS content at the end of ripening in each treatment may be due to advanced ripening stage which resulted in the substantial utilization of sugars and hence the reduced TSS was observed.

The value of TSS is maximum at the peak of ripening period and thereafter it decreases (Dhall & Singh, 2013). Similarly, these finding are in close proximity with earlier result reported after advanced ripening is by Matsumoto, Obara and Luh (1983) in kiwifruit, Ben-Arie, Gross & Sonejo (1981) Singh and Jones (2001) in mango, Jawandha,Gill, Kaur, Singh and Sangwan (2016) in mango, Dhillion and Mahajan (2011) in pear, Zhang, Li, Liu, Long, & Liu (2012) in kiwifruit.

Titratable Acidity (TA)

Changes in titratable acidity in ethephon treated and control kiwifruits are highly significant and are summarized in table 2. Almost consistent and significant decline in acid content was exhibited with ripening period in all treatments including control. Higher acidity was recorded in control fruits which was 1.45% on 3rd day to 1.1% on 30th day of treatment which was statistically at par with result of 100 ppm. The table showed gradual decrease in TA content of fruits treated with 300 ppm ethephon ranging from 1.35% on 3rd day to 0.82% on 30th day of treatment. Higher dose of ethephon (700 ppm) led to sharp reduction in acid content which was 1.24% on 3rd day to 0.66 on 9th day (peak of ripening period) and its slight increment thereafter till its storage period. The result of fruits treated with 700 ppm was followed by 500 ppm where TA ranged from 1.34% on 3rd day to 0.83% on 12th day and almost same value was maintained till end of storage life.

Mean acid content of fruit at harvest was observed significantly higher than at the end of ripening period. The decreasing trend of acid content on ripening period might be due to utilization of organic acids as a substrate in tricarboxylic acid cycle in the respiration process.

Bal and Kok(2007)found that acid content goes on decreasing with maturity levels in experiment of glycerin added ethephon treatment in kiwifruits. Jawandha *et al*. (2016) also reported that there was consistent decrease in juice acid contents of mangoes with ethephon applications. These results are also in close agreement with the finding of Park et al.(2000) in kiwifruit, Zhang et al.(2012) in kiwifruit, Matsumoto et al.(1983), Dhillion and Mahajan (2011) in pear, Singh and Janes (2001) in mango , Dhall & Singh(2013).

TSS/TA *Ratio*

Influence of different treatments on TSS/TA ratio of kiwifruit is depicted in table 3. The effect of treatments was highly significant with respect to TSS/TA ratio throughout ripening period. The significantly maximum ratio was observed in fruits treated with 700 ppm ranging from 7.89 on 3rd day to 25.57 on 9th days of treatment followed by fruits treated with 500 ppm. The minimum ratio was observed in control fruits ranging from 5.18 on 3rd day to 12.1 on 30th day. Similar result was reported by Singh and Janes (2001)in mango.

pH of the fruit

Table 6 reveals that the effect was significant in pH of fruits regardless of treatment used and maximum pH was observed at the end of ripening period in each treatment. The trend shows gradual increment in pH with increase in ripening period. The maximum pH value was observed in fruits treated with 700 ppm from 3.33 to 4.08 on 3rd and 12th day after treatment followed by 500 ppm ranged from 3.13 to 3.75 on 3rd and 18th day of treatment which was statistically at par with 300 ppm. Control fruits exhibited minimum pH value which was 3.13 to 3.5 on 3rd and 30th day of treatment respectively.

Increasing trend of pH may be due to the conversion and utilization of different acids in the respiration process. This finding is in line with the result reported by Bal and Kok (2007), Matsumoto *et al.*(1983) and Ben-Arie *et al*.(1981)

Physiological loss in weight (PLW)

As presented in table 6, the physiological loss in weight (PLW) was significantly increased in all the treatments with the advancement of the ripening period. Maximum weight loss was recorded in fruits treated with 700 ppm ranged from 4.76% to17.28% on 3rd day and 15th day respectively followed by fruits treated with 500 ppm ranging from 2.93% to 13.12% on 3rd day and 21st day . Minimum weight loss was recorded in control fruits and ranged from 2.2% to 11.8% on 3rd and 30th day respectively which was statistically at par with weight loss of 100 ppm and 300 ppm. The maximum weight loss in the fruits treated with 700 ppm might have been due to due to acceleration in the process of transpiration and respiration. The finding is in close agreement with the finding of (Dhall & Singh, 2013) and (Dhillion & Mahajan, 2011) in tomato.

Storability (Post harvest life)

Table 6 reveals that there is high significant differences between ethephon treated fruits and control fruit with respect to storage days. Control fruits exhibited maximum storage life of 48.25 days followed by 100 ppm (32.75 days) which was statistically at par with 300 ppm (30.75 days). Minimum storage life was observed in fruits treated with 700 ppm i.e. 16.25 days which is followed by fruits treated with 500 ppm (22.13 days).

Shortening of storage life in ethephon treated fruits compared to control fruits may be due to higher respiration rate as a result of higher ethylene production that lead to conversion of starch to sugars and utilization of organic acids as substrate that decrease storability of fruit.

Sensory Evaluation

As seen in the table 8, the sensory(eating) quality of kiwi was significantly increased with ripening in ethephon treated fruit compared to control fruits. The kiwifruits were inedible at the time of harvest and eating quality improved with ripening in all treatments. Ethephon treatments contributed to develop better organoleptic quality of fruits in terms of decreased flesh firmness, sugar-acid blending and taste. After 7 days of treatment, fruits treated in ethephon 700 ppm (2.75) developed very much desirable eating quality followed by 500 ppm ethephon treatment (1.75), while the control fruits after the same time had inferior sensory quality (1.0) . After 14 days of treatment, maximum sensory quality was developed in fruits treated with 500 ppm (2.5) followed by fruits with 300 ppm (2.0) which was statistically at par with 700 ppm and 100 ppm fruits whereas control fruit still showed no change in quality (1.0). However, fruit quality in highest dose of ethephon declined significantly at the end of ripening studies and on this stage 500 ppm ethephon doses resulted in very good edible quality attributes followed by 250 ppm.

The development of better fruit quality with ethephon treatments might be due to reduction of fruit firmness, increase in soluble solids content and decrease in acidity. Similar results were reported in finding of Singh and Janes (2001), Jaeger *et al*.(2003) in kiwifruit and Bal & Kok(2007) in kiwifruit.

Correlation matrix

After the analysis of various parameters of ripening in kiwi, different correlation coefficients have been found. Sensory quality (taste) showed strongly positive correlation with total soluble solids (0.683***) and moderately positive correlation with Ph (0.527**). But it showed negative correlation with Titratable acidity (-0.614**).

Similarly, on analyzing correlation coefficient of storage days with other parameters, storage days showed strongly negative correlation with Total soluble solid (-0.882***) and with Ph (-0.914***) as well. But storage days showed strongly positive correlation with titratable acidity (0.907***).

CONCLUSION(S)

Ethephon treatment in kiwi was found effective as the ethephon treated fruit riped quicker as compared to control fruit. On increasing the dose of ethephon, the maximum value of TSS, TSS/TA and pH was found at the end of ripening period in 700 ppm but highest dose resulted in maximum physiological weight loss, short storage life due to early rotting and decline in eating(sensory) quality. Considering the post-harvest life and quality attributes of
kiwi, the concentration of ethephon ranging from (500-700) ppm was found appropriate for ripening of kiwi.

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Establishment of the technological factors contributing to the sustainability of the Farmers Field School (FFS) in Busia County, Western Kenya: A Case of Farmers Field Schools in Busia County

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ABSTRACT
Farmers Field Schools have been in operation as an alternative Agricultural extension approach from South East Asia, Philippines under Integrated Pest Management (IPM) from 1989. This study was on Examination of the differences between staff run and farmer run Farmers Field School on attainment of sustainability in Busia County in Western Kenya region. Kenya is among the over 90 countries in the world that have implemented Farmers' Field School as an agricultural extension approach from its introduction. The problem addressed by this study was that of the 305 Field Schools funded within the study area, they remain unsustainable after the learning cycle. The objective of the study was to establish the technological factors contributing to the sustainability of Farmers' Field Schools (FFS) in Busia County. The literature review revealed that in other nations, many such funded schools don't break up after the end of the learning cycle. Multi-stage random sampling method was used to select field schools at each sub County, while purposive sampling was used to select key informants from program managers and FFS facilitators. Primary data was collected using pre-tested structured questionnaires administered to the 200 selected field schools, face-to-face interview with key informants FFS facilitators, program managers and focus group discussions with the field school's network that is the apex body representing all the field schools was done. Secondary data including content analysis were obtained from publications, journals newspapers and internet access. The hypotheses were tested at 5% level of significance. The data analyzed by statistical package for social science (SPSS) version 20 were presented in tables, chi-square, frequency tables, percentages and pie chart. The following technological factors were identified as the ones contributing to the FFS sustainability: mechanization, conservation agriculture and farm inputs use. The findings revealed that FFS in Busia County could easily attain sustainability if they adapt to use of appropriate mechanization, employ conservation agriculture and internalize in the use of improved agricultural inputs. This will lead to sustained production that will lead to food and nutritional security and hence poverty reduction.

Key words: Sustainability, Farmers Field Skills, factors, agro-ecosystem analysis

1.0 Introduction

Kenya has a well-established extension service and a long history of extension programmes. In spite of this, the performance of Kenya's agricultural sector has been declining which worsened in the 1990-2003 period (GoK, 2005). The causes of the decline were due to lack of appropriate technologies, inefficient extension delivery systems, past extension delivery systems that did not build the capacity of local farmers and inadequate research extension farmer linkages (Purcell and Anderson, 1997).

The sustainable strategies to address the above scenario include patterns of social relationships embodied in adequate institutional arrangements and capacity at the community level. According to Uphoff (1999) and GoK (2005) agricultural extension services play a pivotal role in enhancing empowerment, sustainability of informal and formal farmers and farmer groups by capacity building their ability to participate in group activities and demand for services from external agencies to the community. Food and Agriculture Organization (FAO) introduced Farmer Field Schools (FFS) in 1989, in South East Asia, in Indonesia, as Integrated Pest Management (IPM) program in irrigated rice Khisa (2010). By use of the chemicals, the farmers in Indonesia endangered their crops, their health

and their environment through massive use of highly toxic pesticides. These were promoted aggressively by private industry and government. Farmers through a decentralized programme were trained to become experts in managing the ecology of their fields to get better quality yields, fewer problems because of reduction in use of pesticides, increased profits and less risk to their health and environment. The Integrated Pest Management Farmer Field School (IPM-FFS) and a corresponding large-scale Indonesian programme were developed in response to these conditions. The FFS made farmers experts to manage their ecology in a sustainable manner (Braun *et al*., 2006). They carried out systematic comparative observation in the crop fields under respectively conventional and new technological management by using group methods with emphasis on discovery-based learning (DBL) and hands-on experimentation. The FFS brings together concepts and methods from agro-ecology, experiential education and community development. As a result, hundreds of thousands of rice farmers in countries such as China, Indonesia, Philippines andVietnam were able to reduce the use of pesticides and improve the sustainability of crop yields. FFS networks in a number of countries are involved in a wide-range of self-directed activities including research, training, marketing and advocacy. According to Khisa (2010) initiation of FFS has led to more than two million farmers across Asia participated in this type of learning.

Due to its success in empowering farmers, FFS was tried in other countries of the world. In the Kenyan case, the FFS approach was first introduced in 1996 on a pilot basis by the Special Program for Food Security (SPFS) of the FAO in collaboration with public extension service of the Ministry of Agriculture Livestock, Fisheries and Irrigation (MALF&I). In 1999, the global IPM facility launched an East African sub-regional pilot project for FFS for Integrated Production and Pest Management (IPPM) covering the counties of Bungoma, Kakamega and Busia in Kenya and the Nations of Uganda and Tanzania (Khisa, 2003).

1.1 Statement of Problem

In the past, technology transfer models adopted by most agricultural extension systems were top-down in approach (Röling, 1988). The Training and Visits (T&V) extension system was such a model introduced in India and Africa (Bindlish *et al*., 1993) that was expected to bring researchers and extension staff closer in the process of technology transfer. In these systems/models, smallholder farmers were merely recipients of agricultural messages often presented as technological packages. These systems required huge capital outlays to run, especially in terms of staff and transport which many development countries could ill afford (Anderson *et al*., 2006). FAO therefore looked for an alternative approaches to the T& V approach. FFS was tried in South East Asia.

Farmer Field School (FFS) groups have been widely scaled-up in many Asian and African countries by using either staff run or farmer run FFS. Despite many development partners assisting several nations worldwide, there is a concern world over on how to sustain funded activities at the end of project cycle as many such funded activities still break up leaving beneficiaries still expecting to receive handouts from the donors. However, for the FFS from its inception in Busia County in 1996, there has been no in-depth study to examine the contribution of human factors in the sustainability of FFS in Budalang'i, Funyula, Butula Nambale and Matayos Sub Counties. The FFS that are funded at the end of the learning cycle still break up, just like other projects that break up after the end of funding cycle, it is therefore necessary to examine what human factors of the FFS in Busia County are responsible for the sustainability of the FFS.

1.3 Research objective

To establish the technological factors contributing to the sustainability of FFS in Budalang'i, Funyula, Butula, Nambale and Matayos Sub Counties of Busia County.

1.4 Research question

In order to achieve the purpose of the research, the following guiding question was adopted. What are the technological factors contributing to the sustainability of FFS in Budalang'i, Funyula, Butula, Nambale and Matayos Sub Counties of Busia County?

1.5 Significance

This study is necessary since it will generate a body of knowledge to assist academia, research as well as extension to establish the technological factors contributing to the sustainability of FFS in Busia County. The study will also be vital in guiding policy formulators at the National and the County Governments levels to come up with policies that will guide stakeholders in implementing FFS in a more sustainable manner and in cost effective way. The findings were documented and it will contribute to the body of knowledge done by other researchers.

1.6 Scope of the study

This study was confined to the five Sub Counties of Bunyala, Funyula, Nambale, Butula and Matayos as they were the only Sub Counties in Busia County where FFS were established between 1996 and 2018. Hence, Teso North and Teso South were not covered as there were no Field Schools conducted in them. The data was collected between April 2018 and September 2018.

2.0 Literature Review

2.1 Global perspective of Farmers Field Schools

According to FAO, (2017), FFS were first introduced in 1989 in Asia; they then spread to other continents of Africa and Latin America and Europe. Currently over 90 Countries are using or have adapted FFS under various systems and enterprises. The production systems have been from various high yield irrigated system to rain fed or semi-arid to agro pastoral production systems. FFS have been run starting on IPM on rice then adaptation to IPPM on vegetables, cotton and multiple other crops and other aspects of FFS on livestock, perennial crops, Soil and water conservations and agro biodiversity, Fisheries, flowers and pastoralists. FFS have been used as post disaster to assist the victims recover and reconstruct their livelihoods. It has also been used in schools as farmers Field and life schools as well as forestry field schools and farm business schools. This therefore shows that field schools have been

adapted to various aspects or disciplines, due to its flexibility to various challenges of life.

2.2: The origin and status of the FFS

According to Khisa (2002), the first FFS were conducted in 1989/1990 in Indonesia. These first FFS were designed to educate farmers on the principles of IPM in order to deal with major outbreaks of Brown Plant Hopper (BPH). Serious outbreaks of BPH occurred when abundant use of pesticides had wiped out populations of natural enemies (predators and parasitoids). In the absence of their natural enemies the BPH could multiple rapidly resulting in severe "hopper burn" and crop failure. The solution to this problem was to conserve the natural enemies by reducing pesticide use so that the beneficial insects could control insect pest population. According to Jaim *et al.* (2001), FFS educate farmer participants by analyzing agro-ecosystems, as it includes practical aspects of plant health, water management, weather, weed density, disease surveillance, plus observation and collection of insect pests as well as beneficial insects. The farmers normally look at the interactions of organisms in an environment and effect of one to the others in an ecosystem.

According to FAO (1998) traditional extension methods had failed to educate farmers on this concept of "natural pest control" and the new FFS approach was then developed, with assistance of FAO which managed to address it. According to Bunyatta and Mureithi (2004) FFS has proved to be an effective approach in empowering, farmers in their farms. This new extension approach uses four principles. The four principles are growing a healthy crop or keeping a healthy livestock, conserving natural enemies, conducting regular field observations and farmers becoming experts on their farms or fields. The FFS training approach is based on active participation of farmers' group members sharing knowledge with each other as guided by the facilitator. The FFS members are able to analyze trials or treatments in FFS that are called participatory technology developments (PTDs) and give recommendations on appropriate decisions for better performance. Farmers learn new concept by the facilitator through the experiential learning cycle in a process involving learning by doing. According to FAO (2017) the FFS learning process a bottom up approach with the FFS facilitators helping farmers to learn from each other by practical experience.

In FFS, farmers normally run their own experiments, which they usually share with other farmers during field days and exchange visit. According to Gallagher (2003) the FFS approach does not only equip farmers with knowledge on technologies but also empowers them with skills to experiment and to solve individual and community wide problems. According to FAO (1998) and Uphoff (1999) sustainability is defined as the ability of the FFS to continue with activities beneficial to members with less assistance from project proponents or external agencies making graduated farmers and FFS groups being self-reliant. FFS were as result of Asian farmers discovering that over use of conventional pesticides resulted in insect resistance and killing of natural enemies that led to insect pest outbreak hence reducing crop yields. As a result of this outbreak, IPM was then taken seriously which led to emergence of FFS in 1989 in Asia.

According to Leeuwis (1998) the FFS methodology has resulted in the creation of stronger research-extension-farmer linkages, while maintaining a vital link with modern science. The linkages are essential in empowerment of farmers in order to tackle the socio-cultural and political dimensions of agriculture that require advocacy and lobbying for better policies. The agricultural extension service in Kenya has in the past used a number of extension approaches to deliver research innovations to the farmers.

According to GoK (2005) past approaches include model farmers, T and V, farming systems approach, demonstrations in Agricultural Training Centers (ATCs) and the catchment approach. These approaches unlike FFS were top down and non- participatory. Due to the FFS success in training Asian farmers on IPM technologies, it was then first introduced in Kenya on a small scale in 1996 by the FAO's Special Program for Food Security (SPFS) to promote maize (*Zea mays*) based IPM production system in western Kenya, piloted in Busia, Bungoma and Kakamega Counties (Abate and Duveskog, 2003). It was mainly to address food and nutrition security. Since then, over 2000 FFS have been initiated in Kenya to promote IPPM-FFS technologies for maize, vegetable; poultry production, fisheries, soil fertility management, water harvesting, dairy cattle production, pastoralist and management of HIV/AIDS.

2.3: The technological factors contributing to the sustainability of FFS

According to Davis *et al.,* (2010) FFS participants increased income by 61 percent due to the technology transfer and skills received through the participatory learning during FFS learning cycle. Under technological factors, the study from the literature review identified mechanization, conservation agriculture and farm inputs use.

According to Bunyatta *et al.,* (2006) the farmers who participated in FFS were able to adapt to soil and water management technologies more than those who didn't participate. According Asiabaka (2002) the FFS as a group learning approach builds knowledge and capacity among farmers to enable them diagnose their problems, identify solutions, develop plans, and implement them with or without support from outside. FFS also requires multidisciplinary research agenda that aims at technology development and seeks ways of stakeholder participation in technology development, validation and dissemination. It concludes that this approach will not increase agricultural productivity; but it will also lead to sustainable agriculture in Africa.

2.4: Mechanization

According to FAO (2013) sustainable mechanization is the practice of introducing the proper machinery to farmers to ensure that their agricultural production is not only more environmentally sustainable but is more efficient in growing crops. Sustainable agricultural

mechanization refers to all farming and processing technologies from basic hand tools to motorized equipment. It does looks at the technical aspects of farming as well taking into account the effect that tools have on a farmer's outputs, from crop production along the value chain to marketable products, and in turn, the impact this has on a farmer's income. However, for this study the researcher looked at the basic mechanization of tractors and ox plough that are mainly used by the FFS participants as this is basic to other mechanization. This is basic to higher yields that will later dictate the other post-harvest tools. Mechanization leads to achievement of better harvests and increased income or new jobs for farmers.

According to FAO (2013) farmers can move from subsistence farming to market oriented farming if they rely on mechanization. It relieves labour shortages, improve timeliness of agricultural operations, ensure the efficient use of resources, enhance market access by allowing farmers to sell more than just the raw product and contribute to mitigating environmental damage such as soil degradation. Machines can allow for better practices such as reduced tillage and inter-cropping, the practice of planting different types of crops (e.g. legumes/cereals) in one field that grow simultaneously and complement each other in their growth. Rotational and inter-cropping practices reduce the risk of pests, soil degradation and the effects of unfavorable climate conditions.

With the earth's growing population, there is greater demand for products from the farms at the same time, the planet is facing serious challenges from over exploitation of natural resources and the increasing effects of climate change. There is need design appropriate machines and tools for agricultural production value chain that are vital to increasing outputs in a sustainable way. The reduction of drudgery is a key element of sustainable mechanization and contributes to reducing women's hard workload by taking into consideration technologies apt to their needs and improving their access to appropriate forms of farm power.

FAO is working with private sector partners, governments and farmers to create and promote sustainable mechanization opportunities. Sustainable mechanization leads to the following outputs: increase land productivity by facilitating timeliness and quality of cultivation; support opportunities that relieve the burden of labour shortages and enable households to withstand shocks better; decrease the environmental footprint of agriculture when combined with adequate conservation agriculture practices; and reduce poverty and achieve food and nutrition security while improving people's livelihoods (FAO, 2013).

Since smallholder farmers are the main producers of the world's food, they will have to increase production by up to 100 percent by 2050 to feed the growing population. This will be achieved by preserving natural resources and this is why sustainable agricultural mechanization (SAM) is fundamental to the process. The need for seeders and planters that is capable of penetrating soil surface vegetative cover to deposit seed and fertilizer at the required depth and spacing; and equipment for management of cover crops and weeds. Improved information flows via smallholder farmer-friendly innovation platforms; and continuing development and testing of SAM technologies via regional centers of excellence will both be required especially for sub-Saharan Africa (Sims and Kienzle, 2017).

2.5: Conservation agriculture (CA)

CA is the minimal soil disturbance no-till and permanent soil cover (mulch) combined with rotations, as a more sustainable cultivation system for the future. Cultivation and tillage play an important role in agriculture. CA, mulch and rotation significantly improve soil properties and other biotic factors. CA is a more sustainable and environmentally friendly management system for cultivating crops. Agriculture in the next decade will have to sustainably produce more food from less land through more efficient use of natural resources and with minimal impact on the environment in order to meet growing population demands. Promoting and adopting CA management systems can help meet this goal (Hobb*s et al.*, 2017). CA requires comprehensive weed management strategies which involves improved cultural practices, herbicides applications, and crop nutrition. Small seeded and perennial weeds are more abundant in CA. According to Ayodele and Aluko (2017), integrated weed management compatible to cropping patterns and climatic conditions offers the best results in CA.

As per the 7th MDG, Nations pledged to ensure environmental sustainability, all UN member States pledged to halve the number of people without access to safe drinking water by 2015.This requires good environmental management by ensuring the biodiversity is not destroyed by human interference through exploitation. According to Corcoran *et al.*,(2010) reducing unregulated discharge of wastewater and securing safe water are among the most important interventions, for improving global public health and achieving sustainable development. The enormous impacts and high cost to the environment, society and thus to economies, that wastewater can have when inadequately or inappropriately managed is quite evident. Another perspective for using wastewater is wise investment and appropriate management of wastewater so that can be purified and put various uses. This is a resource tool that can help tackle the global water crisis; urgent health issues, food security and economic productivity, and maintains or improves environmental integrity.

According to Cardi (1997) and Dolly (2005), from 1997 to 2000, the HMB a highly invasive pest species from Asia threatened food security in the region by destroying many food crops. The first serious outbreaks of the pest in Indonesia in 1975 and 1977 caused estimated losses of US$1 billion. The plant hopper reappeared in the mid-1980s because of continued heavy insecticide usage (United Nations, 2011). The African Ministers of Environment declared that a green economy should be underlined by national objectives, social and economic development imperatives.

According to Swaminathan (1983) agricultural production is dependent on the environment together with seed quality, soil health, water quality for irrigation and quantity, clean atmosphere of proper composition of carbon dioxide, nitrogen and oxygen, in addition to support diverse micro-organisms, pollination insects, birds, earthworms, farm animals and other non-domesticated flora and fauna. This therefore requires a lot of care so that any human intervention should maintain the balance of biodiversity to have a healthy environment.

Most of the developing countries of our planet including Africa have vicious downward spiral between accentuating poverty and environmental degradation. In these circumstances, the Malthusian view that population increases beyond the Earth's carrying capacity would cause environmental degradation and outrun the growth of food production gains credence. However, it is also true that modern science and technology have so far thwarted the realization of Malthusian predictions (Trewavas, 2002).

The environmental management is quite pivotal to attainment of sustainable agricultural production and livelihoods. FFS provide a good forum for farmers to debate on how to avoid undertaking practices that are detrimental to the environment that can lead to sustainable natural resource management so that maintaining of biodiversity can be attained hence may lead to sustainable FFS. It was not clear whether FFS in Busia considered environmental sustainability during the implementation.

2.6: Farm input

According to the African Development Bank (2016) the most common challenges that farmers face relate to limited access to inputs and output markets, land tenure and management, access to credit, poor infrastructure and limited extension services. There is a call to the reductions in the use of chemicals and energy in farming, in order to protect the environment. The most of agricultural interventions have been geared towards use of synthetic fertilizers and pesticides that are detrimental to the environment and the ecosystem. The design of agricultural projects for smallholder farmers that do not cause long-term environmental damage must be based as much on a realistic assessment of the socio-economic factors that shape farmers' responses as on the introduction of farming techniques and practices that conserve the resource base. From the existing data, it was clear that the use of fertilizer in the absence of a range of complementary husbandry practices does not usually result in large increases in yields. This therefore means that for better results in production use of fertilizer must be accompanied by appropriate husbandry practices Farm-households will only change to The low-input, sustainable agriculture (LISA) methods if the prevailing circumstances change so that the value of the money saved per kilogram of food produced is greater than the loss in production plus the extra value of labour time required for manuring, composting, tied ridging and so on Low, (2012).

The current trend is to use new disease resistant hybrids, biological pest control, and reduced pesticide use. It also involves cultural practices that reduce the incidence of pests and diseases, better placement and reduced amounts of fertilizers. Insect specific chemicals and biological insect controls are now being utilized, instead of broad-spectrum pesticides leading to reduced number of sprays that reduces costs(Bale *et al*.,2008). According to NAAIAP Implementation Guideline, 2018/2019 financial year), the use of improved inputs has enabled beneficiary farmers to produce average 16.71 bags per acre up from 3 -5 bags of maize prior to the intervention. The National Accelerated Agricultural Inputs Access Programme (NAAIAP) as Government of Kenya program, from Ministry of Agriculture, Livestock, Fisheries and Irrigation, that seeks to address the problem of low farm productivity by offering targeted subsidy in the form of technical inputs to resource poor farmers. The increase in yield and production would meet the household food security and generate surpluses that can be traded and increase household incomes thus enabling investment in agriculture.

3.0 Research Methodology

Description of the Study area

This study was conducted in Busia County found in western part of Kenya in the five sub Counties of Budalang'i, Funyula, Butula, Nambale and Matayos that were the only sub Counties in Busia County where FFS had been conducted by the time of the study. The County boarders the Republic of Uganda to the West, Bungoma County to the north, Kakamega County to the east and Siaya County and Lake Victoria to the South. It falls within the Lake Victoria basin with a range between 1130m to 1375 m above sea level and lies between latitude 0°25.3' and 0°53.2' N & longitude 34° 21.4' and 35° 04' East. The Humidity is estimated to be 84% recording a mean temperature range of16.2ºc to 28.7ºc, while the annual average rainfall ranges from 1080 to 1940mm. The rainfall comes in two seasons, March to May/June as the long rain season and August to October as short rain season. This rainfall pattern supports two crop-growing seasons. The soils in the County are moderately deep sandy loam, but valley bottoms are black cotton soils.

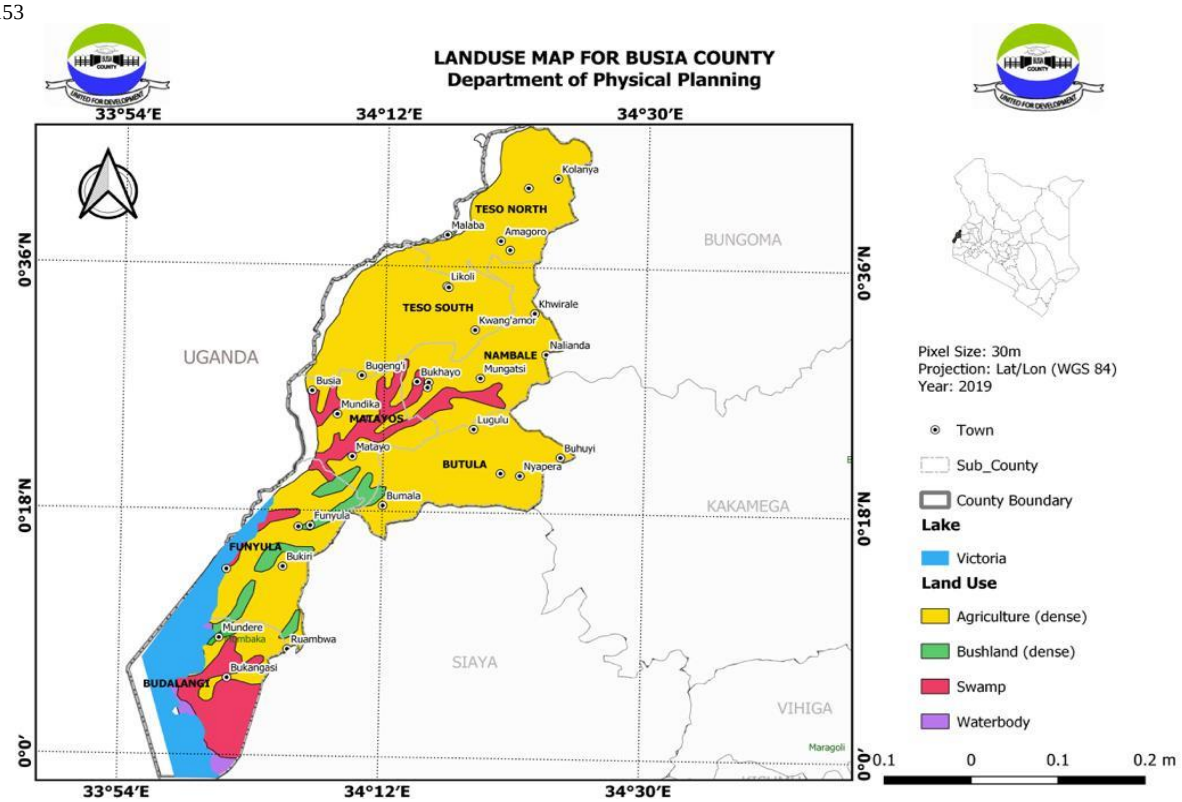

Figure 3.1: Map of Study area

Source: GoK (2019)

The study adapted a cross-sectional survey approach. A cross sectional survey studies the relationship between different variables at a point in time. The study was to establish the technological factors contributing to the sustainability of FFS in Budalang'i, Funyula, Butula, Nambale and Matayos Sub Counties of Busia County. According to TrochimW. (2006) unlike time series, cross-sectional survey relates to how variables affect each other at the same time. The study focused on the FFS by the time of the study that had completed their thirty weeks learning cycle in relation to the type of facilitator that capacity built a given FFS. A purposive sampling method was employed to select the Sub Counties and the key informants and FFS managers that implemented FFS. Purposive sampling allows the researcher to use cases that have the required information with respect to the objectives of the study Mugenda and Mugenda, (1999). A sample of 200 was chosen from the target population of 305 which was done proportionately according to number in the five sub Counties. Samples were taken proportionately from the five Sub Counties with the corresponding numbers of FFS as follows; Budalang'i -48, Funyula-75, Butula-55, Nambale-35, Matayos-92 totaling 305 FFS. The sample size for the FFS was determined by using the modified Cochran's (1977) formula for sample size calculation for small populations. Sample was calculated using the equation below:-

n= no/1+ {(no-1)}/N

Where;

no is Cochran's sample size recommendation of 385

N is the target population, which was the total FFS of 305

n is the new adjusted sample size, which is the sample size used for the study

Therefore, n= no/1+ (no-1)/N = 385/1+ (385-1)/305= 385/2.3= 167

The sample size from the Cochran's formula for small populations was 167, but to take care of dropouts and the non-response the researcher used 200 as the sample size for the study. In-depth interviews were conducted in person with key informants composed of one FFS facilitator, one Sub County FFS network official and the area village elder *(Liguru)*. The key informants were identified through a combination of simple random and purposive sampling techniques. The appointments for interviews were done through phone calls for respective FFS chairpersons who planned for the FFS members' presence during the interview. The items on the questionnaire were developed based on the objectives of the study. Primary data collection was to the selected proportional FFS per Sub County on which focus group discussions was undertaken and for every selected FFS administration of questionnaire was done. Some primary data was also got from the key informants for FFS managers and for FFS facilitators. Data collected was used to determine the human factors influencing the sustainability of FFS in Busia County.

The Secondary data collection was by reports from the County Agricultural and Livestock Directors as well as the Sub County Agricultural and Livestock and Regional Project FFS coordinator offices. This was through data collected from existing and relevant literature review even from internet access and publications. The FFS were randomly selected and the interviews conducted.

According to Wiersma (1995) Validity is the accuracy, soundness, or effectiveness with which an instrument measures what it is intended to measure.The data collected was coded and scored in order to facilitate analysis using the SPSS. Descriptive statistics included frequency and modal distributions, means, standard deviations and percentages. The results from that analysis was used to establish the technological factors contributing to the sustainability of FFS in Budalang'i, Funyula, Butula, Nambale and Matayos Sub Counties of Busia County. The inferential statistics involved the use of Chi-square and factor analysis. The Chi-square and f-test were used to separate the means

3.2 : Ethical Consideration

A research permit was also obtained from the National Council of Science of Science and Technology (NACOSTI). The researcher obtained permit from the County Government of Busia to collect data from FFS. The information obtained was handled with caution since it referred to people and their livelihoods. The purpose of the research was explained to the selected FFS. The collected Data was kept private, confidential and was used only for matters pertaining to the research.

4.0 : Results and Discussion

The establishment of the technological factors contributing to the sustainability of FFS in Budalang'i, Funyula, Butula, Nambale and Matayos Sub Counties of Busia County.

4.1: Mechanization in FFS

The machinery usage in FFS was not quite evident, but one cannot overlook the importance machinery plays in reduction of drudgery, leading to higher production that can address problem of food insecurity and poverty reduction. Table 4.1 indicates the mechanization situation in the County as was captured at the Sub County level. FFS were asked how their undertook land preparation and the results as in table 4.1.

Table 4.1: FFS that had adopted machinery (either use of tractor or ox-drawn implements)

Name of S. County	No. of FFS Selected	FFS adopted mechanization	% of FFS in County
Budalang'i	32	08	04
Funyula	50	17	09
Butula	36	26	13
Nambale	22	26	13
Matayos	60	51	26
Total	**200**	**128**	**64**

Source: GoK (2018)

From the table 4.1 on machinery usage, it was clear that the FFS in Matayos sub County adopted use of machinery more than other Sub Counties but Budalang'i Sub County adopted the least. The reason of less adoption for Budalang'i Sub County could be due to the main activity in that Sub County being fishing as it's along the Lake Victoria. One has to realize that there is a variety of machinery that could be adopted at various levels and along the value chains in production process to utilization, marketing and processing.

According to FAO (2013) farmers can move from subsistence farming to market oriented farming if they rely on mechanization. It relieves labour shortages, improve timeliness of agricultural operations, ensure the efficient use of resources, enhance market access by allowing farmers to sell more than just the raw product and contribute to mitigating environmental damage such as soil degradation. Improved information flows via smallholder farmer-friendly innovation platforms; and continuing development and testing of sustainable agricultural mechanization technologies via regional centers of excellence will both be required especially for sub-Saharan Africa Sims Brian (2015), Busia County having higher poverty levels should adopt to higher mechanization so that more land can be opened and timely operations are achieved. The county should exploit the available mechanization for easy of work. Sustainable mechanization should be embraced by the FFS to ensure agricultural production is not only more environmentally sustainable but is more efficient in the growing crops. Farmers in Busia County should be encouraged to use various machines to easy the operations in the efforts of agricultural modernization. If farmers remain poor then there will be a greater challenge to adaptation of mechanization. This call for farmers within FFS to undertake farming as business so that income got from farming can be reinvested in mechanization.

4.2: The conservation agriculture in FFS

The environmental matter is quite important if sustainability is to be attained. In fact, in the FFS, participants undertake observations on how organisms interact in a given environment, either positively or negatively. This in itself is good setup as farmers in FFS undertake regular observations and employing the right decision to be undertaken to reverse any situation that may be a danger to the environment.

From the Table 4.2 it is seen that majority 37.5% of the FFS addressed environmental matters as an aspect of sustainability through planting indigenous trees, while 25.0% of them did it by conserving water sources, but 18.8% of them started tree nurseries at individual level while 12.5% had no response. This implies that the FFS addresses the issue of environment conservation, which is necessary for attainment of sustainable development. All the variables in table 4.2 had a statistically significant distribution views on environmental conservation since the calculated chi-square was 90.2>7.81 at 3 degree of freedom. According to Kesavan and

Swaminathan (2007)agricultural development is dependent on environmental management; this implies that no sustainable development can be realized without taking care of environment.

According to Cardi (1997) and Dolly (2005), during the period of 1997 to 2000 the HMB a highly invasive pest species from Asia threatened food security in the region by destroying many food crops. To avoid spending much as it was in Indonesia in 1975 and 1977 where estimated loss of US$1 billion was realized, there is need to use appropriate technologies to arrest the situation (United Nations, 2011). There is therefore for a need to use appropriate technologies to ensure no harm is done to the environment. If this is done then sustainability can be attained as the environment remains healthy to produce higher yields and hence sustained income and food can be attained to avert hunger and poverty.

Conservation agriculture is gaining a lot of importance with time; this is because most of the farming does not consider environmental conservation this has led to the pollution of environment hence affecting the agro ecosystem. Table 4.3 is a summary of the situation in Busia.

Table 4.2 Environmental aspects

	Frequency Observed(N)	**Frequency Expected(N1)**	**Residue (Re)**	**$(Re)^2$**	**$(Re)^2/N_1$**
No response	27(12.5%)	45 (50%)	-33	1089	24.2
Do tree nurseries on individually	40 (18.8%)	45 (50%)	-27	729	16.2
Conserve water sources	47 (25%)	45 (50%)	-24	576	12.8
Plant indigenous trees	73 (37.5%)	45 (50%)	-12	144	3.2
Didn't learn about it	13 (6.3%)	45 (50%)	-39	1521	33.8
Total	**200**				**90.2**

Source**:** Researcher (2019)

From table 4.3 on farmers Field Schools practicing Conservation agriculture, the Sub County of Matayos had the highest adaption while Budalang'i and Nambale Sub Counties had the lowest. Conservation agriculture is important if Sustainable Development Goals (SDG) are to be attained. The 15th SDG states that there is need to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation, and halt biodiversity loss. If the FFS embrace conservation agriculture, then environment will be used sustainably.

Table 4.3: Farmers practicing conservation agriculture

Name of S. County	**Total no. of FFS surveyed**	**FFS adopted conservation Agriculture**	**% of the total in the County**
Budalang'i	32	09	05
Funyula	50	21	11
Butula	36	16	08
Nambale	22	10	05
Matayos	60	26	13
Total	200	82	41

Source: Field data (2019)

According to Kesavan and Swaminathan (2007)agricultural production is dependent on the environment together with seed quality,

soil health, water quality for irrigation and quantity, clean atmosphere of proper composition of carbon dioxide, nitrogen and oxygen, in addition to support diverse micro-organisms, pollination insects, birds, earthworms, farm animals and other non-domesticated flora and fauna. The Busia FFS didn't adapt the judicious use of chemicals, which endangers the environment.

It is important to note that the FFS is more placed to handle conservation agriculture due to its nature of being participatory so farmers within the FFS can debate and find the best conservation agricultural method to be adapted in their respective environment. This in fact has a track record from inception of FFS it has helped sustain production by applied climate smart technologies. There is need for the County of Busia to incorporate environmental management in FFS so that if can also address climate change which is the current concern world over.

4.3: Use of improved farm inputs

Improved input is important in attainment of more production. As depicted in table 4.4, FFS were asked to indicate whether they were able to use improved inputs and the result is as indicated in table 4.4

Table4.4 FFS use of farm inputs

Name of S. County	Total no. of FFS surveyed	FFS adapted improved farm inputs	% of the total sampled in Busia County
Budalang'i	32	05	03
Funyula	50	17	09
Butula	36	18	09
Nambale	22	10	05
Matayos	60	25	13
Total	**200**	**75**	**38**

Source: GoK (2018) and Researcher, (2018)

From the results of table 4.4, the total usage of improved inputs within Busia County is 38%. This is quite low and hence could be one of the causes of poverty in Busia County. From the table 4.4 on use of improved farm inputs, it revealed that Budalang'i Sub County had the least adoption with percentages of five. This could be explained by the fact that Budalang'i Sub County is the driest part of Busia County and has an alternative livelihood of fishing. Matayos Sub County had the highest adoption rates of 25 percent. Generally, from this study, the County of Busia has a lower usage of improved input, which could be attributed by the higher poverty levels. According to NAAIAP program, GoK (2017), use of fertilizer and improved seed coupled with good agronomic practices gives better yield that can make farmers reinvest in farming sustainably. According to GoK, (2018) the use of improved inputs has enabled beneficiary farmers to produce average 16.71 bags per acre up from 3 -5 bags of maize prior to the intervention. If Busia farmers have to address food insecurity, therefore this requires the farmers to increase their usage of improved farm inputs. If the farmers are poor as most are then there is a need to jump start them by having a grant as NAAIAP does or subsidizing the farm inputs. If this is done then more farmers will be able to access the inputs which will give better yields that could lead to sustained incomes and food and nutritional security.

5.0: The summary of the findings, conclusions and recommendations

5.1: Summary of findings

The research was conducted in Busia County within the five sub Counties of Budalang'i, Funyula, Butula, Nambale and Matayos in which the FFS had been conducted by the study period. The study was on the technological factors contributing to the sustainability of FFS in Busia County. The study findings were compared with the literature related study in line with the objective. The literature was obtained from journals, books, magazines, internet and some policy documents. Chapter three on research methodology dealt with description of the study area, study population, research design, sample size and sampling procedure, instrumentation, data collection, validity and reliability of the data instrument, data processing, analysis and presentation and the ethical considerations. The study was on technological factors contributing to the sustainability of FFS in Busia County.

5.2: Conclusion

The technological factors were identified that contribute to the FFS sustainability in Busia County were mechanization, conservation agriculture and farm inputs use. If farmers are to have sustainability in the FFS program, then there is a great need to adapt to sustainable agricultural mechanization, use of conservation agriculture technologies and make use of improved farm inputs.

5.3: Recommendations

FFS in Busia County can easily attain sustainability if they adapt to use of appropriate mechanization, employ conservation agriculture and internalize in the use of improved agricultural inputs. This will lead to sustained production that will lead to food and nutritional security and hence attainment poverty reduction.

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Comparison of Vas Values to The Administration of Oral Preemptive 10 Mg Oxycodone and 15 Mg Morphine Sulphate in Patients After Upper or Lower Extremities Surgery with General Anesthesia

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***Abstract*- Background:** Postoperative pain is an unresolved problem even though understanding of pain management continues to grow. Several studies of preemptive analgesia show that administration of systemic opioids before surgery is more effective in reducing postoperative pain. Oxycodone and morphine sulphate are opioids that are often used as analgesia and have 1:1 analgesic potential.

Objective: To determine the comparison of VAS values with oral administration of 10 mg oxycodone and 15 mg morphine sulphate in patients after upper or lower extremities surgery with general anesthesia.

Method: This research is an experimental double-blind randomized design. After obtaining approval from Ethics Committee, Faculty of Medicine, Universitas Sumatera Utara, based on inclusion and exclusion criterias, 66 research samples were collected. All sample were divide into 2 groups. Group I received 10 mg oxycodone and group II received 15 mg morphine sulphate. Data were tested by Chi Square with significance of $p<0.05$ (statistically significant).

Results: This study found a statistically significant difference in the average VAS value 6 hours after drug administration at the time of T1 and 12 hours after drug administration at the time of T2. No significant difference found ($P>0.05$) for additional analgesics.

Conclusion: Postoperative Pain, VAS, PONV, Analgesics, Oxycodone, Morphine sulphate

***Index Terms*-** About four key words or phrases in alphabetical order, separated by commas. Keywords are used to retrieve documents in an information system such as an online journal or a search engine. (Mention 4-5 keywords)

I. Introduction

Surgery and anesthesia are health care services that plays important role in reducing the risk of death and disability of million peoples around the world every year. The need for surgery and anesthesia services is expected to continue and increase over the next few years. Globally, nearly 313 million operations were performed in 2012, while in the US, estimated 28 million inpatient surgical procedures and 48 million outpatient surgeries were reported in 2006 and 2010. Although surgery and anesthesia play a significant role in reducing the risk of death and disability, surgery is also associated with potential dangers, including pain during and after surgical procedures.[1,2]

Postoperative pain is an unresolved and uncontrolled problem although good understanding of pain mechanism and increased progress in the pain management approach continues to develop. According to US Institute of Medicine data, 80% of patients who undergo surgery report postoperative pain, with 88% of these patients reporting moderate, severe, or extreme pain. In national survey of United States, about 300 adults who underwent surgery in the previous 5 years, 86% of patients experienced postoperative pain, and 75% of patients who reported pain were found to have moderate-extreme pain during postoperative period.[3]

Effective management of postoperative pain is essential. Effective pain management with few side effects will speed up the recovery and return of patients from hospital. Providing adequate postoperative analgesics is a priority, and remains a major challenge. There are several groups that often used to treat postoperative pain. One of them is opiod. Opioids are natural or synthetic compounds that produce effects such as morphine sulphate. All drug in this category work by binding to specific opioid receptors on central nervous system to produce effects that mimic the effects of the neurotransmitter endogenous peptide, opiopeptin (eg endorphins and encephalins). The main use of opioid analgesic is to relieve deep pain and accompanying anxiety, either due to surgery as the result of wound or disease such as cancer.[5]

This is also appropriate with research obtained that oral oxycodone showed a better effect in reducing postoperative pain compared to placebo in patients undergoing laparoscopic cholecystectomy, abdominal or pelvic surgery, bunionectomy, breast surgery, and spinal surgery. When compared with intravenous opioids, oral oxycodone provides better or comparable pain relief in knee arthroplasty, spinal surgery, cesarean section, laparoscopic colorectal surgery, and cardiac surgery. One of postoperative pain study reported that pain control

with oral oxycodone is lower than morphine sulphate. In many studies, the demand for additional dose of analgesia and total opioid consumption was reduced in oxycodone treatment group. Patients who received oral oxycodone experienced fewer opioid-related side effects than other opioids, and experienced the same postoperative nausea and vomiting (PONV) as patients using placebo.[4]

II. METHODS

This study is an experimental study, a double-blind randomized design with administration of 10 mg oxycodone and 15 mg morphine sulphate to the degree of postoperative pain in patients undergoing upper and lower extremity surgery under general anesthesia. Consecutive sampling is a sample selection technique by which all subjects who come and meet the selection criteria are included in the study until the number of subjects is met. After obtaining approval from Ethics Committee, Faculty of Medicine, Universitas Sumatera Utara, based on inclusion and exclusion criteria 66 research samples were collected. All samples were divided into 2 groups. Group I received 10 mg oxycodone and group II received 15 mg morphine. Data were tested by Chi Square with significance of $p<0.05$.

III. RESULTS

The study was followed by 66 subjects who were divided into two groups with the same amount, each as many as 33 people where group A received 15 mg morphine sulphate-Controlled Release (CR) and group B received oral 10 mg oxycodone-Controlled Release (CR).

4.1 Demographic Data Table

	Morphine sulphate		Oxycodone		P value
Age Group	N	%	N	%	
18-30	10	30,3	10	30,3	
31-43	7	21,2	3	9,1	0,396*
44-56	9	27,3	8	24,2	
57-70	7	21,2	12	36,4	
Sex Group	N	%	N	%	
Men	19	57,6	24	72,7	0,301**
Woman	14	42,4	9	27,3	
The Duration Of Operation	N	%	N	%	
<2 hours	19	57,6	9	27,3	
2-4 hours	14	42,4	24	72,7	0,434**
Total	33	100	33	100	

Table 4.1 shows that the sample frequency in terms of age was found to be highest in the age range of 57-70 years with 12 samples (36.40%) in oxycodone group and 7 samples (21.2%) in morphine sulphate group. The second largest age range was 18-30 years in morphine sulphate group of 10 samples (30.3%) and in oxycodone group of 10 samples (30.3%). The third highest age range of 31-43 years was found in morphine group with a total of 7 samples (21.2%) and in oxycodone group of 3 samples (9.1%).

Subjects with male sex in the morphine sulphate-CR group were 19 people (57.6%) and women as many as 14 people (42.4%). Subjects with male sex in the oxycodone-CR group were 24 people (72.7%) and women as many as 9 people (27.3%).

Figure 4.3 shows that the duration of surgery with duration < 2 hours in the morphine sulphate-CR group were 19 people (57.6%) and the duration of operation > 2 hours were 14 people (42.4%). Whereas in the oxycodone-CR group with < 2 hours duration of operation were 9 people (27.3%) and > 2 hours as many as 24 people (72.7%).

4.2 VAS Value Normality Test

VAS	Value P*	Information
T0	0,123	Normal
T1	0,123	Normal
T2	0,123	Normal

*Kolmogorov-Smirnov test

The statistical test used for the normality test (table 4.2) between the control group and the case group is the Kolmogorov-Smirnov test, and obtained data with normally distributed results ($p> 0.05$).

4.3 VAS Value T0

	Morphine sulphate		Oxycodone		P value*
VAS	N	%	N	%	
1	7	21,2	7	21,2	
2	15	45,5	15	45,5	0,956
3	11	33,3	11	33,3	
Total	33	100	33	100	

Table 4.3 Is the result of the chi square test, a table comparing the VAS values between the Morphine sulphate and Oxycodone group when T0 was found in patients who had VAS 1 in the morphine group were 7 people (21.2%) and the Oxycodone group 7 people (21.2). Samples that had VAS 2 in the morphine sulphate group were 15 (45.5%) and the oxycodone group 15 people (45.5). Samples that had VAS 3 at T0 in the morphine sulphate group were 11 people (33.3%) and the oxycodone group 11 people (33.3%). It can be seen that there were no statistically significant differences in the mean VAS results before treatment at T0 (p = 0.956).

4.4 VAS Value T1

	Morphine sulphate		Oxycodone		P value*
VAS	N	%	N	%	
1	0	0	3	9,1	
2	15	45,5	15	45,5	0,001
3	13	39,4	13	39,4	
4	5	15,2	2	6,1	
Total	33	100	33	100	

Table 4.4 Is the result of the chi square test, a table comparing the VAS values between the morphine sulphate and oxycodone groups when T1 was found in patients who had VAS 1 in the morphine sulphate group were 0 people (0%) and the oxycodone group 3 people (9.1). Samples that had VAS 2 in the morphine group were 15 (45.5%) and the oxycodone group 15 people (45.5%). Samples that had VAS 3 at T1 in the morphine sulphate group were 13 people (39.4%) and the oxycodone group 13 people (39.4%). Samples that had VAS 4 on T1 in the morphine sulphate group were 5 people (15.2%) and the oxycodone group 2 people (6.1%). It can be seen that there was a statistically significant difference in the average results of the VAS value 8 hours after drug administration at T1 (p <0.05)

4.5 VAS Value T2

	Morphine suphate		Oxycodone		P value*
VAS	N	%	N	%	
1	2	6,1	0	0	
2	4	12,1	11	33,3	
3	11	33,3	9	27,3	0,000
4	9	27,3	6	18,2	
5	6	18,2	7	21,2	
6	1	3,0	0	0	
Total	33	100	33	100	

Table 4.5 Is the result of the chi square test, a comparison table of VAS values between the morphine sulphate and oxycodone group when T2 was found in patients who had VAS 1 in the morphine sulphate group were 2 people (6.1%) and the oxycodone group 0 people (0%). Samples that had VAS 2 in the morphine sulphate group were 4 (12.1%) and the 11-person oxycodone group (45.5%). Samples that had VAS 3 in the morphine sulphate group were 11 people (33.3%) and the oxycodone group 9 people (27.3%). Samples that have VAS 4 in the morphine sulphate group are 9 people (27.3%) and an oxycodone group of 6 people (18.2%), samples that have VAS 5 in the morphine sulphate group are 6 people (18.2%) and an oxycodone group of 7 people (21.2%)), VAS 6 in the morphine sulphate group is 1 person (3.0%) and the oxycodone group is 0 people (21.2%). It can be seen that there is a statistically significant difference in the mean VAS results 12 hours after administration of the drug at the time of T2 (p<0,05)

4.7 Additional Analgesic Value T1

Groups	Additional analgesics T1		Total	P Value *
	No	Yes		
Oksikodon (%)	30 (91)	3 (9)	33 (100)	0.692
Morfin (%)	29 (88)	4 (12)	33 (100)	
Total	59	7	66	

Table 4.7 shows the results of the chi square test showing the use of additional analgesic drugs used at the time of T1 (6 hours after drug administration) of this study. In the oxycodone group, 3 samples needed additional analgesic drugs while in the morphine group 4 samples needed additional analgesic drugs. It can be seen that there is a difference in the number of patients receiving additional analgesics, but it is not statistically significant (P> 0.05). This illustrates that both the oxycodone and morphine sulphate groups received the same additional analgesics at T1.
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4.8 Additional Analgesic Value T2

Group	Additional Analgetic T2		Total	P Value
	No	Yes		
Oksikodon (%)	19 (58)	14 (42)	33 (100)	0.806
Morfin (%)	18 (55)	15 (45)	33 (100)	
Total	37	29	66	

Table 4.8 shows the results of the chi square test showing the use of additional analgesic drugs used at the time of T2 (12 hours after drug administration) of this study. In the oxycodone group there were 14 samples requiring additional analgesic drugs while in the morphine sulphate group 15 samples needed additional analgesic drugs. It can be seen that there is a difference in the number of patients receiving additional analgesics, but it is not statistically significant (P> 0.05). This illustrates that both the oxycodone and morphine sulphate groups received the same additional analgesics at T2.

IV. CONCLUSIONS

There is no difference in the value of VAS before and after the treatment of oxycodone with morphine sulphate in the observation before drug administration, but showed a significant difference in the observation 6 hours after drug administration and 12 hours after drug administration. Patients given oxycodone have post-upper or lower extremity pain with the highest VAS 2 VAS at observation before drug administration, 6 hours after drug administration and 12 hours after drug administration.

In patients who were given morphine sulphate, post-upper and lower extremity pain with the highest VAS 2. VAS was observed before drug administration and 6 hours after drug administration and VAS 3 was observed 12 hours after drug administration. In patients given morphine sulphate, post-pain is obtained. Side Effects of PONV are more common in patients given morphine sulphate than oxycodones.

The use of additional analgesics is more common in patients given morphine sulphate compared with oxycodone at the observation 6 hours after drug administration and 12 hours after drug administration.upper and lower extremity surgeries with the highest VAS value VAS 2 at the observation before drug administration and 6 hours after drug administration and VAS 3 at observation 12 hours after drug administration.

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Molecular Characterization of Bacteria Associated with Diarrhoea in Children (0-5) from some Selected Hospitals in Makurdi, Benue State

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Abstract- Molecular characterization of bacteria associated with diarrhoea in children (0-5) years attending selected hospitals in Makurdi was carried out. A total of 377 stool samples were collected from children attending Federal Medical Centre, General Hospital North Bank and Bishop Murray Memorial Hospital, High level Makurdi. Standard methods involving microbiological, biochemical and molecular analysis using PCR were employed in characterizing bacteria associated with diarrhoea in children (0-5) years. Out of the 377 stool samples examined for diarrhoea associated with bacteria, 51 (13.7%) were positive for *Escherichia coli*, *Shigella* and *Salmonella* species. Out of these 51, 40 (78.4) were *E. coli*, 8 (15.7%) *Shigella* and 3 (5.9%) were *Salmonella* respectively. Out of 51 positive for bacteria associated with diarrhoea in children, 17 (11.4%) were from Male and 34 (13.7%) from Female. Infection rate was highest 23 (29.5%) among children between the ages of 13 – 24 months and the least 2 (2.6%) between 40 – 60 months. Amplification result using PCR confirmed *Enterohaemorragic E. coli*, *Shigella dysentriae* and *Salmonella typhi.* Exclusive breast feeding increases immunity in children, therefore breastfeeding should be recommended for children of breast feeding age, so that incidence of diarrhoea infection can be brought to the bearest minimum.

Index Terms- Diarrhoea, Children, Bacteria, Molecular characterization

I. Introduction

Diarrhoea is a disease condition of having at least three loose or liquid bowel movements each day (James *et al.*, 2003). It often lasts for a few days leading to dehydration as a result of fluid and electrolyte loss (Sinclair *et al.*, 2013). The Signs of dehydration often begin with loss of normal skin stretches irritable behavior and progress as a decrease in urination, loss of skin color, a fast heart rate, and decrease in responsiveness as it increases in severity (Addy *et al.*, 2004). *Enterotoxigenic E. coli*, *Salmonella paratyphi*, *Shigella species* and virus appeared to be the most common etiological agents but Certain circumstances are associated with and especially high incidence of acute diarrhoea disease (WHO, 2017). However, the causes of approximately 40 % of the cases are still unknown (UNICEF, 2010). Diarrhoea is a major cause of childhood disease in the developing world, global mortality estimates from diarrhoea and its complications range from 1.5 to 5.1 million deaths per year for children under the age of five (Nataro and Kaper, 1998). The most common cause of diarrhoea is through infection of the intestines with a virus, bacteria or a parasite- a condition known as gastroenteritis. The infections are often acquired through consumption of food or water that has been contaminated with faeces, or through direct contact with an infected person (WHO, 2017). There are three types of diarrhoea which include; short duration watery diarrhoea, short duration bloody diarrhoea and persistent diarrhoea (which lasts for more than two weeks) (Agho *et al.*, 2011). The short duration watery diarrhoea may be as a result of infection by cholera. It is rare in developed world. If blood is present it is also referred to as dysentery (Agho *et al.*, 2011). Although at least 25 different bacteria and protozoa can cause an identical clinical symptoms of gastroenteritis whereas over 75% of gastroenteritis cases are caused by viruses. Viral gastroenteritis is one of the most common infectious diseases worldwide, causing significant morbidity and mortality in children. Four major viral pathogens are associated with gastroenteritis; three of them are RNA viruses which includes Rotavirus, Norovirus, and Astrovirus and one DNA virus which include enteric Adenovirus. (Akinyemi *et al.*, 2011).

II. Materials and Methods

Determination of Sample Size

Samples size was determined by the Raosoft online calculator using accepted standard error of 5% at 95% confidence interval (Raosoft Sample Size Calculator, 2014). For this study, a minimum of 301 children were required; however, sample size of 377 children was used for the study.

Sample Collection

A total number of 377 faecal specimens were collected from patients attending three different hospitals in Makurdi, namely Federal Medical Centre, Bishop Murray hospital and General Hospital North Bank. About 1 gram of the fecal sample was transferred into sterile 9ml Cary Blair medium under aseptic technique. The faecal samples were transported to the University of Agriculture Microbiology laboratory of Federal University of

Agriculture for further bacteriological analysis (Cheesbrough, 2006).

Microbiological Analysis

All the media used was prepared according to manufacturer's standard

Prepared media was first warmed to room temperature (30±^{0}C) and the agar surface to dry before inoculating.

The specimen was inoculated and streaked on SSA, EMB as soon as possible after collection, except on TCBS. All specimens on swab to be cultured were rolled over a small area of the agar surface and the plates incubated aerobically at 37°C for 24 hours.

One gram (1g) of the faecal sample was inoculated into 10ml of alkaline peptone water and incubated at 37°C for 24 hours, thereafter; it was sub cultured onto TCBS agar and further incubated for 24 hours (Tankeshwar, 2016).

Bacterial Isolation

The inoculated plates were incubated at 37 ° C for 48 hours. The plates were observed for the peculiar growth characteristics of *Salmonella*, *Shigella*, *E.coli* and *Vibro cholerae* and result recorded. Distinct colony with the growth characteristics of interest were sub-cultured into nutrient agar for biochemical and molecular characterization (Cheesbrough, 2006).

Biochemical Characterization of the Isolates

The isolated bacteria were subjected to the following biochemical analysis like citrate, oxidase, catalase, indole, methyl red test, Voges Proskauer test, motility test, hydrogen sulphide, starch hydrolysis and sugar fermentation test using methods of Cheesbrough, (2006).

Molecular Analysis

Bacterial DNA Extraction for PCR Assay

Genomic DNA was isolated as described by Arciola *et al.* (2001). Nutrient broth was used, the bacterial cultures were inoculated into the broth in the tubes and allowed for growth at 37 ^{o}C overnight in orbital shaker. The tubes were then vortexed and 100 µl of the cultures were taken into Eppendorf tubes. They were centrifuged at 10,000 rpm for 5 minutes and the supernatant was removed, the pellet was washed using distilled water and centrifuged and the supernatant discarded again. The pellets were re suspended in the lysis buffer 50mM Tris HCL P^H (8.5), 1mM EDTA, 0.5% SDS (sodium dodecyl surphate), 20 cg/ml proteinase K. The tubes were centrifuged at 1000rpm for 10 minutes, then 100 cl of the supernatant were transferred to a new 1.5ml Eppendorf tube, 3.0 µl of the supernatants was used in PCR reaction. Genomic DNAs were ready and stored at -20 ^{o} C.

DNA Amplification of target genes

Procedure for running the PCR for the detection of target genes involved the use of two sets of primers (Forward and Reverse oligonucleotides) which were mixed in the folowjng way: Two micro liters (2 µL) of water was added to the negative control tube, then 2 µL of sample (template DNA) was added to the sample tube and all the lids were closed. The procedure was completed by adding the positive control DNA and the lid also closed. The tubes were placed into the PCR automated themocycler (biometra) and programmed as presented in Table 1.

Preparation of the Agarose Gel

Agarose solution (1.5%) was prepared by dissolving 1.5g agarose powder in 100ml of 0.5X TBE buffer, boiled in a water bath, and cooled to 40-50 ^{o}C. The agarose solution was poured into the set-up gel tray. The gel was left to solidify for 15-30 minutes. A staining bath containing a final concentration of 5 µg/mL ethidium bromide was prepared according to the method of PEN (2006). This stain served as an intercalating agent binding to double strand DNA and fluoresced when illuminated with UV light. Intact DNA usually appeared as a distinct band.

Electrophoresis procedure

The gel (comb) was put into the electrophoresis unit and refilled with buffer. The 5 µL of each PCR sample was mixed with approximately 2 µL loading dye and was loaded into the wells of the gel along with a molecular marker. The lid of the unit was replaced and the gel was run by starting the electrophoresis process. The lid of the unit was removed after a complete run of 30 minutes at 100 volts and the gel was placed in a staining-bath for about 30 minutes, removed, rinsed and the gel visualized for bands using the UV-transiluminator. They were observed for the presence of the specific bands of test samples corresponding to that of the control.

Table 1: Molecular characterization (PCR) Organization of Gene Primer-sequence

Organization	Gene	Primer	Primer-sequence	Bp fragment	Amplified temperature	Reference
E. coli	UidA	EC F	5"AAAACGGCACAAAAAGCAC-3"	147bp	65 ^{o}C	Bej *et al.*, 1991
		EC R	ACGCGTGCTTACAGTCTTGCG			
E. coli	eae	EC F	TCAATGCAGTTCCGTTATCAGTT	482bp	58 ^{o}C	Vidal *et al.*, 2005
		EC R	GTAAAGTCCGTTACCCCAACCTG	127bp repetitive		
Shigella	ERIC	ERIC F	ATGTAAGCTCCTGGGGATTCC		40 ^{o}C	Versaloric *et al.*, 1991
		ERIC R	AAGTAAGTGACTGGGGTGAGCG			

Salmonella	InvA	InvA F	TCGTGACTCGCGTAAATGGCGATA	423bp	63 ºC	Freitas *et al.*, 2010
		InvA R	GCAGGCGCACGCCATAATCAATAA			
	ViaB	ViaB F	CACGCACCATCATTTCACCG	738bp	54 ºC	
		ViaB R	AACAGGCTGTAGCGATTTACG			

The molecular ladder used was 100bp to 1000bp.

Statistical Analysis

All data that were obtained from this study were entered into Microsoft Excel and analyzed using statistical package for social sciences (SPSS) version 19.0 statistical software.

Both descriptive and analytical statistics were employed. Comparison based on age, bacterial strains were performed using chi square test were used to analyze data at P<0.05 significant level (Guerra *et al.*, 2014).

III. RESULTS AND DISCUSSION

Table 2: Sex Distribution of Diarrhoea Children in Selected Hospitals in Makurdi

SEX	Number of stool sample Examined	Number positive (percentage)
Male	149	17 (11.4)
Female	248	34 (13.7)
Total	**377**	**51 (13.5)**

x^2= 70.153, DF=1. P<0.05

Table 3: Age Distribution of Diarrhoea Children in Selected Hospitals in Makurdi

Age group (Months)	Number of stool sample Examined	Number positive (percentage)
≤12	74	2 (2.7)
13-24	78	23 (29.5)
25-36	84	19 (22.6)
37-48	64	4 (6.3)
49-60	77	2 (2.6)
Total	**377**	**51 (13.5)**

x^2= 17.078, DF=4. P<0.05

Table 4: Molecular characterization of Diarrhoea causing Bacteria in Stool of Children Age 0-5 years in selected Hospital in Makurdi.

Species	Number of positive (%)	Number confirmed molecularly	Number not confirmed	Total (%)
Enterohaemorrhagic E. coli	40 (10. 6)	40 (10. 6 %)	0	40 (10. 6 %)
Shigella dysentriae	8 (2.1)	8 (2.1 %)	0	8 (2.1 %)
Salmonella typhi	3 (0.8)	3 (0.8 %)	0	3 (0.8 %)
Total	**51 (13.5)**	**51 (13.5)**	**0**	**51 (13.5)**

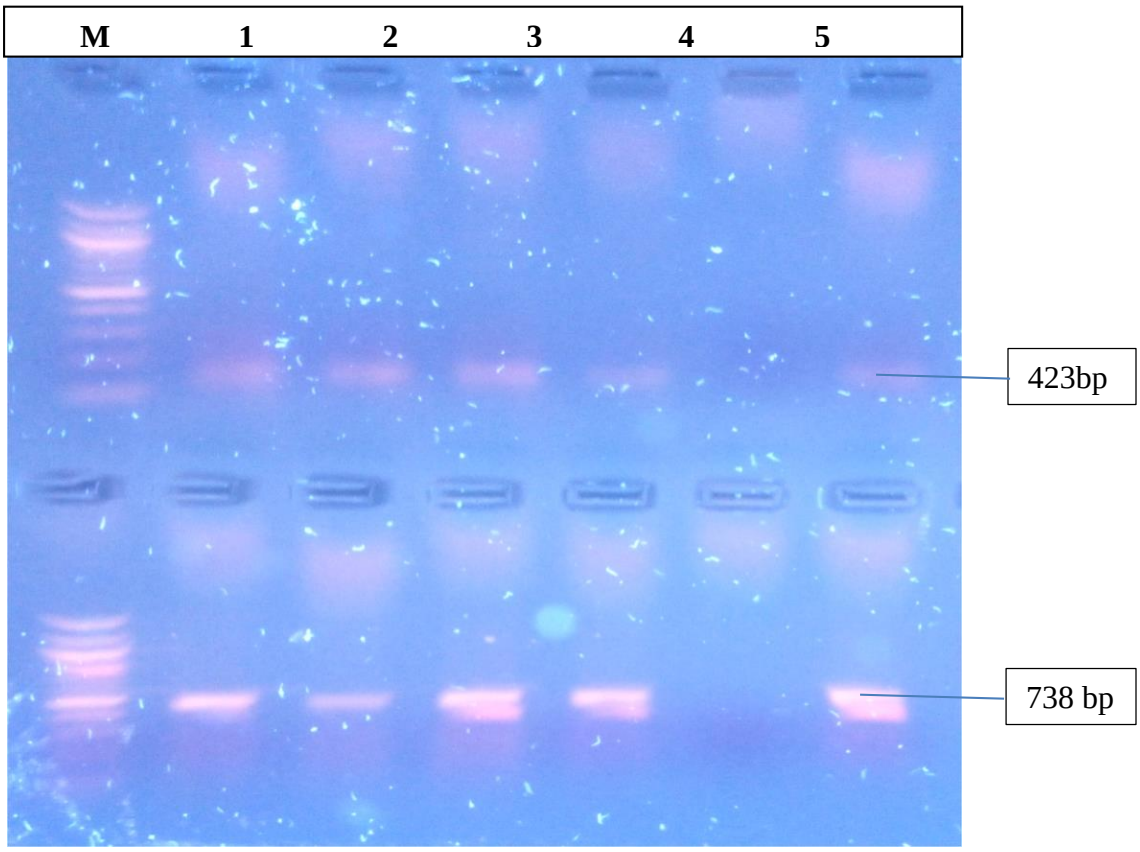

Plate 1: Amplification of *Salmonella typhi*
Upper gel: InvA gene amplification yields 423 bp fragments to confirm *Salmonella* species
Lowe gel: ViaB gene amplification yields 738 bp fragment (lanes 8, 9, and 10) to confirm *Salmonella typhi* and distinguish typhoidal from non-typhoidal *Salmonella* species (lanes 2,-7, 11 and 13). Land 1 = 100 bp DNA size marker. Lane 12 = negative control.

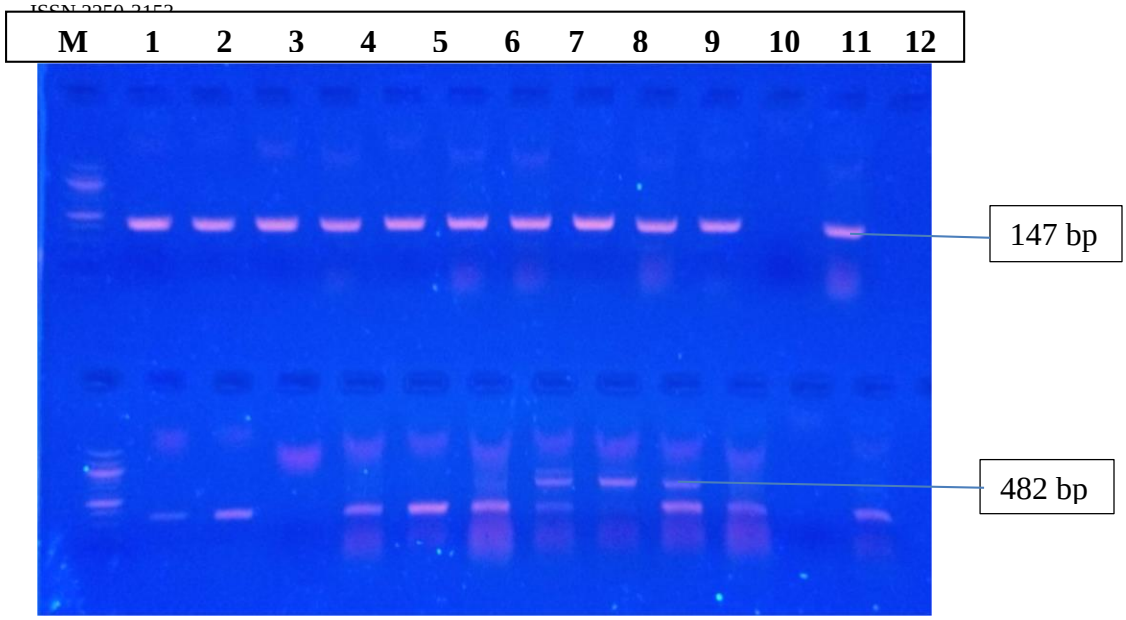

Plate 2: Amplification of Enteroheamoragic *E. coli*
Upper gel: uidA gene amplification generates 147 bp fragments to confirm *E. coli*
Lower gel: eae gene amplification generates 482 bp fragments to confirm enteroheamoragic*E. coli*

IV. DISCUSSION

Diarrhoea due to bacterial infections is one of the main causes of morbidity and mortality amongst infants and young children in most developing countries including Nigeria (Odetoyin *et al.*, 2015; Igbinosa and Beshiru, 2018). One of the important steps towards the control of diarrhoea is the identification and classification of the enteropathogens involved in diarrhoea disease in the country (Olowe *et al*., 2003). In this study, results shows that three bacterial species (*Enteroheamoragic Escherichia coli, Salmonella typhi, Shigella dysenteriae)* were isolated from diarrhoeic children. The prevalence of cases of diarrhoea in Makurdi, Nigeria with a potential bacterial pathogen detected was 13.53%. This was higher than 7.9% prevalence reported in China by Yu *et al*. (2018) but lower than the findings of this study. It is however in contrast with the work by Lubbert *et al*. (2016) who reported that the most common pathogenic bacteria associated with acute diarrhoea in children under 5 years of age were found to be *Salmonella* spp. However, it corresponds with Odetoyin *et al.* (2015) who reported toxin-producing *E. coli* to be (42, 16.7 %). This variation in prevalence might be attributed to differences in infrastructural and socio-economic indices. Although there are geographical difference in the spectrum of bacteria incriminated in childhood diarrhoea, Enterohaemoragic *Escherichia coli* and *Shigella dysenteriae* species were isolated at a high rate. Statistical analysis showed that *Escherichia was* significantly associated with diarrhoea in children younger than 3 years ($P<0.05$). There appear to be conflicting reports about the association of *Salmonella* species with diarrhoea. Conversely, the occurrence of *Salmonella* species in this study agrees with the findings from Abakaliki, south –eastern Nigeria (Ogbu *et al*., 2008). In addition, this report of Enteroheamorragic *Escherichia coli* species (78.4%) is in agreement with former reports from similar studies in China (Yin *et al*., 2018) which reported *E. coli* to be significantly associated with diarrhoea. Bacterial isolation age - wise diminished between the ages of 0-12, 37- 46 and 47 -60 months but significantly high between 13-24 and 25-36 months and is in consonance with past reports from Abuja (Ifeanyi *et al*., 2009). Molecular characterization confirmed presence of enteroheamorragic *E.coli,* and *Salmonella typhi.*

V. CONCLUSION

It was concluded from findings of this study that *Enteroheamorragic Escherichia coli, Salmonella typhi, Shigella dysenteriae* were associated with diarrhoea disease in children (0-5) from the study area. *Enteroheamorragic Escherichia coli* had the highest prevalence of occurrence. Children within 25- 36 months were mostly affected with diarrhea.

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Proportion of Fungal Infection in Fishmonger Traditional Markets in Medan City

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***Abstrak*-Background:** Dermatomycosis is estimated to affect about 20-25% of the world's population and is one of the most common forms of infection in humans. The causes of dermatomycosis are dermatophytes and Candida species.

Objective: To determine the proportion of fungal infections in the feet, hands and nails of traditional market fishmongers in Medan.

Methods: This study is a descriptive study with cross sectional method conducted from December 2018 to August 2019 involving 30 fishmonger who suffer from fungal infections at the Polyclinic of the Dermatology and Venereology in H. Adam Malik Hospital Medan. The diagnosis is based on anamnese, clinical examination, microscopic examination using a 10% - 20% KOH solution from skin and nail scrapings, and fungal culture.

Results: The fishmonger who suffered the most fungal infections were 16 men (53.3%), in the age group 36-45 years, 12 people (40%). There were 5 fishmongers (18,5%) who mostly infected by *Candida Famata* species and diagnose with interdigital cutis candidiasis followed with 4 fishmongers (13.3%) who infected by *Candida albicans* species and also 4 fishmongers (13.3%) who infected with *Candida parapsilosis* species diagnosed with onychomycosis. There were 27 fishmongers (90%) who mostly diagnosed with interdigital cutis candidiasis and onychomycosis followed with 3 fishmongers (10%) diagnosed with onychomycosis. There were 20 fishmongers (66.7%) who had been working for over 5 years as a fishmonger.

Conclusion: Interdigital cutis candidiasis and onychomycosis were the most common fungal infection in fishmongers, followed by onychomycosis.

Index Term-Fungal infections, fishmongers

I. BACKGROUND

Dermatomycosis affects 20-25% of the world's population and is one of the most common forms of infection in humans.[1,2] The most common causes of dermatomycosis are dermatophytes and Candida species.[3]

Dermatophytosis caused by dermatophyte fungi, attacks the skin, nails and hair containing keratin. This disease has a high morbidity and affects psychological effects, where men are more often than women.[4]

Candida is the main fungal pathogen of humans, causing diseases ranging from superficial mucosal infections to systemic infections that are often life-threatening.[5] *Candida albicans* is the most common Candida found in 70-80% of cases.[6]

The most common dermatophytosis cause is *Trichopyton rubrum* which is 32.8% followed by *Trichopyton mentagrophytes* 29.2%.[4]

The prevalence of onychomycosis in the United States is 12%, while in Europe, France the highest prevalence is 16.8%, Germany 12.4%, Finland 8.4% and the United Kingdom 2.7%.[4] The prevalence of tinea pedis and onychomycosis in Algeria, North Africa is 15% and 4.6%.[7]

Clinical diagnosis of fungals on the skin and nails by scraping using a 10-20% KOH solution and fungal culture. Fungal culture is the gold standard for species identification.[8]

II. METHODS

This study was a descriptive study with cross-sectional method. 30 fishmongers in traditional market from December 2018 to August 2019. Recording of basic data was collected by researcher at Dermatovenereology department of Haji Adam Malik Hospital. The recording of basic data includes the patient's identity and anamneses. Skin sample was scraped by laboratory workers of Pathology Clinical department Haji Adam Malik Hospital and culture was carried out by laboratory staff of Microbiology Department of Haji Adam Malik Hospital.

This study has obtained ethical clearance from the Research Ethics Commission Faculty of Medicine, University of North Sumatra.

III. RESULT

Characteristics of the study were the number of subjects suffering from fungal infections were most in the age group 36-45 years, total 12 people (40%) and 16 people were men (53.3%) more than 14 people were women (46.7%). Characteristics based on duration of work found that most subjects have worked as fishmongers for over 5 years is 20 people (66.7%), while the group with the least amount of 3-5 years is 3 people (10%).(Table 1)

Table 1. Subject Characteristic

Characteristic		N	(%)
Gender	Male	16	53,3
	Female	14	46,7
Age	17-25	6	20
	26-35	5	16,7
	36-45	12	40
	46-55	7	23,3
	>56	0	0
Working period	< 6 month	0	0
	6 month – 1 years	0	0
	1 years – 3 years	7	23,3
	3 years – 5 years	3	10
	> 5 years	20	66,7

The most common fungal infections were interdigital cutis candidiasis with onychomycosis about 27 people (90%) followed by onychomycosis were 3 people (10%).(Table 2)

Table 2. Fungal Infection

Fungal Infection	n	(%)
Onychomycosis	3	10
Interdigital cutis candidiasis + Onychomycosis	27	90

Table 3. Fungal Species

Location	Species	N	(%)	Total
Interdigital cutis candidiasis	*Candida albicans*	1	3,7	27
	Candida parapsilosis	4	14,8	
	Candida famata	5	18,5	
	Cryptococcus laurentii	1	3,7	

	Candida duovushaemulonii	1	3,7	
	Candida guiliermondii	1	3,7	
	Fungal growth was not found	14	51,8	
Onychomycosis	*Candida albicans*	4	13,3	30
	Candida parapsilosis	4	13,3	
	Candida famata	3	10	
	Candida guiliermondii	1	3,4	
	Fungal growth was not found	18	60	

The most species of fungal infections in interdigital cutis candidiasis of 27 people were *Candida famata* about 5 people (18.51%) and on onychomycosis were *Candida albicans* and *Candida parapsilosis* about 4 people (13,3%).(Table 3)

IV. DISCUSSION

In this study, there were more male gender subjects than females, 16 males (53.3%). In Adhiguna and Lestari's research on dermatomycosis conducted at the main state medical education hospital in Indonesia in 2009-2011 found that the incidence of dermatomycosis incidence was similar in men and women. Most cities show more males than females, perhaps due to work factors that involve more physical and hot condition so that a lot of sweating and facilitate the occurrence of dermatomycosis.[9]

Study by Lubis in H. Adam Malik General Hospital in Medan in 2014 found the number of subjects with onychomycosis were more often in women (71.4%).[10] Study by Setianingsih in 2015 on pig farms from 40 samples found more tinea unguium sufferers in women than in men, there 10 (71%) and 4 (29%), 8 people had worked for more than 5 years (57%).[11]

Research conducted in Dermato and Venereology Polyclinic of RSUP Prof. Dr. R. D. Kandou Manado in January-December 2012 period showed that from 65 cases of dermatophytosis (1,61%) of all dermato and venereology cases in 2012, the most gender were female (67,70%).[12]

Research conducted by Soetojo and Astari in 2011-2013 in Regional Hospital Dr. Soetomo Surabaya, from 114 patients with skin infections and 23 patients with nail infections, the most gender was female, that in 2011 (54,3%), 2012 (80%), and 2013 (56,6%).[13] The study by Rizal et al on 2011 at H. Adam Malik General Hospital in Medan from 33 onychomycosis patients, the most gender was female, 24 patients (72,7%) and 9 men (27,3%).[14]

In this study the highest frequency of occurrence in the 36-45 year age group was 12 people (40%) and the least in the 26-35 year age group was 5 people (16.7%). Study by Lubis in H. Adam Malik General Hospital in Medan on onychomycosis found the most common age group were in 16-25 years old (22,9%) and 56-65 years old (22,9%).[10] Study by Harahap in 2009-2012 at H. Adam Malik General Hospital in Medan found that the most incident on onychomycosis were in 18-45 years old (1,9%) from all of dermatomycosis incident.[15]

A retrosfective study conducted at Dermatovenereology clinic of Prof. Dr. R.D.Kandou Manado General Hospital in 2009–2011 out of 10,003 patients who visited showed that the women most likely to suffer from cutaneous candidiasis (61.25%), in the 45–64 age group (38, 13%). This study was conducted retrospectively on patients with cutaneous candidiasis who came to Dermatology clinic and the results obtained showed that from a total of 10,003 visits there were 160 people (0.53%) new patients with cutaneous candidiasis, 26.27% of 598 new cases of fungal disease, with the highest type of candidiasis is intertriginous candidiasis (95.63%).[16]

Research conducted by Soetojo and Astari in 2011- 2013 at Regional Hospital Dr. Soetomo Surabaya, from 114 patients with skin infection and 23 patients with nail infection, the most common skin infections were intertriginous candidiasis (62,2%), candidiasis infections on the skin and nails (91,3%).[13]

Research conducted by Puspitasari et al in candidiasis patients in Mycology Division of Dermatovenereology Outpatient Unit Dr. Soetomo Surabaya on 2013-2016, in 298 new patients there were 14 cases of interdigital candidiasis (4.7%).[17]

In this study, from the clinical feature shows that it is a tinea pedis et manum, but at the time of examination of fungal cultures obtained the most species were candida. Study by Otasevic et al in 2016, 761 patients onychomycosis were found, from the results of 137 culture tests caused by Candida, consisting of *Candida albicans* (36.59%), *Candida parapsillosis* (23.78%), *Candida krusei* (9.76%), and *Candida guilliermondii* (6.71%).[18]

Jamaliah research in 2014 on tofu factory workers in Medan Deli sub-district in Medan, from the results of dermatomycosis culture obtained *Candida sp* (61.1%), *Aspergillus fumigates* (11.11%) and *M. gypseum* (5.55%).[19]

Retrospective studies conducted by Tan in Singapore showed the most common causes of onychomycosis were *Candida albicans* (37.9%) and non dermatophyte molds (5.6%).[20]

Study by Lubis in H. Adam Malik General Hospital in Medan on 2014 found that the species of onychomycosis was *Candida albicans* about 15 people (42.8%). Some factors that could cause no fungal growth were found due to differences in the sample collection process, differences in culture media, differences in optimal temperature, inadequate number of culture samples and site selection.[10]

V. CONCLUSION

Candidiasis cutis interdigitalis and onychomycosis were the most common fungal infection in fishmongers, followed by onychomycosis.

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Accounting and Financial Reporting Practices of Small and Medium Sized Entities/ SMEs in Wolaita Sodo, Southern Ethiopia

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Abstract: The purpose of this study was to assess the current status of accounting and financial reporting practices by the Small and Medium Sized Entities/SMEs in Wolaita Sodo, Southern Ethiopia. Most of the studies conducted previously in relation to SMEs focus on the importance of SMEs and challenges faced by the SMEs in Ethiopia. Despite the importance of accounting to SMEs, little has been researched about the accounting and financial reporting practices of SMEs in Ethiopia. This research used descriptive cross sectional survey approach based on a statistical analysis of questionnaires completed by owner managers of SMEs. The sampling rate of 10% was applied across five major sectors/strata to come up with a sample of 67 SMEs owner managers. The findings from the study revealed that the accounting and reporting practices by the majority of the SMEs in Wolaita Sodo was not in line with the basic assumptions such as economic entity assumption and accrual assumption pointing out the major reason as lack of knowledge by the owner managers. For the daily recording of economic events majority of the SMEs use the single entry system. Most of the SMEs consider accounting as a means of complying with the requirement of the tax authority and rely on external consultants for the preparation of financial statements. From these findings, it is recommended that it would be better if the concerned regulatory bodies and other stakeholders give attention to the accounting and financial reporting issue of the SMEs so as to promote informed decision by different external stakeholders particularly creditors.

Key terms: Accounting and financial reporting, SMEs, owner managers, Wolaita Sodo.

1. Introduction

Even though there is no globally accepted common definition to SMEs, they are always playing significant roles in the real Gross Domestic Product (GDP) growth, new job creation and reduction of poverty in the global economy (Karadag, 2016). Peter Drucker, the father of post war management thinking said that small enterprises represent the main means of economic development. Those small businesses contribute extremely to achieving the basic goals to any national economy, becoming the backbone of social and economical progress

(Druker, 2009 cited in Neagu, 2016). This is supported by Association of Chartered Certified Accountants/ACCA report stating SMEs as the backbone of the global economy in the after effects of the global economic crisis of 2008-9 (ACCA, 2010).

SMEs represent over 99% of the total number of enterprises in most economies (OECD, 2017). According to the International Finance Corporation/IFC, 2010 cited in OECD, 2017 in developing economies, SMEs contribute up to 45% of total employment and 33% of Gross Domestic Product (GDP). As per Gebrehiwot (2006), the SMEs contribute up to 3.4% to the GDP of Ethiopia and 90% to the country's employment.

Even if SMEs are considered as backbone for the development of countries economy particularly in developing countries, they are facing a number of challenges. Among the challenges, access to finance and making informed business decisions are noted as the major constraints to the growth of SMEs in different countries including Ethiopia (Emeizie 2017; Getahun 2016; and John and Sylvester 2011). According to the World Bank (2015) report, the government of Ethiopia has been given major emphasis to the SMEs expecting the hopes of transforming the country's economy in Growth and Transformation Plan/GTP developing support packages concerning different stakeholders such as financial service providers, technical and vocational education institutions and various levels of government institutions. Despite the support packages, lack of access to adequate finance remains the most critical constraining factor for SMEs growth due to lack of acceptable and/or sufficient collateral and lack of credit history with banks. According to this report commercial banks take 92.6% of the total assets of the financial sector with which SMEs have almost no credit history. From the total small and medium enterprises, 3% and 23% respectively have credit line with banks. The report also found SMEs as the missing middles to have access to finance. Because, banks do have credit line with large companies and micro financing institutions are providing finance to the micro level enterprises (World Bank, 2015).

As indicated by Nega and Hussien (2016) banks and Micro Finance Institutions/MFIs in Ethiopia acknowledged poor accounting records by SMEs as one of the firm specific obstacles to provide credit to the SMEs. Access to finance was positively related to accounting practice of SMEs (Mosisa, 2011). According to Appui au Development Autonome/ADA asbl, 2017, Ethiopian MFIs primarily determine loan size based on the value of collateral as opposed to the creditworthiness or cash flow potential of the client and project. The study also noted that the amounts of credit that they require are all too often well above the value of the collateral they own. The level of credit risk affects the interest rate/cost of capital to the borrower and rate of return to the lender. Hence, to evaluate the credit risk of the businesses as well to determine the cost of capital, financial institutions required to see and evaluate the financial reports of the businesses. According to Nott, 2003 cited in

Nega and Hussien, 2016 in the absence of sufficient financial information especially in developing countries, banks generally rely on high collateral values, which according to bank reduce the risks associated with the problems of adverse selection and moral hazards resulting from imperfect information.

Generally, the access-to-credit environment is not conducive to businesses that are struggling for growth, require external finance, and are shortage of the collateral amount demanded by financial institutions. Therefore, one of the strategies to improve the SMEs access to financing and ensuring their sustainability and growth is improving their financial recording so as to enable the lenders of money/primary users of accounting information to make analysis regarding to the credit worthiness of these firms based on relevant and faithful financial reports. Beyond getting finance, having proper financial report has benefit to enable businesses to make informed decisions and enable intra and inter business comparisons thereby enhance competition and growth in each business sectors (IFRS foundation, 2015).

As emphasized by different literatures in the case of Ethiopia, opposing to the contribution of the sector to employment, its contribution to the GDP is very small. This could be due to little attention to the utilization of resources in the enterprises efficiently. The efficient utilization of resources also linked with making informed business decisions by the enterprises. To do so accounting information are very important. As far as the knowledge of the researcher is concerned, there had been no such study tried to assess the accounting and reporting practice of SMEs in Wolaita Sodo, Southern Ethiopia. Therefore, the purpose of this research was to investigate the status of accounting and financial reporting practices of SMEs from the SMEs owner managers' perspective. This study is expected to add knowledge in the literature regarding to the topic and enable different stakeholders to identify areas of deficiencies for future intervention.

2. Literature review

2.1.Definition of Small and Medium Entities/SMEs

There is no universally accepted definition of SMEs because in each economic system every country has its own classification according to its industrial regulation. When the International Accounting Standards Board/IASB develop International Financial Reporting Standard/IFRS for SMEs, the IASB did not impose any kind of specific size limits to define small companies for the adoption of IFRS for SMEs. Instead, it might specify that size limits which are already given in national legislation or standards could be adopted for the purpose (IFRS foundation, 2016). According to the definition set by Accounting and Auditing Board of Ethiopia/AABE which was based on the IASBs 2009 general definition, SMEs are entities that: do not have public accountability and publish general purpose financial statements for external users. Examples of external

users include owners who are not involved in managing the business, existing and potential creditors, and credit rating agencies (Federal Democratic Republic of Ethiopia/FDRE proclamation No. 847/2014 and IASB, 2009).

Recently, the National Micro and Small Enterprises/MSE development strategy guideline and the Development Bank of Ethiopia defined Micro, Small and Medium Enterprises/MSMEs by number of employees and paid up capital. According to this definition, small enterprises are enterprises having 6 to 30 employees and paid up capital of birr 50,001 to 500,000 (EUR 2,001 to 20,000) in the case of service sector and from birr 100,001 to 1,500,000 (EUR 4,001 to 60,000) in the case of industry or manufacturing sector. However, the Development Bank of Ethiopia recently set a definition of medium enterprises (for its lease financing operations) based on number of employees and total capital irrespective of the sector in which the enterprises operate. Accordingly, medium enterprises in both the manufacturing and service sectors are enterprises with 31-100 employees and/or with a paid up capital of birr 500,001 (EUR 20,001) to birr 7.5 million (EUR 300,000) (ADA, asbl, 2017).

2.2.Accounting and reporting practice of SMEs

Accounting is considered as the language of business and the most credible source of financial information about an entity to different stakeholders so as to undertake their respective decisions. The accounting and reporting practice in the double entry system is defined as; the process of identifying relevant and measurable economic events based on the source documents; keeping a systematic and chronological record of events measured in monetary units; posting the events to the ledger; balance-off the accounts and prepare trial balance; make adjustment to accruals and deferrals and communicates the collected information to interested users by means of accounting reports (Weygandt, Kimmel and Kieso 2013; Keiso, Weygant and Warfield, 2014). At the end of 2014, Ethiopia adopted IFRS which is based on the double entry system as a guiding principle for the financial accounting and reporting practice to the reporting entities where SMEs considered as reporting entities in the country (proclamation No. 847/2014). Double entry system is a system which records the two side effect of a particular economic event. To get relevant and faithful financial information from the system, the IASB's conceptual framework (2010) also sets the basic assumptions guiding the accounting process. Among the basic assumptions, economic entity and accrual basis of accounting assumptions are indispensable. In order to communicate useful information to the stakeholders for assisting them to undertake decision, there are some basic financial records that SME managers or owners need to keep. These basic records will normally include the sales day book (sales journal to record credit sales), purchases day book (purchases journal o record credit purchases), cash book (to record cash transactions), general journal, general ledger, receivables' ledger and payables' ledger (Onaolapo and Adegbite, 2014 as cited in Musah, 2017).

Contrary to the theoretical requirements, empirical studies conducted by Mehari and Pasha Shaik (2017) and Ali, Berhe and Mihret (2014) in Arba Minch town and Tigray region in Ethiopia respectively revealed, accounting practices of SMEs are not structured/at low level to produce required information to both external and internal users for decision making purposes. Poor accounting practice by SMEs was also acknowledged by different empirical studies conducted in different countries such as Stephen and Zotorvie, 2017 in Ghana; Madurapperuma, Thilakerathne and Manawadu, 2016 in Siri Lanka and Asaduzzaman, 2016 in Bangladish. Based on the above empirical studies some of the major reasons for poor accounting practice by SMEs were lack of technical knowledge of accounting by the owner/managers to the businesses, high cost of hiring qualified accountants and lack of clear guiding accounting rules.

2.3. Importance of accounting and reporting system for SMEs

Despite the actual accounting and reporting practice by SMEs, the place of sound accounting and reporting systems in any business, irrespective of its size, cannot be overemphasized. The growth of the SMEs can be determined through maintenance of proper records of accounts, which provides the basis for making proper operational and strategic business decisions. The growth and sustainability of a business is hindered if there is operational inefficiency, taking inappropriate decision, investing in the wrong projects etc.

There are plenty of studies emphasized on the importance of accounting and reporting practice by SMEs. For instance, as per Nwobu et al., (2015) some of the benefits of employing accounting services include increased accountability of business operations, reduced fraud, correct measurement of profit and achievement of managements' set goals. Musah (2017) stated the importance of proper record keeping and accounting by the SMEs in Ghana as enabling the businesses to make essential business decision; getting feedback after their action and making adjustment to the future and thereby reduce operating costs and improve productivity and efficiency by the businesses.

Conceptual framework

The conceptual framework for the study is based on the assumption that the current accounting and financial reporting practice is evaluated in terms of accounting system, basic assumptions: economic entity assumption and accrual basis of accounting assumption, types of financial statements, users and purpose of financial statements.

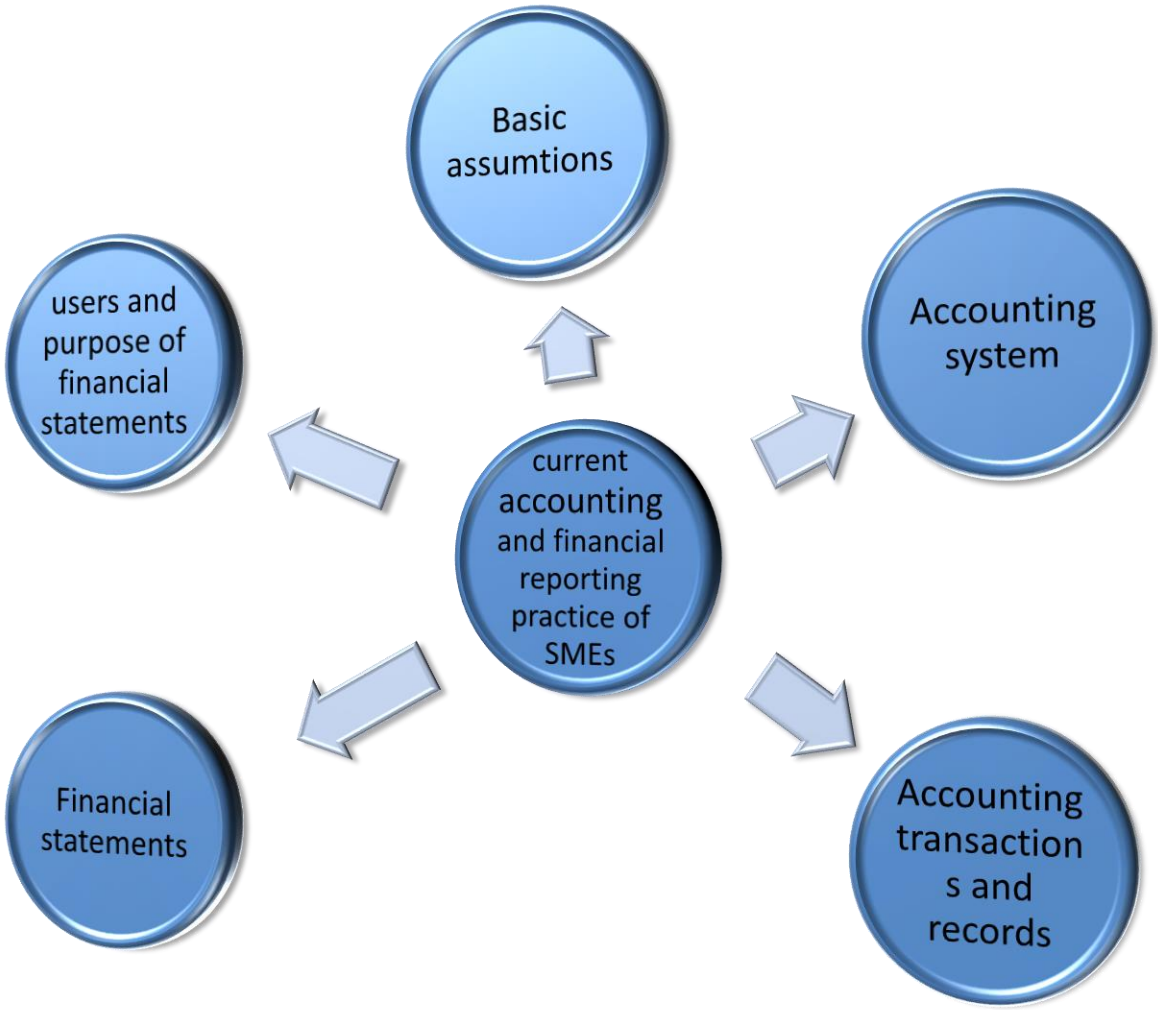

Figure 1: Conceptual frame work. **Source:** authors own construct.

3. Objectives of the study

General objective

The general objective of the study was to assess the current accounting and financial reporting practice of SMEs in Wolaita Sodo, Southern Ethiopia.

Specific objectives

- To evaluate the accounting practice by SMEs in light with the underlying assumptions to accounting.
- To investigate the types of accounting transactions and records being kept by SMEs.
- To describe the preparation of financial statements by the SMEs

4. Methods

Study Area

The study was conducted in Wolaita Sodo town in Southern Ethiopia. The area was chosen for this study because almost all businesses in the town are MSMEs and the researcher is in need of knowing the accounting and financial reporting practice of the businesses to push intervention in their point of deficiencies by different stakeholders.

Study Design

Research design refers to the plans and procedures for research that cover the decisions from broad assumptions to detailed methods of data collection and analysis (Creswell, 2009) Descriptive cross sectional survey design was employed to this particular study. A descriptive research design attempts to describe or define a subject, often by creating a profile of a group of problems, people, or events, through the collection of data and tabulation of the frequencies on research variables or their interaction, (Cooper & Schindler, 2006).

According to Bryman and Bell (2007), a cross-sectional survey is a design in relation to which data are collected using questionnaires or structured interviews with the intent of generalizing from a sample to a population Babbie, 1990 cited on Creswell, 2009. predominantly by self-completion questionnaires or by self-structured interviews on more than one case and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables which are then examined to detect patterns of relationship. A survey was used because it provides a quick, efficient, and accurate means of assessing information about a population.

Population

The target population selected to achieve the objectives of this study include SMEs registered with the trade and industry office of Wolaita Sodo town as of June, 2018. To differentiate SMEs in the town from other enterprises, the study assumed the definition set by National MSE development Strategy and Development Bank of Ethiopia triangulating with the definition given by IASB and AABE to adopt IFRS for SMEs. Accordingly, 670 SMEs operating in five major sectors (40 in construction, 60 in manufacturing, 210 in service, 330 in trade and 30 in urban agriculture) were considered.

Sample size and sampling technique

Bryman and Bell (2007) described a sample as the segment of the population that is selected for investigation. Sample is considered if the population size is unreachable with the available time and other resources. Sevilla et.al (at Tejero, 2006) stated that for descriptive study, the sample size is equal to 10% of the total population. 10% sample size was used by Tankana, 2015 for similar studies. Saunders, Lewis and Thornhill (2009) defined the sampling frame for any probability sample is a complete list of all the units in the population from which the sample units will be drawn. Hence, for this particular study the sampling frame consists of all units in the target population. Our sample covered 67 SMEs which were sampled from 670 SMEs as listed by the Trade and Industry Office of the town as of June, 2018.

The sampling technique used to draw sample units from the SMEs was the probability sampling method which ensured that each unit of the population had equal chance of being selected. The stratified random sampling method which is the process of selecting the assigned proportion from each stratum was used. It involves dividing the population into strata and then taking a random sample from each stratum. This sampling technique was preferred because the population is divided into several strata comprising the different major sectors that most SMEs operate in.

Table 1: SMEs in various sectors which were sampled for the Study, 2019

Types of Business sectors	Number SMEs per business sector	Sampling rate (%)	Sample size
Construction	40	10	4
Manufacturing	60	10	6
Service	210	10	21
Trade	330	10	33
Urban agriculture	30	10	3
Total	**670**	**100**	**67**

Data type and source

Quantitative data were used for the study. The study considered primary sources of data to assess the current financial accounting and reporting practice of SME. The owner managers of the SMEs in the sample were considered as the source for the required information+.

Data collection method

One set of questionnaire was developed for the owner managers which include open-ended and closed-ended questions and divided into three sections: characteristics of SMEs, the current record keeping practices of SMEs and reporting practices of SMEs. To minimize none response rate and ambiguity with the questions to the owner managers, the questionnaires were administered through the help of interviewers. Intensive training was given to data collectors on how to approach the respondents and collect the data.

Data analysis tools

Data from questionnaire were analyzed statistically using Statistical Package for the Social Sciences (SPSS 20). The analysis of data using SPSS allowed us to draw valid and reliable conclusions and recommendations. Data from questionnaires, especially open-ended questions were analyzed qualitatively in the form of discussion.

5. Results and Discussion

5.1.Respondents and SMEs Characteristics, Wolaita Sodo, Southern Ethiopia, 2019

Respondents gender category

Out of the 67 respondents, the majority were males (70.1%), with females comprising 29.9%. This clearly indicates the males' dominancy in managing the SMEs in the town. The result is consistent with (Getahun, 2016).

Age (in years) of respondents

The age distribution of respondents is shown in Table 2. Nearly half (47.8%) of the respondents were within age group between 31 to 40 years. The remaining 25.4%, 19.4% and 7.5% of the owner managers were in the age category of 20 to 30; 41 to 50 and above 50 age groups respectively. This shows that the young populations manage majority of the SME sector. The result is in support to (Musah, 2017).

Table 2: Age distribution of respondents

Age range	Number	Percent
20-30 years	17	25.4
31-40 years	32	47.8
41-50 years	13	19.4
Above 50 years	5	7.5

Source: Field data, 2019

Respondents' Educational Level

More than one third (35.85%) of the SMEs owner mangers were learned up to secondary school level (figure 1). The results show that all of the respondents possess the level of literacy required to understand the issues rose on the questionnaire and as such would be able to provide reliable information about the SMEs' accounting practices. This also could be good opportunity to enhance the perfection of the SMEs accounting system through training of their owners.

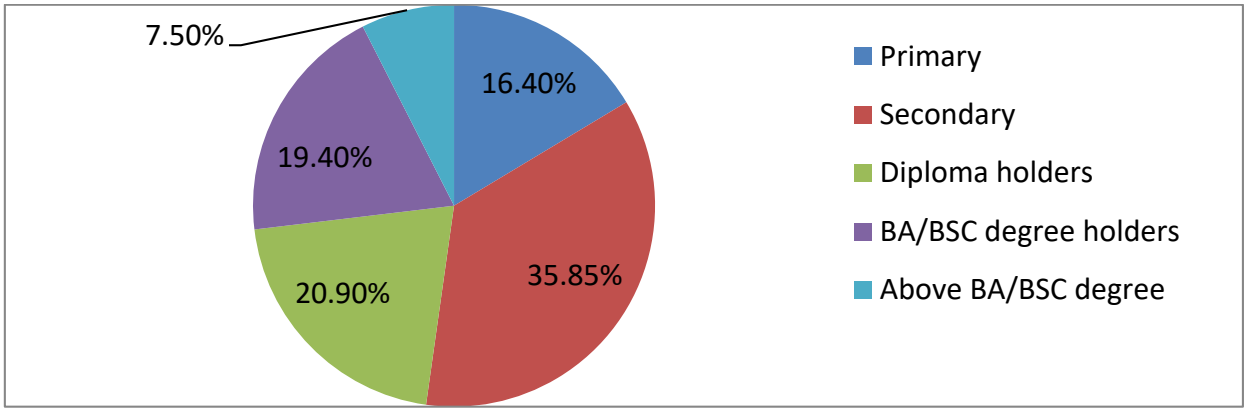

Figure 2: Respondents' education level. **Source:** Field data, 2019

Experience of respondents in managing their business

Data on respondents' experience in doing their business is displayed in Figure 3. 65.7% of the SMEs owner managers had experience of more than 5 years in doing their business and 29.9% have experience of between 1 to 5 years, whereas only 4.5% of the owner managers were beginners/ with the experience of less than a year. Therefore, as the result shows almost all of the owner managers do have good experience of managing their business which will help them to know in detail the economic events and the status of accounting practice of their respective businesses.

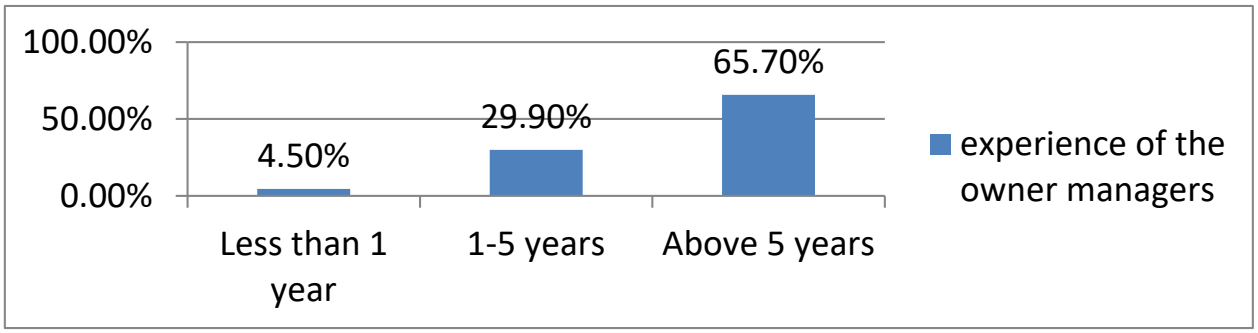

Figure 3: Respondents' experience. **Source:** Field data, 2019

Sector of Business Activities

Almost half (49.3%) of the SMEs in the town were operating in the trade sector (Figure, 4). This is mainly due to small capital required to start such business. The same cannot be said of manufacturing and construction sectors which require much capital and expertise. This could be good opportunity to install accounting and reporting system in accordance to IFRS for SMEs, because the types and numbers of business transactions to trading businesses is relatively less complex than businesses in the other sectors.

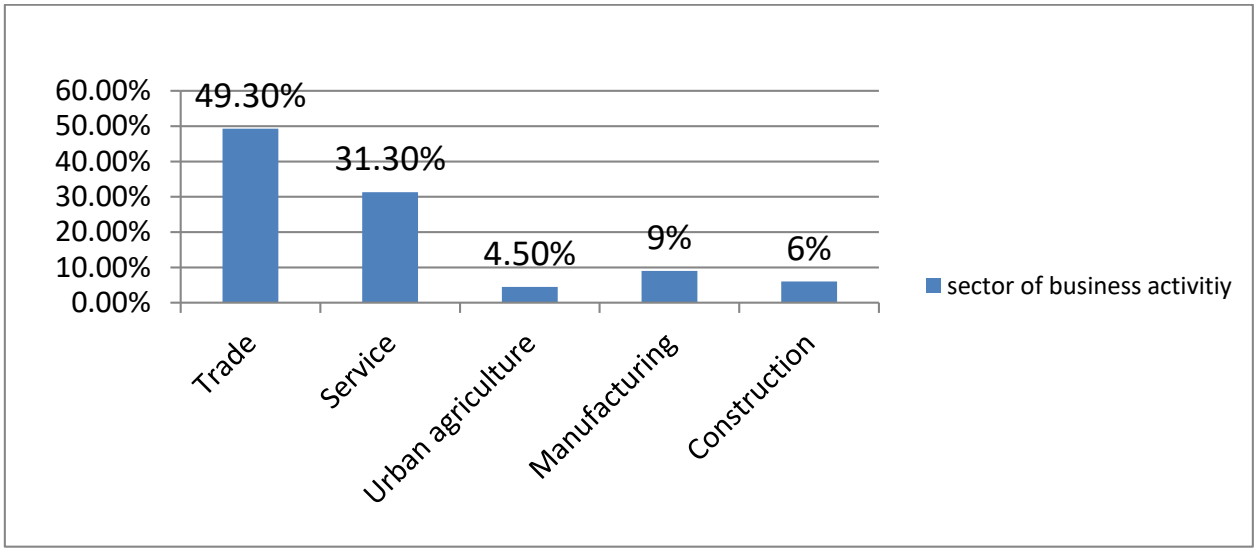

Figure 4: Sectors of business activities. **Source:** Field data, 2019

Number of employees in the SMEs

Number of employees is one of the key parameters used to define SMEs in most the countries. Majority (56.7%) of the SMEs were created employment opportunity for 6 to 30 individuals followed by 35.8% of SMEs employing 1 to 5 individuals (Figure, 5). This might be linked with the finding that majority of them were entities engaged in businesses that do not require a large number of employees to function. On the other hand, when we trace the definition for SMEs set by the development bank of Ethiopia in 2017, based on the number of employees 56.7% (6 to 30 employees) were small businesses and 6.0% (30 to 100 employees) were medium businesses.

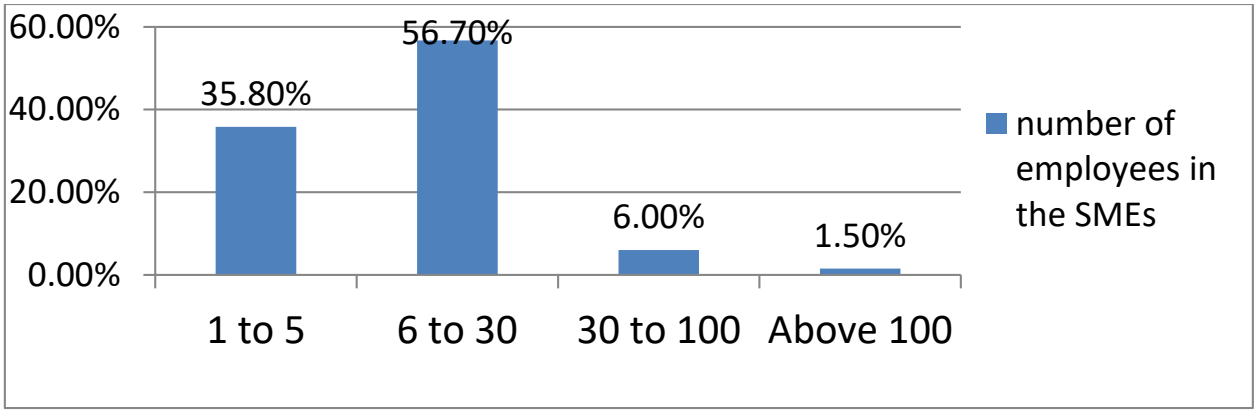

Figure 5: Numbers of employees in the SMEs. **Source:** Field data, 2019

Forms of business ownership

In figure 6, it has been shown that majority of SMEs (71.6%) were sole proprietorships followed by family owned (14.9%), partnership (9.0%) and private limited companies/PLCs (4.5%). This clearly shows the dominance by sole proprietorships, controlling more than two third of the enterprises among SMEs. The result is consistent with (Getahun, 2014).

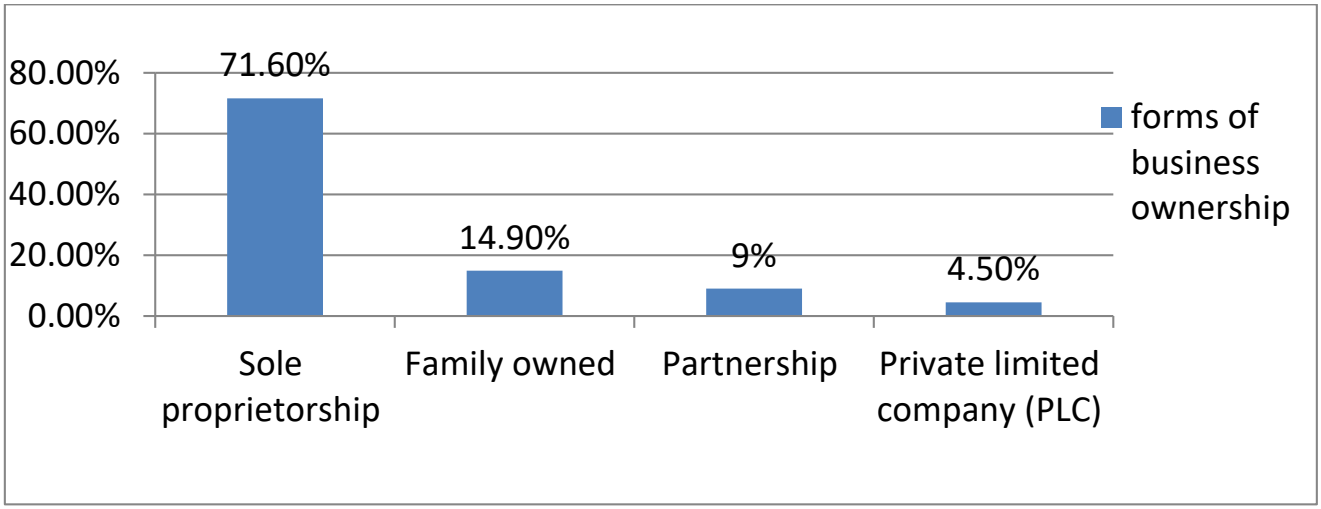

Figure 6: Forms of business ownership. **Source:** Field data, 2019

5.2.Accounting practice of SMEs in terms of the basic assumptions of accounting and financial reporting, Wolaita Sodo, Southern Ethiopia 2019

Economic Entity Assumption

Among the sampled SMEs, 58.2% did not segregate the activities of the businesses from the owner's personal affairs and other entities affairs for the accounting and reporting purpose (Figure, 7). In IASBs conceptual framework, economic entity assumption is one of the basic assumptions to external reporting (Keiso, 2014). Unless a particular reporting entity apply the economic entity assumption, the financial statements produced by the accounting information system cannot communicate fair and relevant information to the decision makers about the entity.

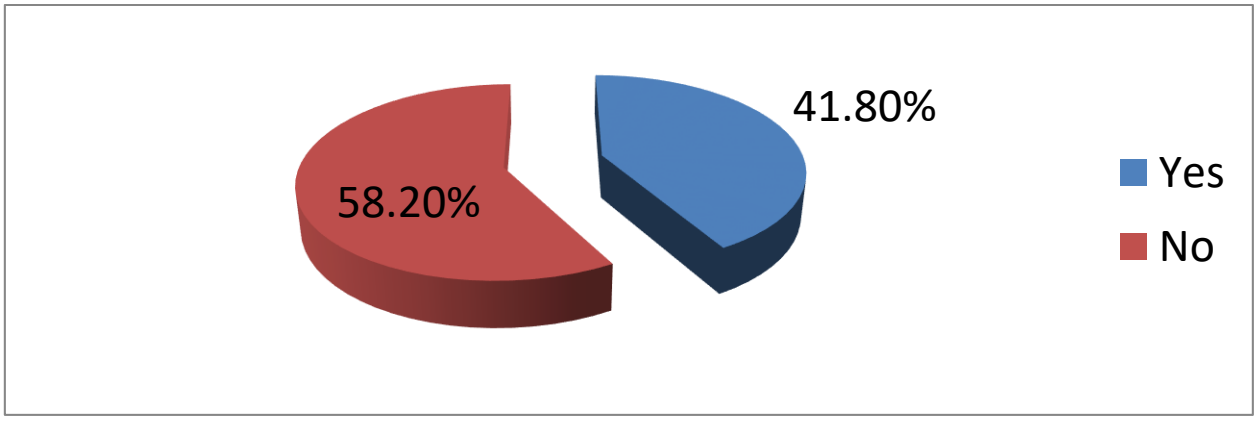

Figure 7: Economic entity assumption application by the SMEs. **Source:** Field data, 2019

Concerning reasons for not applying business entity assumption, 82.1% of the SMEs stated that lack of knowledge on basics of accounting whereas 7.7% of the respondents stated it is not important to their businesses because their businesses are small in size. The remaining 10.2% of the respondents stated other reasons such as considering their businesses as the source of meeting their basic needs so they do not have separate record, absence of follow up from any regulatory body, sole form of ownership, combining one entity income and expense with the other entity because all are owned by one person and because the entities were operating through capital from different sources and using the resources both for entities operation and personal use. It was also noted that as the owner managers level of education increase, the application of economic entity assumption also increase.

Accounting system

More than three fourth (76.1%) of the SMEs were using the single-entry accounting (Table, 3). Among those businesses using the single entry system, majority (72.5%) were indicated lack of knowledge on the double-entry system as the reason to use the single-entry system. This could be due to the reliance of SMEs on external consultants to the preparation of financial statements annually for the taxing purpose. Due to the absence of strict follow up from the regulatory bodies for the day to day recording of economic events, SMEs owner

managers were not forced to know about the modern accounting system. Simply they were collecting the necessary receipts and other documents and giving to their consultants so as to prepare financial statements required by the tax authority. The result also indicated that, the share of enterprises with double-entry accounting increases as the size of enterprise increases consistent with (Lindner and Hoelzl, 2012).

Bases of accounting

More than three fourth (80.6%) of the respondents indicated the recognition of revenue at the time of cash receipt or considering cash base whereas the remaining 19.4% were recognizing revenue when it is probable that future economic benefits will flow to the company and reliable measurement is possible (accrual basis of accounting). Among those respondents using the cash basis of accounting, 46.3% stated the reasons for the cash basis as lack of knowledge on accrual basis of accounting. Among the SMEs using cash bases of accounting, almost 89% were using the single entry system. Contrary to this result, IFRS for SMEs adopted by the government of Ethiopia with the proclamation No. 847/2014 require the accrual basis of accounting based on the double entry system for the preparation of general purpose financial statements by the SMEs in the country.

Table 3: Accounting practice of SMEs in terms of the choice for accounting system and basis of accounting, Wolaita Sodo, Southern Ethiopia, 2019

Variables		**Number**	**Percent**
System of accounting	Double entry system	16	23.9
	Single entry system	51	76.1
Reason for single entry (n=51)	Easier than double entry	12	23.5
	Lack of knowledge on double entry	37	72.5
	Others	2	4.0
Basis of accounting	Cash base	54	80.6
	Accrual base	13	19.4
Reason for cash base (n=54)	Easier for application	19	35.2
	Lack of knowledge about accrual base	25	46.3
	Others	10	18.5
	Others*: absence of credit sales and purchases; vouchers used as source documents were received or given on the date of purchase or sale		
NB: all of the SMEs with double entry system have been using debit credit rules.			

Source: Field data, 2019

5.3. Business transactions and types of accounting records being kept by SMEs, Wolaita Sodo, Southern Ethiopia, 2019

Transactions recorded by the SMEs

Almost all (97%) of the sampled SMEs were keeping record for purchase transactions followed by record for sales transaction (91.0%) (Table, 4). Recording purchase transactions could be to get the Value Added Tax/VAT refund for purchase with VAT and getting tax advantage with high amount of expenses relative to income. The smallest number (10.4%) consider recording of depreciation in relation to fixed assets. This result indicated that there were no complete recording of all measurable economic transactions and other events which can change financial position, financial performance and cash flow status of the entities. This is contrary to the IASB's conceptual framework which require complete recording for faithfulness of accounting reports.

Accounting records maintained by the SMEs

Among the accounting records considered in the instrument such as source documents, chart of accounts, journals, ledger and trial balances, 97% of the SMEs in the town were using the various source documents/vouchers and 77.6% were using journals as accounting records (Table, 4). Among the SMEs in the town, only 9.0% keep advanced forms of records such as chart of accounts and ledger whereas very few (6.0%) keep trial balance as a means of proofing the equality between the debit and credit entries.

Table 4: Business transactions and records held by SMEs in Wolaita Sodo, Southern Ethiopia, 2019

Variable		Number	Percent
Transactions recorded by the entity	Purchase of goods and service	65	97.0
	Sales of goods and services	61	91.0
	Decline in the value of long lived tangible assets/depreciation	7	10.4
	Payment of wages and salaries	37	55.2
Accounting records	Source documents	65	97.0
	Chart of accounts	6	9.0
	Journals	52	77.6
	Ledger	6	9.0
	Trial balance	4	6.0

Source: Field data, 2019

Source documents maintained by the SMEs

Among the SMEs using source document as a base for recording business transactions and other economic events, 92.5% were using purchase invoice to record purchases, sales invoice to record sales (83.6%), checks to record cash receipts and payments (25.4%), cost record to record cost of production (3%), contractual papers with customers and suppliers to record receivables and payables (20.9%), asset utilization plan to record depreciation (1.5%), payroll to record salary expense (52.2%) and special record forms for voucher less payments (26.9%). None of the SMEs were using the debit and credit memos to record the reconciliation adjusting entry in relation to cash in the checking account. Those SMEs which were not using any of the above source documents stated the reason as the absence of mandatory regulation (Table 5).

Among the SMEs keeping journals as the first book to record business transactions and other economic events, 42.8% were holding sales day book for recording of credit sales, purchase daybook for the recording of credit purchases (22.4%), cash book for the recording of cash transactions (23.9%) and general journal (35.8%) for other transactions (Table, 5).

Table 5: Types of vouchers/source documents and journals held by SMEs in Wolaita Sodo, Southern Ethiopia, 2019

Variable		Number	Percent
Source documents (n = 65)	Purchase invoice	62	92.5
	Sales invoice	56	83.6
	Checks to record cash receipts and payments	17	25.4
	Cost records to record cost of production	2	3.0
	Credit and debit memos	0	0.0
	Contractual papers with customers and employees	14	20.9
	Asset utilization plan to record depreciation	1	1.5
	Payroll to record salary expense	35	52.2
	special record forms for voucher less payments	18	26.9
Journals(n=52)	Sales daybook, for the recording of credit sales	28	41.8
	Purchase daybook, for the recording of credit purchases	15	22.4
	Cash book, for the recording of cash transactions	16	23.9
	General journal , for other transactions	24	35.8

Source: Field data 2019

5.4.The Preparation of Financial Statements by SMEs, Wolaita Sodo, Southern Ethiopia, 2019

Reasons for the preparation and preparers of financial statements prepared by the SMEs

Among the SMEs in the town, 94% were preparing financial statements. As it is shown on table 6, the leading reason for the preparation of financial statements by the SMEs was, for the taxing purpose because it is mandatory requirement by the tax authority. The result was consistent with Ali, Berhe and Mihret, (2014). Those SMEs which were not required to prepare statements by the regulation for the taxing purpose are businesses with annual turnover of less than birr 500,000. Hence, it is indicated that majority of the SMEs were with annual turnover of more than birr 500,000 and able to accommodate the cost of reporting if IFRS for SMEs come in to implementation.

More than three fourth of the SMEs in Wolaita Sodo town preparing financial statements lacks internal accounting staff and relay on external independent consultants for the preparation of financial statements. Among the remaining SMEs preparing financial statements, 7.5%, 4.5% and 6% were preparing with the enterprises' own accountant, owner manager of the enterprises', and in the enterprise with the cooperation of external consultants respectively. Some of the respondents pointed out that their consultants had been reluctant to show every detail about the accounting and reporting issue of their entity to themselves and they were not accountable to their activities. From this point it is understandable that, the owner managers want to have training on the basics of accounting and reporting to get better understanding on the accounting reports.

Table 6: Users of, reasons for the preparation and preparers of financial statements prepared by the SMEs in Wolaita Sodo, Southern Ethiopia, 2019

Variable		Number	Percent
Preparation of financial statements	Yes	63	94.0
	No	4	6.0
Users of financial statements (n=63)	Owner manager/s	34	50.7
	Employees	0	0.0
	Taxing authority	62	92.5
	Lenders and suppliers	16	23.9
	Others	1	1.5
Purposes of financial statements (n=63)	For making important operational and investment	33	49.3
	For support in getting loans	18	26.9
	For profit sharing	3	4.5
	For the calculation of	62	92.5

	income tax		
	Others	8	11.9
Outsourcing of preparation of financial statements (n=63)	Enterprise own accountant	5	7.5
	Owner manager of the enterprise	3	4.5
	External independent consultant	51	76.1
	In the enterprise with the cooperation of external consultants	4	6.0

Source: Field data, 2019

Types of financial statements prepared by the SMEs

As shown on table 7, the types of financial statements used for different purposes vary from SME to SME. This indicates irregularity in the preparation of financial statements. The complete set of financial statements in accordance to IFRS for SMEs include statement of financial position, profit and loss statement and comprehensive income statement, statement of cash flows, statement of changes in equity and notes to the financial statements (IASB, 2009, Par 3.17). Among these statements, the profit and loss statement was the statement prepared by the majority of SMEs in the town followed by the statement of financial position. This was due to the principal reason for the preparation of financial statements which was for the taxing purpose. According to the tax proclamation, those entities registered to VAT (entities with annual turnover above 1,000,000 birr) in Ethiopia has to prepare statement of financial position and profit and loss statement. Those entities with annual turnover in between of 500,000 to 1,000,000 birr required to prepare profit and loss statement for the taxing purpose. The finding also revealed that, absence of distinction between specific purpose and general purpose financial statements. In other words, all of the SMEs were using a particular statement for different purposes.

Table 7: Types of financial statements and the purposes to prepare financial statements by SMEs in Wolaita Sodo, Southern Ethiopia, 2019

Variables						
Financial statements and reasons	Statement of financial position/balance sheet	Profit and loss statement	Statement of cash flows	Statements of changes in equity	Notes and disclosure	Other
For making important operational	25(75.8%)	18(54.5%)	3(9.1%)	1(3.0%)	0(0.0%)	2(6.1%)

and financial decision (n=33)						
For support in getting loans (n=18)	14(77.8%)	15(83.3%)	3(16.7%)	0(0.0%)	0(0.0%)	3(16.7%)
For profit sharing (n=3)	0(0.0%)	1(33.3%)	0(0.0%)	0(0.0%)	1(33.3%)	2(66.7%)
For the calculation of income tax (n=62)	53(85.5%)	56(90.3%)	5(8.1%)	0(0.0%)	0(0.0%)	6(9.7%)
*others: Daily report for the purchase and sale for internal purpose; purchase report supported with voucher to have VAT refund						

Source: Field data, 2019

6. Conclusion and Recommendations

6.1.Conclusion

The study set out to determine the current accounting and financial reporting practice of SMEs in Wolaita Sodo, Southern Ethiopia. The study went further to evaluate the general accounting practice by SMEs in light with the underlying assumptions to accounting and to investigate the types of accounting records being kept and maintained by SMEs in the town. In addition to this, the study also aimed at describing the reasons to prepare financial statements and the types of financial statements prepared by the SMEs in the town.

The study pointed out that, majority of the SMEs in the town were not considering business entity assumption for accounting and reporting purpose (58.2%); use the single entry accounting system (76.1%) and consider the cash basis of accounting for the recognition of revenue and expenses (80.6%). The principal reason was lack of knowledge to the basics of accounting and reporting. Most of the SMEs were maintaining different forms of source documents and journals but few of them kept ledger, chart of accounts and trial balances.

Among the SMEs in the town, 94% were preparing financial statements. The leading reason for preparing financial statements by the SMEs was for the taxing purpose because they are required by the regulation. More than three-quarter of the SMEs in Wolaita Sodo town preparing financial statements lacks internal accounting staff and relay on external independent consultants. The types of statements prepared by the SMEs and the users showed great irregularity. Despite this irregularity, majority of them prepare profit and loss statement because it is a mandatory statement required by the tax authority to those SMEs with annual turnover of above 500,000 birr.

6.2.Recommendations

The recommendations coming out of this study will be useful for several parties, including regulatory bodies, entities, academics, and accounting professionals. First, for the proper enforcement of the accounting and reporting regulation in the country, there has to be nationally acceptable definition to SMEs operating in the country. Secondly, it is important for all stakeholders such as preparers, users, auditors, academics, regulators to participate in training workshops and continuous development courses. In these trainings, an appreciation of the importance of modern accounting and reporting by SMEs to different stakeholders would be created. Finally, different regulatory bodies of the country which have been worried about the growth of these businesses and the country as a whole need to give attention to the root cause for the problems faced by SMEs (constituting around 99% of the businesses in the country) particularly access to finance by developing and pursuing strong regulations for the accounting and reporting practices of SMEs in the country. By doing so, we can enhance the flow of funds in the country in an economically favorable way, employment opportunity by the sector and income of the government through increase in transparency in reporting of the economic affairs of those businesses.

Acknowledgment

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Paradigm Shift of Value Education in School, Since ancient period

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Abstract- This paper presents the paradigm shift of value education in school since ancient period. It highlights the basic structure of ancient education which contributed quality manpower imbibing moral, social and civic values to the society. It also shows the erosion of values and how values shifts from the ancient base to modern era. As a result, calls for several reforms in present situation which can be implemented from the ancient education for overall development of students as a human being. The quality of education generally influences on the quality manpower for social benefits.

Index Terms- Paradigm, Shift, Value education, Erosion, Downward of values.

I. Introduction

A paradigm shift is the fundamental change in individual's or a society's view of how thinks work in the world. Values are the principles or standards of behavior, one's judgment of what is important in life. In ethics, value denotes the degree of importance of something or action, with the aim of determining what actions are best to do or what way is best to live or to describe the significance of different actions. The value of a person or a group are the moral principles and beliefs that they think are important.

India has a glorious educational and cultural background. The development of Indian education and culture stands by the conflict. As well as Indian history, the educational and cultural history of India has also time spam of ancient, medieval and modern period. Values are the soul of Indian education and culture. It is a pity to state the fact that, even as an Indian further we must be aware and educated in values. In the past Ancient period, there was Gurukul system. Students lived with Guru and acquired value oriented education. It was situated far away from bursty urban to sylvanic rural area. What an excellent choice of area ! The basis of admission in the rural sylvanic educational Institutions were moral fitness and unimpeachable conduct. Students had to read the value based epical stories, which was the curriculum. They can easily acquired the basic idea about what is sin and had abstained from that type of work. The father and the mother only create the body but the condition derived from the instructions of the preceptor was sacred, undecaying and immortal The preceptor had regarded as father and mother and must had against sin . Both the general course of the narrative and the episodes or stories of the Ramayana and the Mahabharata introduce us to ideal students , teachers , schools and hermitages and other centre's of learning . The main features of ancient education was infusion of a spirit to piety and righteousness, formation of high character and development of personality, inculcation of civic social values, preservation-modification and transmission of culture. Living within the joint family, family values like to take care of the young and new born babies jointly, respecting the elders, to sacrifice someone's own interests for growing another one's happiness and many more such family values were continuously present to be caught and practiced. Self discipline, yoga, meditation etc were practiced for build up physical values and also emphasized for self knowledge. The importance of a calm and peaceful mind which can regenerate love, peace and world brotherhood. Dignity of labour was taught to inculcate the value that, nobody is made superior or inferior by God and all type of work which he performs is not be measurement of superiority or inferiority.

The erosion of values started right from the medieval period. The foreign attackers like Taimur Long, Mahammud Ghori, Sultan Mahammud destryed many Hindu temples and ancient literatures. The great traveler and historian Iban Batuta saved many such ancient literatures from the invaders and sent it to Bagdad, Persia and other Isslamic states to their friends. It is a great lost of Indian civilization specially in the field of moral, cultural and aesthetic values. On the other hand in the Pathan, Sultan and Mughal regime the remaining values erosed by destroy of Hindu temples, transfer of religion, non-tallerence of other religions and non-assistance of financial allotments with other benefits for the vedic type of educational institutions.

The modern era started with the hands of British. Like other expeditionary they also attacked our saints, temples, education and culture. They set up education highlighting English language by neglecting Sanskrit, Hindi, other Indian languages and our traditional culture. The Christian Missionary education is self centric and other type of erosion of values. It is the fundamental change in shift of values. Joint family system is at its decline and nuclear family concept being accepted. Single parent family and childless couple concepts are also accepted. Actually thirst for sensual pleasures we are really losing all types of values. We became self centered by avoiding the needs of older and younger generations. Educational institutions became discriminating houses. From admission to evaluations, from selections to promotions the only value we are fostering is discrimination. In the light of above mentioned facts, let's we analyze our today's education system .Where we went wrong ? What happened that started the decrease of these human values ? Compared to today's scenario, in ancient India there were less opportunities, now sins and more corruptions. In independent

India, various committees and commissions (Radhakrishan Commission, Mudaliar commission, Kothari Commission) report also suggested to revive our losing downward values.

II. CONCLUSION

In the modern age our education reaches at the highest peak , students achieve external knowledge with out acquiring values. From the analysis of events shows the present scenario of the Indian education , it's achievements and draw backs. It demands further reforms by imbibing moral , social and civic values from the ancient education .

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Identification of Hepatic Arterial System Variations Using Multi-Detector Computed Tomographic Angiography

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***Abstract*- Introduction:**Variation in hepatic arterial system (HAS) is common and has importance in preoperative planning to reduce the risk of accidental vascular injuries during surgical and radiological intervention of the liver. The aim of this study was to measure the prevalence of celiac trunk and describe different types of variations using Computed Tomographic angiography (CTA). **Materials and Method**: This is a retrospective cross sectional study. CTA images were retrieved from June till September 2017. Images were reconstructed in 3-dimensional volume reformatted (3D VR) format using workstation and reviewed for the variations of HAS. The results were calculated using IBM SPSS version 22. **Results:** A total of 117 patients were included in this study. Mean age was 58 (SD=14.4) years and male/female percentage was 66/34. Anatomical variation in the HAS was found in 35 (29.9%) cases. The most common variation found was (Michel's type V) in 9 (7.7%) cases followed by (Michel's type III) in 6 (5.1%) cases. Accurate knowledge and identification of anatomical variations in the HAS is crucial before undergoing any surgical or invasive imaging procedure. This can help surgeons and interventional radiologists to prevent accidental vascular injuries and perform a safe procedure..

Keywards- Anatomical variation, Common Hepatic Artery, Left Hepatic Artery, MDCTA, Right Hepatic Artery

I. Introduction

The accurate knowledge about HAS variation is extremely important in any surgical procedures of upper abdomen such as hepato-biliary, pancreatic surgery, as well as in interventional radiological procedures [1-3]. In particular, in the liver transplantation procedure, it is crucial to have accurate knowledge of the arterial anatomy of the liver to plan the best resection approach and to minimize the risk of accidental vascular injuries [4, 5]. Similarly, when treating isolated liver tumors or performing partial hepatectomy, an accurate depiction of hepatic arterial variants is helpful to make a safe surgical procedure [5, 6].

The liver has a variant blood supply. Saba et al has quoted Nelson et al report that in 25-75% of cases, the liver receives its arterial supply from branches of the celiac trunk (CT). In case of anatomical variation, the liver receives arterial supply via branches from superior mesenteric artery (SMA), left gastric artery (LGA) or directly from the abdominal aorta. These vessels may be totally replaced (representing the primary arterial blood supply to the liver) or accessory (occurring in addition to the normal arterial supply) [6].

During literature review many authors described several types of variations in order to introduce a single classification of the most common variations [7-9]. Michel described an internationally recognized classification in 1966. He carried out classic autopsy series of 200 cadaveric dissections, and defined the basic anatomical variations in HAS [9]. Recent advancement in imaging gives new clinical importance to the previous classical anatomic studies.

Multi-detector computed tomography angiography (CTA) is a non-invasive assessment of normal and variant hepatic arteries which provides high quality 3D reconstructed images [1, 6].

II. Material and Methodes

A retrospective cross-sectional study was approved by the ethics committee. A total of 117 patients who underwent CTA (abdomen) for any reason including those who underwent computed tomography arterial phase performed for liver and renal protocol in HTAA, from June till September 2017 were included in the study.

The images were obtained using a 256-slice Siemens CT SOMATOM Definition Flash (Siemens, Erlangen Germany). Contrast used is non-ionic contrast, Iopamidol 300mgI/ml with total volume of 120ml. A dual head injector was used for the administration of contrast material, which allows the simultaneous injection of a compact iodine bolus followed by a normal saline bolus, both of them at the same injection rate of 4.5-5.0 ml/s.

The images were retrieved from Picture Archiving and Communication System (PACS), and transferred to Syngo via workstation for image reviewing. A multi-plane reconstruction (MPR) in the three spatial planes and three-dimensional reconstructions (3D) using maximum intensity projection (MIP) and volume rendering technique (VRT) was performed.

The origin of common hepatic artery (CHA), gastro-duodenal artery (GDA), right hepatic artery (RHA) and left hepatic artery (LHA) were identified and recorded for statistical analysis. Anatomical variations of the HAS were described according to Michal's classification as shown in Table 1 [9].

The prevalence of normal and variant anatomy of the HAS was measured by calculation of frequencies and percentages using Chi-square test in IBM SPSS statistics version 22. The level of significance lower than 5% ($P<0.05$) was considered statistically significant.

Ethical approvals for this study was obtained from International Islamic University of Malaysia (IIUM) Research Ethical Committee (IREC) and was registered National Medical Research Registration prior to conduct the study.

Table 1. Michel's classification of the HAS

Type = Michel's classification	Description according to Michel's classification
I.	Normal anatomy
II.	r-LHA from LGA
III.	r-RHA from SMA
IV.	r-LHA from LGA+ r-RHA from SMA
V.	a-LHA from LGA
VI.	a-RHA from SMA
VII.	a-LHA from LGA+ a-RHA from SMA
VIII.	a-LHA from LGA+ r-RHA from SMA
IX.	CHA from SMA
X.	CHA from LGA
Un classified	CHA from aorta

(r-LHA = replaced left hepatic artery, LGA = left gastric artery, r-RHA = replaced right hepatic artery, SMA = superior mesenteric artery, a-LHA = accessory left hepatic artery, a-RHA = accessory right hepatic artery, CHA = common hepatic artery)

III. Results and Findings

There were 117 patients included in this study, where 77 (65.8%) were males and 40 (34.2%) were females. The mean (SD) age was 58 (14.4) years, the minimum age was 24 years and the maximum age was 82 years.

The prevalence of normal HAS variation (Michel's type *I*), where the CHA originated from the CT which then divided into GDA and proper hepatic artery (PHA), the latter then subdividing into RHA and LHA, was the most common variation in our study. It was found in 82 (70.1%) cases. On the other hands, the variations in HAS was found in 35 (29.9%) cases as shown in Table 2. The most common variation in our study was accessory LHA (Michel's type *V*) in 9 (7.7%) cases followed by replaced RHA (Michel's type *III*) in 6 (5.1%) cases as shown in Table 2 and Figure 1.

Table 2 CHA Variation According Michal Classification

Type of variations	Number of cases	Percentage	Cumulative Percentage
Normal pattern	82	70.1	70.1
r-LHA	5	4.3	74.4
r-RHA	6	5.1	79.5
r-LHA + r-RHA	5	4.3	83.8
a-LHA	9	7.7	91.5
a-RHA	4	3.4	94.9
a-LHA + a-RHA	2	1.7	96.6
CHA originates from SMA	4	3.4	100.0
Total	117	100.0	

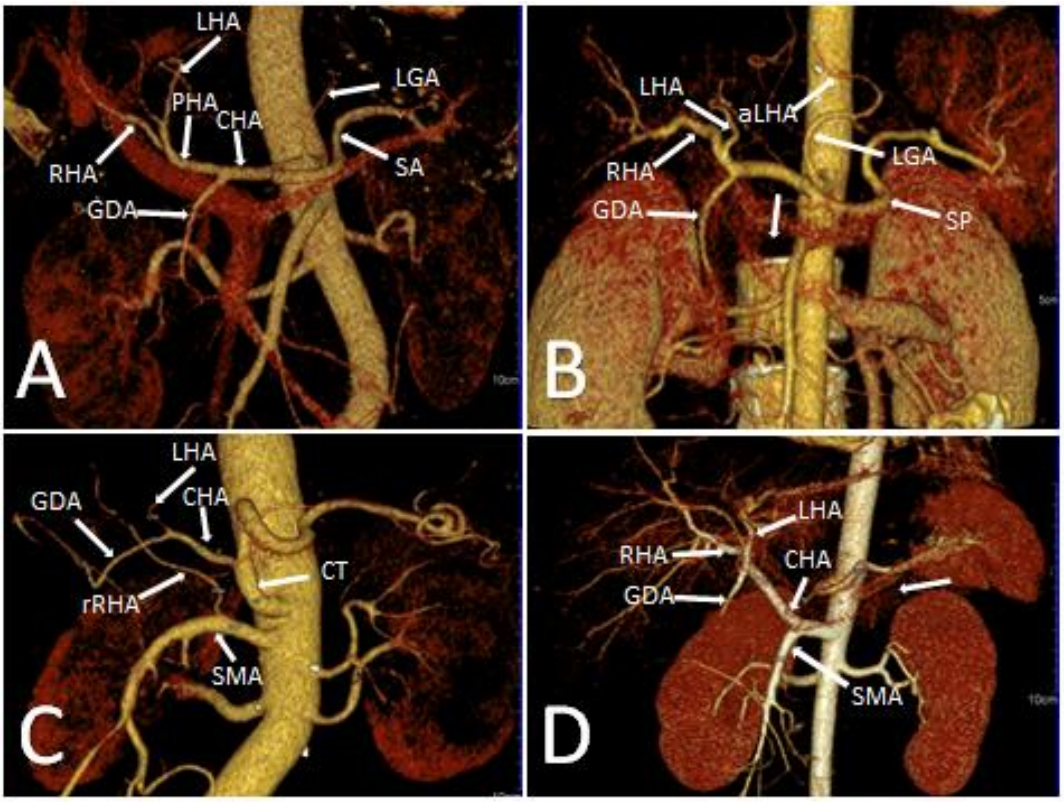

Figure1: A 3D- reformatted images. (A) Normal pattern of HAS (Michel's type *I*), CHA arises from the CT and giving off the GDA and then divides into RHA and LHA, with variant CT as celiac-colic trunk. (B) Variant HAS (Michel's type *V*), accessory LHA originates from LG. (C) Variant HAS (Michel's type *III*), replaced RHA originates from SMA. Note left side double renal arteries. (D) Variant HAS as hepato-mesenteric trunk (Michel's type *IX*) with variant CT as gastro-splenic trunk

A significant difference was observed in the point of origin of CHA as well as RHA and LHA. It was found that CHA was originated in 113 (96.6%) cases from the CT and in the remaining 4 (3.4%) from the SMA. In addition, in the majority of cases, the RHA originated from proper hepatic artery in 94 (80.3%) of cases, while from the CHA was observed in 10 (8.5%), and its origin from the SMA was present in 11 (9.4%) cases and only in two cases (1.7%) it was originating from the CT.
Moreover, LHA was originated from the PHA in 92 (78.6%) cases, while its origin from the CHA was observed in 15 (12.8%) and the remaining 10 (8.5%) cases depicted its origin from the LGA.

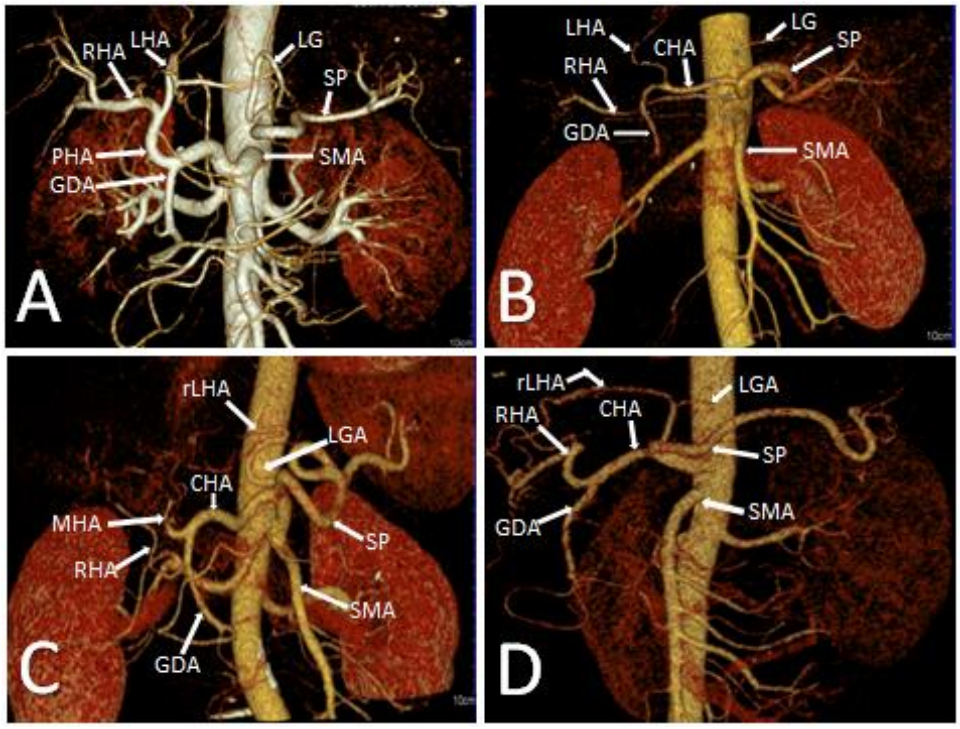

Figure 2: A 3D- reformatted images. (A) Variant HAS (Michel's type *IX*); CHA originates from SMA as hepato-mesenteric trunk with coexistence of gastro-splenic trunk and celiac-colic trunk. (B) RHA has replaced origin directly from the CT along with other three branches: CHA, LGA, SP. (C) Variant HAS (Michel's type *II*); the replaced LHA originates form LGA, where right and middle hepatic arteries arising from CHA. CT and SMA have a common point of origin from aorta as Celiac-mesenteric trunk. (D) Variant HAS (Michel's type *II*); the replaced LHA originates form LGA.

IV. Discussion

The mean age in our study was 58 years which shows similar results in other studies. It is because most people suffer from hypertension, aortic aneurysms, chronic liver diseases, renal problems in this age and refer to health centres and seek treatment [6].

Michel described anatomical variation of HAS in ten different types [9]. In this article we described our finding based on Michel's classification. Michel's type *I* was the most common type of HAS with 82 (70.1%) cases.

The prevalence of classical description where the liver takes its entire blood supply from right and left branches from the celiac hepatic artery reported by other authors ranging 25-75% [3, 6], The prevalence of anatomical variations in the HAS found in this study was found in 35 (29.9%) cases which is consistent with the results reported in other studies ranging 16-48%. Arifuzzaman et al reported 30.9% variations in HAS where the replaced RHA and LHA (Michel's type *IV*) was the most common variation [4]. Moreover, other studies done by Osman et al, Saba et al and Ugurel et al show almost the same results with 26.7%, 38.73% and 48% variations respectively [2, 6, 10].

The most common variation in our study was accessory LHA arising from LGA (Michel's type *V*) which was counted for 9 (7.7%) cases followed by the replaced RHA from SMA (Michel's type *III*) counted 6 (5.1%) of case and the least common variation was accessory RHA and LHA (Michel's type *VII*) in 2 (1.7%) cases. Prabhasavat et al reported 16% of all variations and Michel's type *III* was observed in 6% as the most common variation [11].

In our study we found that CHA originate from coeliac trunk in 113 (96.6%) cases. Song et al and Chen et al reported almost the exact percentage in their study of 5002 and 974 cases respectively. They found that CHA ~~was~~ originated from the SMA in 3.4% and 1.5% of cases respectively [5, 12]. However, the prevalence of this variation is rare and reported ranging 0.5% - 4.5% in other studies [3], Zagyapan et al reported 6.6% of this variation [13].

In addition, it was found that RHA originat directly from the CT apart from the three main branches in two (1.7%) cases. In 11 (9.4%) cases it was arising from the SMA. A similar result was reported by Olewnik et al and Kamath et al. They reported the origin of RHA form CT in three (7.5%) cases and four (10%) cases [3, 14]. Zagyapan et al reported the origin of RHA from SMA 17.8% [13]. Moreover, in our study it was found that LHA arise from LGA in 10 (8.5%) cases. Zagyapan et al reported this variation in 13.1% of cases [13].

One possible reason of this higher prevalence of the variation seen could be due to a relatively small number of studied populations compared to other studies. In addition, the sensitivity of the MDCTA is higher than cadaveric dissection, where small branches such as inferior phrenic arteries (IPAs) are difficult to preserve during dissection. this is the first reported study in a

single institution at Kuantan population and previous reports of different prevalence had been documented among different countries [15].

V. CONCLUSION

Anatomical variations in hepatic arterial system can be found in three out of 10 patients based on this study from a single institution in Kuantan. Accurate knowledge about these variations is important and can help surgeons and interventional radiologists to prevent iatrogenic vascular injuries and perform safe procedure.

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Business Intelligence Techniques and Organizational Performance of Selected Commercial Banks in South Rift Counties in Kenya

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Abstract- The major role of Business Intelligence (BI) Techniques in an enterprise is data resource utilization. Banks could create more value by leveraging on the data they have. However, greater portion of contemporary banks confront difficulties such as data underestimation, fragmented financial systems, small banks serving niche markets and are not contributing to competition in the sector, limited Outreach program of financial systems, fraud detection, mismanagement and even loss of business among others have remain glaring in the sector. Business data and data analysis process have necessitated the need for precise choices to be made and adoption of new tasks that enhances business performance. The study sought to determine the effects of BI analytical techniques on organizational performance in banking sector where descriptive research design. The study was carried out in selected commercial banks in Bomet, Kericho and Narok counties. The target population of the study was 820 where 246 employees were sampled through random sampling technique to complete the questionnaires which was the primary source of data. The study established that; banks need to use data mining tools for extracting information in a database; data visualization enabled easy comparison of the performance of bank.

Index Terms- intelligence, business intelligence, technique, system, organizational performance, analytical technique,

I. Introduction

Principle role of Business Intelligence is to utilize data resources in terms of information and analyses of business within the setting of key business practices that necessitate specific choices and actions that brings about improved performance, Williams, (2006). BI techniques has the ability to boost utilization of data by exhibiting it in standard forms, coordinating and keeping it in a data warehouse making it open for extraction of valuable and shrouded data, along these lines expanding the precision of decision making and creating an upper hand that can likewise be called "competing on analytics" (Davenport, 2005). Contemporary banks in Serbia confront difficulties, for example, fierce rivalry, a high market dynamics, the need of strict control; fluctuating customer requests and risk administration are just a portion of the highlights of the business circumstances where present day banks conduct their activities.

Fundamental tasks of Business Intelligence Systems are integration, exploration, grouping, aggregation and a multidimensional examination of information beginning from different data assets, Olexová, (2014). To carry out these assignments, Business Intelligence frameworks utilize specific products, innovations and procedures that depend on a specific data framework foundation including methods, for instance, data warehouse and Enterprise Resource Planning (ERP) frameworks. A business intelligence technique captures the data gathered by a company, stores and transforms them into significant information that managers use in their everyday functions. It is helpful in depiction of data and provides a form of reality in open an open reports and analysis, so that better and convenient business choices can be taken in all operational, strategic and vital levels.

Some companies measure performance in view of how effective the company uses its assets to create benefit Mutuku, (2013). Further to that use of assets is likewise in view of the system picked by the association. The banking sector in Kenya is monitored by the Central Bank of Kenya (CBK) presently constituted under Article 231 of the constitution 2010. The CBK has the obligation of framing monetary policy, upholding price stability, issuing currencies and different capacities as expressed by a demonstration of parliament. Beck and Fuchs (2004) expressed that regionally, Kenyan financial framework is generally all around created and broadened, a laud it appreciates right up 'til the present time, and that it appreciates larger amounts of credit channeled to the private segment and higher deposits in money related establishments when contrasted with other sub-Saharan nations. Beck, (2010) expressed that the Kenyan financial system is the biggest and mostly developed in Eastern parts of Africa and that its steadiness has multiplied in the recent time.

Nevertheless, many challenges endure, the banking system is still fragmented, small banks serving niche markets and now not contributing to competition in the area and outreach of the financial apparatus nevertheless confined. The Kenyan financial outlook has of late witnessed the progress like M-PESA and mobile cash by and large, seen as being corresponding to the arrangement of financial facilities offered by extensive financial organizations, Allen, (2013). Indiatsy (2014) inferred that there has been developing rivalry from worldwide and also local banks and would require basic investigation of the focused powers in the business. This rivalry is ascribed to an expansion in take-up of client record of loan repayment and endorsements to begin agency banking and entrance of global banks into the Kenyan market.

1.1 Statement of the problem

The major role of Business Intelligence Techniques in an enterprise is data resource utilization. Business data and data analysis process have necessitated the need for precise choices to be made and adoption of new tasks that enhances business performance. Empirical studies reveals that, numerous enterprises have put up critical investments on innovations that helps business processes and fortify productivity in operational structure. Banks could create more value by leveraging on the data they have. However, greater portion of contemporary banks confront difficulties such as data underestimation, fragmented financial systems, small banks serving niche markets and are not contributing to competition in the sector, limited Outreach program of financial systems, fraud detection, mismanagement and even loss of business among others have remained glaring in the sector. Therefore, this study sought to determine the effect of Business Intelligence analytical techniques on organizational performance in banking sector in South Rift Counties in Kenya

II. Business analysis techniques and organizational performance

As indicated by Sharma (2010) BA is the collection, storing, statistical examination and apprehension of a lot of organizational information with the point of settling on better decisions and enhancing organizational performance and increasing competitive edge. BI has been used as an umbrella term to portray ideas and techniques to help enhanced basic leadership by utilizing factual based supportive systems, while business intelligence and Analysis (BIA), in 1989, has made progress in IT and scholars in the recent past and it alludes to the technologies, frameworks, practices and applications that analyses business information that the firm better comprehends its business, as proposed by Lim (2012).

As the BI idea wound up famous in the 1990s, BA was acquainted to mirror the analytical segment in BI. Chen , (2012) offering ascend to the adoption of the term BI.BI could be seen as a framework that recognizes difficulties and openings in information utilizing analytical techniques with a standout among the most widely recognized utilization of BA being planning and forecasting (Xia & Gong, 2014).Information to be analyzed has been incorporated into one database or data warehouse from various operational databases, where analysis is effected utilizing procedures, for example, data mining, visualization, online analytical processing (OLAP), statistical examination and prescient models. Information from different diverse sources is coordinated into a comprehensible body for upgraded strategic planning and decision support, conveyed at the ideal time, right area and in the correct form, bringing about enhanced decisions (Tan, 2011).

A number of researchers have recorded uses of business analytics that can add to organizational performance, for example, in promotions that can diminish client wearing down and enhance client benefit, enhance value of internet business, additionally production and manufacturing, sales and forecast, production designs, in finance, human asset and innovative work as observed by Sharma (2010).Organizational benefit and performance is at the center of firms and BA guarantees this, as Ranjan (2008) recommended that the desire for actualizing more brilliant business forms is the place where business intelligence impacts the execution of firms. All organizations want to pick up advantage over their rivals and are set up to embrace BA if seen to offer the preferred standpoint they require. Furthermore changes in ICT has driven information examination technologies to utilize parallel figuring ways to deal with impediments of existing database frameworks to enhance through input, as indicated by Tambe (2014), and that the expansion in rate and size of data accumulation has raised the value of development in information handling innovations.

Business analytics is seen by Xia and Gong (2012) as having advantages, for example, encouraging quicker and more precise reporting, and enhanced decision making, enhanced client services and expanded income. As per studies embraced by Ranjan (2008), Business analysis device is said to give basic understanding in empowering organizations to settle on the right and auspicious choices and encourages the investigation of different parts of business tasks to raise new income or save money on costs by expanding rate of return and supporting information decisions. Research studies have portrayed various utilization of business analysis techniques procedures and how they could enhance execution and upper hand. Nonetheless, an obviously explained theoretical grounded model of the components and procedures essential in ascertaining performance picks up from business analytics has been subtle as seen by Sharma (2010). Knowledge of the elements and prerequisites important for business analysis applications could empower organizations exploit the new facts and apply it to their vital strategic decisions making, along these lines responding faster to factors confronting the said business.

Sharma (2010) watched that past studies on business analytics had speculations on how it may add to upper hand nevertheless; a clear theoretical based model of the components associated with realizing the potential performance benefits is yet to be presented. Njuguna (2013) in his study uncovered that execution of business knowledge dashboard by Kenya Power has effectively enhanced their decision making process. Notwithstanding, Otieno (2010) in his examination discovered that difficulties looked by banks in adoption of utilization of ICT included resistance to change, security dangers, high introductory costs, cost of maintaining ICT improvements, fraud, expenses on software, high expenses of training staff, changing to new financial systems and so on. These difficulties would then definitely influence the usage of BA in the commercial banks.

Mbaluka, (2013) in his studies revealed that Kenyan banking sector is starting to put out plans on where enormous data could convey the most value however, numerous financial firms are careful about making these investments in a move towards business analysis. As firms go to the acknowledgment of the possibility of better decision making and expanded client esteem, they are progressively embracing business systems in their tasks which enables business officials' proactive capacities to foresee, estimate, evade, do correction and control circumstances in their organizations (Business Week Research Services, 2009). The contributions of business analytics to an enterprise performance isn't completely appreciated as it is quite new idea in Kenya, suggesting an absence of appropriate comprehension of its tasks and the principle objective of its application.

A noteworthy objective of BA is to automate and incorporate however many advances and capacities as would be prudent and besides to give information for analysis that are as instrument autonomous as could be allowed. This sets the phase for use of business analysis methods in banking sector in south rift locale to access data that could be utilized to improve decisions and in an opportune way. This is relied upon to enhance the execution of the organization in the levels of operations that is corporate, business and functional levels, and furthermore to enhance its upper hand.

BA is an expansive scope of scientific systems and software answers for gathering, combining, examining and giving access to data for endeavors that they may settle on better informed choices (Ranjan 2008). Investigation has certainly discovered advances into organizations, for example, banks, media transmission organizations, retail outlets. More so marketing offices where there is a powerful urge to reach the correct individuals at the right place and at the ideal time with the correct offers. All marketing promotions analysis has dug in itself solidly in helping organizations to understand more about their clients, areas of opportunities, building brand dependability and averting wearing down.

Mbaluka (2013) discovered five key business zones that present generally safe open doors for quantifiable execution of utilizing enormous information which were; target marketing, customer service, intelligent forecasting, client profiling, customer detection and fraud identification. Furthermore, Trkman (2010) implied that BA has been distinguished as a critical instrument in production network administration. Likewise they propelled regions of use of BA in organizations; they separated them into inward and outside components. Outside elements depended on Porter's five forces that is competitors, suppliers, customers and substitute products. The interior elements were procedures and activities, HR administration topped with help from top management. Decision path consulting (2010) discovered three major territories of tasks that BA is applied but with difficulties, these are in finance, sales and marketing and in operations. Njuguna (2013) uncovered that execution of business knowledge dashboard by Kenya Power, have effectively enhanced their decision making process. Factor for organizations is finding ways of integrating the vast amounts of data generated from business processes and making sense of them.

Further with the development of company intranets, extranets and the internet has created a favorable environment for rapid development of internet banking to take root in developing countries according to Nazir (2011). Made by clients, for example, transaction types, recurrence, funds utilization and so forth. This offers Internet bank can improve the institutions key activities while empowering clients, they state further. E-banking offers methods for banks to gather information from the transactions, an open door for the banks to complete examination on the information and generate products that supplement client propensities. A noteworthy driver for BI as per Ranjan (2008) is that organizations as of now have frameworks that gather information however, wind up in circumstances without any strategies to put this information and data to use for key decision making. Operational activities caught by banks over a period of time have a tendency to be immense.

These organizations are then faced with the possibility that they could utilize these huge measures of information to use their upper hand and this has been made progressively conceivable by the quick advancement in computer development and related advances. Accessibility of substantial incorporated databases and advancement of intense strategies of visualization and information examination has produced enthusiasm for business analysis for development of decision making, thus better organizational performance and improved competitive advantage (Sharma, 2010).Extra progressions in ICTs have extraordinarily affected their application and thus how organizations work together.

Late upgrades in business analytics including new advances in technology, system integration and User Interface configuration have been driven by business values, and to expand this analytics are progressively getting installed into bigger systems, accordingly, information accumulation, storage and processing together with different issues particular to analytics are progressively considered into general systems plan (Kohavi, 2002). Making reference to the Strategy Alignment Model (SAM) of Henderson and Venkatraman (1989) Masa'deh (2008) induced that IT-business arrangement is achievable by building linkages among four key areas, that is business strategy, IT technique, organizational foundation and procedures and IT framework and procedures.

III. Findings on Effectiveness of Business Intelligence Analysis Techniques on Organizational Performance

Respondents were asked to indicate the level of their agreement on effects of business intelligence techniques used in their organization on the performance of the bank. The results are as per table 4.6 where 5 is Strongly Agree, 4- Agree, 3 Undecided, 2 Disagree and 1 is Strongly Disagree.

Table 1 Business Intelligence Analysis Techniques and Organizational Performance

BI Analysis Techniques	1	2	3	4	5
Data warehouse techniques affects performance in our organization	38 (16.3%)	62 (26.6%)	4 (1.7%)	58 (24.9%)	71 (30.5%)
Data mining is used to improve performance in our organization	38 (16.3%)	58 (24.9%)	4 (1.7%)	62 (26.6%)	71 (30.5%)
Data visualization enables the presentation of information in our organisation	68 (29.2%)	38 (16.3%)	6 (2.6%)	44 (18.9%)	77 (33.4%)
Online Analytical processing (OLAP) facilitates the analysis of information online in our organisation	54 (23.2%)	40 (17.2%)	4 (1.7%)	57 (24.5%)	78 (34.5%)

Statistical examination is a tool used to enhance data analysis in our organization.	49 (21.0%)	60 (25.5%)	15 (6.4%)	38 (16.3%)	71 (30.5%)
Prescient models aids the analysis of information in our organisation	53 (22.7%)	53 (22.7%)	6 (2.6%)	56 (24.0%)	65 (27.9%)
Dash boards effects the analysis of information positively in our organisation.	74 (31.8%)	36 (15.5%)	4 (1.7%)	75 (32.2%)	44 (18.9%)

Source: Research Data (2019)

The first objective was to determine the effects of BI analytical techniques on organization performance in banking sector. Majority of the respondents who were129 (55.4%) agreed that data warehouse is a business intelligence technique which is a focal store of data that can be examined so as to settle on better decision thus affect performance of an organization. This are in agreement with Sharma (2010) who noted that business intelligence is the collection, storing, statistical examination and apprehension of a lot of organizational information with the point of settling on better decisions and enhancing organizational performance and increasing competitive edge. Data mining which entails extracting information in a database was an effective business intelligence technique used by banks to improve their performance since majority of respondents who were 133 (57.1%) agreed to it. Data visualization by use of graphs, charts and tables to display summarized information enable easy comparison of the performance of bank had been adopted by majority of the banks according to the majority of the respondents who were 121 (52.3%). Online analytical processing technique which is an automatic online analysis of data was used by majority of the banks as revealed by majority of the respondents who were 135 (59%). Statistical examination for making quantitative decisions about a process or process was used by most of the bank since majority of the respondents who were 135 (59%). Prescient model gave knowledge of events before they take place was used by majority of the banks as revealed by the majority of the respondents who were 121 (51.9%). Dash board used for progress report was embraced by majority of the banks since majority of the respondents who were 119 (51.1%). This concurs with Tan (2011) who said that information to be analyzed has been incorporated into one database or data warehouse from various operational databases, where analysis is effected utilizing procedures, for example, data mining, visualization, online analytical processing (OLAP), statistical examination and prescient models. It also agrees with Njuguna (2013) who uncovered that execution of business knowledge dashboard effectively enhanced decision making process.

IV. Conclusion

Data warehouse is business intelligence techniques which is a focal store of data that can be examined so as to settle on better decision thus assist in decision making by the executives hence banks need to embrace it. Data mining entails extracting information in a database and is an effective business intelligence technique which banks need to use. Data visualization by use of graphs, charts and tables to display summarized information enables easy comparison of the performance of bank. Online analytical processing technique which is an automatic online analysis of data need to be adopted and be used by banks for them to be able to improve on their performance Statistical examination for making quantitative decisions about a process or process ought to be used by banks so do prescient model used to give knowledge of events before they take place as well as dash board for progress report.

V. Recommendations

The study recommends that the banks need to effectively use BI systems since it brings better organizational performance through use of business analysis techniques, business measuring techniques, business knowledge discovery techniques and reporting techniques. Awareness about the capabilities of BI is quite low among these Commercial banks hence banks need to be sensitized on the benefits of using business intelligence since knowledge management is one of the most important key factors of competition and productivity growth and in today's competing business environment, companies should consider the competitive advantages of BI tools that provide much more advanced analysis options for organizational data. On the other hand, organizations should overcome the technical and organizational challenges of implementing BI in order to achieve an efficient utilization of it since BI improves the business performance and improves the overall performance of the organization. More specifically, banks that are equipped with BI have higher association between their operations and business performance and that banks that collect and analyze data using BI outperform those who do not.

Further study can be done by replicating the research objectives with longitudinal data so as to unfold the causal relationship among variables over a longer period of time. Future research can replicate the present study on organizations that are using customized BI techniques developed in-house with those which use over the counter BI Software's.

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Partner Discussion and Adolescent Smoking Behaviors in Indonesia: IDHS 2012

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Abstract- The adolescent knowledge and perception on such risk behaviors might be shape by whom the health related information has been discussed. Smoking has negative impact for the future adolescent life. This research aims to assess to what extent discussion partner influence on adolescent smoking behavior. Data used in this research is Indonesia Demographic and Health Survey 2012, Adolescent Reproductive Health component. The population of the research is unmarried young men and women aged between 15-24 years old. The result shows that a discussion partner is proven to have association with smoking behavior. Adolescent who discuss with friends will increase smoking behavior. Adolescent who discuss with fathers have potentially higher risk to smoking than the other one. The quality of discussion partner and information values need to become consideration to help protect adolescent from negative behaviors. This research shows that mothers need to involved in the effort to overcome risky behaviors.

Index Terms- adolescent, discussion partner, smoking.

I. Introduction

Adoslecents are a phase where individuals continue to grow into maturity and have full of curiosity to try new things that tend to lead to risky behavior. The results of the 2010 Population Census show that Indonesia's population is 237.6 million and 26.67% of them are adolescents, which of can affect social, economic, and national development aspects[1]. Seeing the large number of adolescents, it needs to get serious attention because they are vulnerable to expose behavior that impacts on their health.

Health problems that occur in adolescents are associated with risky behavior such as smoking, drinking alcohol, drug abuse, and having premarital sex. Smoking has negative impact for the future adolescent life. According to the Basic Health Research data[2], the number of Indonesians who smoked in 2007 was 34.2%, in 2010 it was 34.7% and continued to increase until 2013 to 36.3%. The Global Youth Tobacco Survey (GYTS) states the number of Indonesian adolescent smokers in 2009 was 20.3%[3].The younger a adolescent smokes, the more likely to become a heavy smoker in his adult life and of course the impact of smoking will be even greater.

Risk behavior is influenced by several factors. Various studies have suggested factors that influence risk behavior in adolescents. Green and Kreuter's theory[4] stated that behavior is influenced by predisposing factors, enabling factors, and reinforcing factors. One of the reinforcing factors that has a strong relationship with risky behavior is their communication with whom they discuss. Sources of information that are easily accessible to adolescents are chosen to satisfy their curiosity about reproductive issues.

Based on IDHS data 2012[5], there are various partner discussion that are preferred by adolescents including mothers, fathers, friends, teachers, siblings, health officer, and religious leaders. The information delivered by partner discussion certainly affects the attitude in the adolescent's behavior. This research aims to assess to what extent discussion partner influence on adolescent smoking behavior.

II. Research Methodology

The sampling method used in the 2012 IDHS is a three-stage sampling method. The first stage is carried out by selecting the Primary Sampling Unit (PSU) from the PSU sample framework established for the purposes of various surveys with a household approach in a probability proportional to size (PPS) method. PSU is a group of adjacent census blocks that become the coordinator's task area in the 2010 Population Census team. The second step is to choose a PPS census block at each PSU selected in the first stage. The third step is to choose 25 ordinary households in each census block systematically.

The data used in this study were all adolescents aged 15-24 years unmarried at 19,882 respondents. A total of 8,902 female respondents and 10,980 male respondents were successfully interviewed with response rates of 94 percent and 89 percent, respectively.

Partner discussion is chosen as independent variables based on a spontaneous question with multiple response types. Respondents make it possible to choose more than one answer choice. Measurement of the dependent variable was obtained from all adolescents who answered ever had smoked. There are no variables that describe how often and in depth the patterns of discussion of adolescents with the partner discussion, how is the knowledge, how to deliver information and what type of

information delivered. Logistic regression is used to measure the association of partner discussion and smoking behavior.

III. RESULTS AND DISCUSSION

Smoking is a risk behavior that is most often found among adolescents. The incidence of smoking in male adolescents are very high. At the level of education, adolescents with higher education are more likely not to smoke. male adolescents tend to live freely and find it easier to leave the house for fun compared to women, whereas women are usually more likely to be watched by parents or older siblings[6]. In general, the higher the economic status, the lower the proportion of smoking behavior. Santrock in Barus (2013) explained that juvenile delinquency is more common in lower socioeconomic groups. The hard demands of life make adolescents aggressive.

Table 1.Socio-demographic characteristics of adolescents smoking behavior in Indonesia, 2012

Socio-demographic	Smoking	
	N	(%)
Sex		
- Female	8,902	10.5
- Male	10,980	70.9
Education		
- Completed junior high school	6,704	54.8
- Senior high school	13,032	47.1
Residential		
- Urban	11,241	48.8
- Rural	8,641	51.6
Socio-economy		
- Poorest	3,970	53.5
- Poor	4,024	53.6
- Middle	4,049	51.3
- Rich	3,731	49.7
- Richest	4,108	43.9
Media exposure		
- Good	6,754	50.0
- Lack	12,680	49.3

There are various sources of adolescent information relating to the role of the family (mother, father, sibling), the role of the school namely the teacher and the role of the community (peers, health workers and religious leaders). Partner discussion has an important role as a source of reproductive health information and matters relating to adolescent behavior[7].

Adolescent female discuss more with mothers than male. Naturally there is a close relationship that occurs between mother and daughter, while boys lack emotional ties with their mothers[8]. Father became a figure who is very rarely invited to discuss both for male and female. Busyness and the role of the father as head of the family and family income seekers make the presence of the father figure rarely seen in the midst of the family.

From various choices of partner discussion, it is seen that more than half of adolescents choose friends. Peers are explained as a group that is closely related to the exchange of information and ideas in groups[9]. Friendship between peers can have good or bad effects depending on the quality of the group. Nearly half the adolescents make the teacher as the opponent of the discussion. The teacher is interpreted as second parents because students have a lot of time interacting with the teacher[10]. Teachers play an important role as health promoters in schools. The teacher's attitude has a positive or negative influence on his students depending on what they convey. No wonder, indeed, most adolescents prefer to look for partner discussions from their peers and teachers at school. The role of siblings did not show such a large number. The same thing can also be seen in the minimal role of health workers and religious leaders.

Table 2. Partner discussion of adolescents in Indonesia, 2012

Partner discussion	Female	Male	Total
Mother	44.0	9.9	24.9
Father	4.6	8.2	6.7
Friends	60.2	58.6	59.4
Relative	26.1	11.7	18.1
Teachers	43.2	38.7	40.9
Health workers	16.0	17.0	16.8
Religious leaders	5.1	11.1	8.6

Several studies have proven there is a link between one risky behavior to another risky behavior. Adolescents who have committed one of the risky behaviors will have the opportunity to try a variety of other behaviors. Adolescent smokers have a 5.4 times greater risk for consuming alcohol compared to adolescents who did not smoke. Adolescents with experience using cigarettes tend to try other risk behaviors including alcohol consumption.[11] The Global Youth Tobacco Survey examined adolescents aged 13-15 years and found that teenage smokers were twice as likely to consume alcohol.

Table 3. Smoking and other risky behavior in Indonesia, 2012

Smoking and other risky behavior	OR	95% CI	
Sexual intercourse	2.1	1.4	3.2
Drug use	1.2	0.9	1.6
Alcohol drinking	5.4	4.4	6.5

Partner discussion have an influence on the incidence of risk behavior. Overall, adolescents who discuss with friends have a greater risk for risky behavior than adolescents who do not discuss with friends. Peers is one of the external factors that can influence adolescent health behavior[12]. Being accepted by a peer group becomes more important than being accepted by someone else.

Conversely, adolescents who discuss with mothers have self-protection against risky behavior. This study is in line with the study of Lestary[13] which states that adolescents who did not communicate well with their parents have a 3.6 times greater chance to behave riskfully than adolescents who communicate well. Specifically, adolescents who have good communication

with their mothers are reported to have good health quality, have a less desire to smoke, a low frequency of drinking alcohol, and a low desire to have sex before marriage[14].

Adolescents who discuss with friends have a greater risk for smoking. That peer groups are associated with adolescents' decisions to smoke[15]. In addition, the effect was also seen in adolescents discussing with fathers. Adolescents who discuss with fathers have a 1.2 times greater risk for smoking. The family in this case the father used as role models as preparation for the process of maturity. Fathers who have the habit of smoking can be used as examples of their children to do the same behavior. Conversely, the figure of mother, siblings, family and teacher becomes a protection against smoking behavior.

Table 4. Risk of Smoking Based on Partner Discussion

Partner discussion	Smoking		
	OR	95% CI	
Friends	1.4	1.2	1.6
Mother	0.1	0.1	0.2
Father	1.2	1.1	1.5
Relative	0.7	0.6	0.8
Teacher	0.7	0.6	0.8
Health provider	0.9	0.7	1.1
Religious leader	1.1	0.8	1.5

*controlled by socio-demographic factor

IV. CONCLUSION

Peers play an important role in the influence of adolescent behavior. The social system that is formed creates pressure that regulates all styles, attitudes, behaviors in the group. The negative group will control adolescents towards the negative effect. On the other hand, peer groups are specially controlled and formed which contain a leader as a promoter towards positive behavior that will help lead adolescents to positive behavior. Adolescents need to be equipped with life skills so that they can increase their confidence to reject negative invitations from their friends and be able to choose positive activities to avoid associations that bring closer behavior. Bronfenbrenner's theory (1979) concludes that a person's behavior depends on the environment closest to the individual. Messages delivered to individuals can be received or not accepted depending on the environment that is most influential.

The results of this study can provide information and knowledge about the role of opponents in discussions with the incidence of risk behavior in adolescents. The quality of the opponents of the discussion needs to be taken into consideration because it really determines the information given to adolescents. The findings show there is a relationship between friends as partner discussions on the occurrence of risky behavior. While mothers have a positive role to protect adolescents from negative behavior. The values of discussion are important to be considered to improve the quality of information between adolescents and their parents. This research is expected to be the basis of further research by adding other variables. This will enrich the results of research and deepen knowledge about adolescent risk behaviors.

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Demographic and Socioeconomic Characteristics of Fish Farmers and their Effects on Fish Farming Management Practices in Kakamega County, Kenya

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Abstract- Fish farming in Kakamega County, Kenya faces the challenges of underinvestment and poor management, which often results in low yields. Many farmers have shied away from investing in fish farming and some who have tried fish farming have later on abandoned their fishponds. This study determined the relationship between the demographic and socio-economic characteristics of fish farmers and fish farming management practices in Kakamega County, Kenya. The study focused in Lugari, Lurambi and Khwisero sub-counties in Kakamega County, Kenya. The main study population was fish farmers in fish farming households. The correlational research design was used. The study employed multi-stage random sampling of fish farms. The results were that male members of the society dominate fish farming in Kakamega County. A Chi-square test ($\chi 21, 0.05 = 9.19$, $p = 0.031$) of independence showed that the ownership of the fishponds by women and land tenure are significantly ($p < 0.05$) related implying that ownership of the fishponds by women depends on whether the women also own the land. Many of these households represented by 20.31 % ($n = 77$) have 7 members and with this large number of people, they are likely to use family labour at their fish farms and this reduces production cost. The study concluded that demographic and socio-economic characteristics of fish farmers in Kakamega County affect the application of fish farming management practices since they involve the interactions of people and psychological and situational factors and therefore determine investment patterns in the fisheries sub-sector. They also influence fish farmers' response to changes in technology and affect participation in fish farming development. The study recommended the need to strengthen the capacity of fish farmers irrespective of their demographic and socioeconomic status and the need to promote an overall enabling environment in order to increase their response to technological changes and participation in the development in fish farming.

Index Terms- Demographic characteristics, Fish farming, Fish farming management practices, Socio-economic characteristics

1.0 INTRODUCTION

Fish production has been the fastest-growing food industry in the world for the last 40 years and it is expected to remain so in the near future (Béné *et al.*, 2015). In Africa, small-scale fish farming has continued to grow steadily with millions of poor families relying heavily on fish farming as a livelihood (Gatonye, 2017). Fish farming has great potential of growth in Kakamega County due to the presence of a wide variety of water sources such as rivers, springs, dams and rainfall (County Government of Kakamega, 2015). Fish farming households in western Kenya where Kakamega County is located mainly culture *Oreochromis niloticus* (Nile tilapia) and *Clarias gariepinus* (African catfish) (Nguka *et al*., 2017). Land fragmentation coupled with the rugged terrain in the county permit farmers to construct only small fishponds which although cumulatively add up to a large pond area, production in the area is still far below the market demand (Kiiru and Munguti, 2014). According to Shitote *et al.* (2013a), the major problems facing fish farmers in Western Kenya are high costs of feed, shortage of quality fingerlings and feeds, flooding, poor security and poor fish farming practices. Other challenges that affect fish farming in Kakamega County are poor road infrastructure, poor pond management practices, limited access to adequate sources of water, high costs of fish feed, poor location and high cost of construction of fishponds (Kundu *et al.*, 2016).

Understanding the factors influencing the development of aquaculture is critical in planning (Kundu *et al*., 2016). Warner and Sullivan (2017) similarly state that an understanding of social, cultural and economic attributes is important to development partners and communities as a basis for sustainable investments in livelihood and to policymakers in matters relating to the governance of these livelihoods. Social attributes influence how people participate in fish farming. The socio-economic characteristics pertaining to demography, means of production and investment, income and expenditure pattern of people living in a particular location strongly influence their responses to technological changes and participation in development schemes (Pandey and Upadhayay, 2012).

Ondiba and Matsui (2019) opine that social attributes such as age, education, family size, annual income, contact with extension services, cosmopoliteness, innovativeness and aspiration in farming influence entrepreneurial behaviours among people and the adoption of integrated homestead farming technologies. The age of rural women has a significant negative correlation with their adoption of integrated homestead farming technologies while their other socio-economic characteristics, namely, education, family size, annual income from field crop, annual income from homestead, contact with extension media, cosmopoliteness, innovativeness and aspiration in farming have significant positive relationships with their adoption of integrated homestead farming technologies (Aurangozeb, 2019).

Fish farming is an activity that requires a lot of inputs and workforce especially in the initial stages of digging the pond than in the routine management of the pond after stocking including the application of manure in the pond, feeding the fish and cleaning the pond (Akankali *et al*., 2011). Therefore, human capacity is of utmost consideration in the development of fish farming since whereas the aquaculture system exerts control over fish production through its design and water quality and quantity, the farmer has control over the reproduction of fish through genetic selection and breeding, feeding and disease control (Lahsen and Iddya, 2014). The availability of resources and the farmer's management ability determine the most suitable level of intensity in farming (FAO, 2018). In Kakamega County, the majority of the fish farmers (75.6 %) have fishponds that are less than 300 M^2 (Shitote *et al*., 2013b). There is a need to focus on the choice of technologies and their adoption in order to increase production, productivity and farm incomes (Bundi *et al.*, 2018). The likelihood of adopting a new technology e.g. use of improved feed in Kenya will surge with improved extension service delivery, access to government-subsidized feed, and ease of market access for purchasing improved feed and sale of mature fish (Amankwah *et al*., 2018).

1.1 Statement of the Problem

Fish farming in Kakamega County faces the challenges of underinvestment and poor management, which often results in low yields. Production in the county is low and despite efforts by several players to revitalize fish farming, the development process is at a snag and is characterized by pond productivity that is low and not rising (Nguka *et al*., 2017). Many farmers shy away from investing in fish farming and some who try fish farming abandon their fishponds later on. These factors have considerably contributed negatively to the development of the fisheries sub-sector in the county. The yield of fish in Kakamega County is below expectation since it does not meet the demand (Otieno, 2014). Even though the fish farming management practices that are promoted by various players appear quite simple, less complicated and more appropriate for local adoption, there is a slow rate of adoption (Kiiru and Munguti, 2014). The study seeks to determine whether there is a relationship between the demographic and socio-economic characteristics of fish farmers and fish farming management practices in Kakamega County, Kenya.

2.0 MATERIALS AND METHODS

The study was carried out in Kakamega County in Kenya with a focus in Lugari, Lurambi and Khwisero sub-counties. The main study population was fish farmers in fish farming households. The correlational research design was used. The study had the objectives of determining the relationship between the demographic and socio-economic characteristics of fish farmers and fish farming management practices in Kakamega County, Kenya.

Kakamega County has 12 sub-counties. Three sub-counties were purposively sampled to represent their ecological zones and the farming systems; Lugari and Lurambi from the Upper Medium (UM) ecological zone and Khwisero from the Lower Medium (LM) ecological zone. Lugari Sub-county also formed an important area of study because it had the highest number of fishponds in the county. Lurambi Sub-county has the Kakamega Fish Mini-processing Plant and, therefore, ready market for fish. Khwisero Sub-county had an active fish farmers' cooperative. In addition, it was important to concentrate on these sub-counties in order to allow in-depth exploration and understanding of the fish farms and thus increase the quality of data collected. The study employed a multi-stage random sampling of fish farms. 384 fish farmers were sampled from the three sub-counties. However, the sample size was added another 10 % to be 400 fish farmers in order to take care of non-response or lose of data during the data collection process. The fish farmers were proportionately sampled in the selected sub-counties in ratios relative to the total number of fish farmers in the sub-county.

Questionnaires containing closed and open-ended questions were administered to the fish farmers and/ or fish farm managers at the household level. During the visits at the fish farms, observable existing fish farming management practices including the site of the fishpond, water quality, methods of controlling predators, methods of controlling diseases and method of controlling pests among others were recorded and photographed as a way of supplementing the information collected on the questionnaires.

Three focus group discussions (FGDs) were organized for the fish farmers at major townships in the selected sub-counties; Kakamega Town, Lumakanda Township and Khwisero Township. Interviews were held with purposively selected key informants including the chairpersons for Kakamega County Fish Farmers Cooperative and Khwisero Fish Farmers Cooperative, one official from the Aquaculture Association of Kenya (AAK) and the Fisheries Director, Kakamega County. Secondary data were obtained from farm records, documented reports in various offices that were visited and policy documents regarding fish farming in Kakamega County and Kenya.

The demographic and socio-economic characteristics of the fish farmers were summarized in tables, means and graphs using Microsoft Excel and Statistical Packages for Social Scientists (SPSS) version 20. These demographic and socio-economic characteristics were gender, household/ family size; land size and tenure; pond ownership; experience and age; education level; social participation and membership to farmers' groups, cooperatives and Aquaculture Association of Kenya (AAK); household income distribution and expenditure pattern; occupation of the fish farmer; and consumption of fish. They were analyzed using descriptive and inferential statistics and qualitatively using narrative analysis and correlated with fish yield in order to determine if there were any relationships. Inferential statistics included correlation and Chi-square tests of independence, variation and association.

3.0 RESULTS AND DISCUSSIONS

The study sought to determine the relationship between the demographic and socio-economic characteristics of fish farmers and their application of fish farming management practices in Kakamega County, Kenya. These socio-economic characteristics include gender, household/ family size, education level, occupation, consumption of fish, age, experience, social participation, size of land, nature of land tenure, nature of pond ownership and household income distribution pattern.

3.1 Gender

Male members of society dominate fish farming in Kakamega County. Of the fish farmers, 93.4 % (n = 358) were male farmers. This research unveiled two scenarios of women involvement in fish farming. First, women who have their own fishponds and take part throughout the fish farming value chain. This is not common and accounts for about 4.43 % (n = 17) of the fish farmers as revealed by the study and of interest to the researcher. Secondly, women who participate jointly with their husbands in the management of fish farming by contributing to one or more of the activities under the fish farming value chain. This is the most common scenario and exists in almost all fish farming households.

Women in most fish farming households in Kakamega County participate in almost every aspect of the fish farming right from the general management of the fishponds, post-harvest handling and marketing. However, the research went further to investigate why very few women own fishponds in Kakamega County by looking at whether these women also owned the land from where they were doing fish farming. Table 1 presents this.

Table 1: Comparison by land tenure between women who own fishponds and women who do not own fishponds but participate in managing family fishponds in Kakamega County, Kenya

Tenure by women of the land where fish farming takes place	Percentage of women in the category
	Women who own fishponds (N = 17)
Women who own land	76.47 % (n = 13)
Women who do not own land	23.53 % (n = 4)

Source: Researcher (2018)

It was clear that most of the women who own fishponds also own the land from where they are doing fish farming. This represented 76.47 % (n = 13) of the women who have their own fishponds and take part throughout the fish farming value chain. Some other 23.53 % (n = 4) of the women who have their own fishponds and take part throughout the fish farming value chain has acquired land through leasing and using the land for fish farming. The women who do not own fish ponds but participate jointly with their husbands in managing family fishponds do not themselves own the land from where they are doing fish farming. These women are either joint contributors in the investment in fish farming or co-managers or both. A Chi-square test ($\chi^2_{1,\ 0.05}$ = 9.19, p = 0.031) of independence showed that the ownership of the fishponds by women and land tenure are significantly ($p < 0.05$) related implying that ownership of the fishponds by women depends on whether the women also own the land.

Key Informant Interview (KII) findings from the Department of Fisheries in Kakamega County showed that Kakamega County has about 8,336 fishponds that are owned by about 7,845 fish farmers of which less than 5 % (n = 7,845) of them are women. The field findings are very close to the Key Informant Interview (KII) findings from the Department of Fisheries in Kakamega County where about less than 5 % (n = 416) of the fishponds in the county fall under the first scenario and here women own fishponds and do most of the work in managing the ponds.

Information from all the focus group discussions (FGDs) revealed that the constraints to ownership of fishponds by women are limitations in accessing productive land resources, socio-cultural boundaries, and limitations in decision-making at the household level. During the focus group discussion (FGD) in Lurambi, one of the male farmers (Participant 1 from Lurambi, July 3, 2017) stated that:

> "Traditionally among us Luhyas, women were restricted within homesteads by socio-cultural and religious boundaries. The women are usually responsible for activities within the household such as childcare, food preparation and washing; and agricultural activities that do not require them to move outside the homestead such as vegetable gardening, post-harvest handling of produce and care of poultry and livestock. The women were in some instances allowed to take the produce to the market. Today, with the changing social context, women are increasingly becoming involved in income-generating activities such as farming."

It was observed that most of the fishponds were located near homesteads. This makes the women participate actively in the works at the fishponds while simultaneously attending to their roles at the homestead.

Shitote *et al*. (2013b) also observed the dominance of men in fish farming in Kakamega County. Luomba (2013) reports that capture and aquaculture have often been regarded as male responsibilities. However, this study found out that women also participate in fish farming. Where fishponds are located within and close to homesteads, women are able to work simultaneously on the fishponds and at their homes without forcing them to be away from their homes for long periods that might force them to neglect some of their roles at their homes (Pandey and Upadhayay, 2012).

According to Huyer (2016), closing the gender gap in fish farming and building the capacity of women for participation in fish farming is likely to boost the productivity of fish farming and generate gains in terms of lifting many households out of poverty and ensuring household food security, economic growth and social welfare.

Luomba (2013) says that the important role played by women in aquaculture have to some extent been derailed by land tenure systems which give ownership rights to males, inaccessibility to credit and savings services and facilities, low literacy and inadequate technical knowledge on pond management. Kiragu and Flohr (2016) say that with most of the household land in Western Kenya held by men, leasing remains a viable option for women to wish to participate in agricultural production although there is a need for a properly guided way for leasing in order to protect the rights of both the landowner and the leasee. Hence, women in Kakamega County can lease land and use it for fish farming.

3.2 Household/ Family Size

Majority of the fish farming households in Kakamega County represented by 20.31 % (n = 77) have 7 members. Table 2 presents the distribution of household sizes.

Table 2: Distribution of household/ family sizes of fish farming households in Kakamega County, Kenya

Household/ family size	Percentage (&) distribution	Percentage (%) relying mainly on family labour
1	1.0	9.4
2	7.7	4.5
3	12.2	7.8
4	16.8	4.5
5	8.7	3.7
6	11.2	3.6
7	20.4	5.3
8	13.3	7.5
9	4.1	7.3
10	1.5	11.3
11	2.6	18.3
12	0.5	16.8
Total	**100**	**100**

Source: Researcher (2018)

Even though most of the fish farmers represented by 46.50 % (n = 178) are the main sources of labour at their fish farms, many of those who receive labour assistance represented by 34.50 % (n = 132) depend on their family members as a source of labour for the management of their fishponds. Only 18.90 % (n = 72) of the farmers have employed managers and other workers at their fish farms. 19.10 % (n = 73) of the fish farmers have had their family members assist them in digging their fishponds. Of the labour force provided by the family members, the spouses account for 53.00 % (n = 203), the children account for 36.20 % (n = 139) and the other family members account for 10.90 % (n = 41).

A Chi-square test ($\chi^2_{11,\ 0.05}$ = 14.7, p = 0.041) of variation showed that there was significant ($p < 0.05$) variation in the household family size implying that the individuals listed as members of the household have no effect on the total household size. A Chi-square test ($\chi^2_{11,\ 0.05}$ = 47.56, p = 0.023) of association showed there was a significant ($p < 0.05$) relationship between household size and dependence on family labour implying that fish farmers whose households or families have a large number of people are the ones who are likely to consider family labour as their main source of labour.

However, as can be seen from Table 2, some of the households that have large numbers of members do not necessarily rely on family labour. This is because the involvement of any family member in the labour at the fishpond depends on the availability of that member since there are seasonal variations in the fishpond activities, the social relationship of the member and the fish farmer, the health and the age of the member, which determines the ability of that member to undertake the work.

Those farmers who themselves made their own fishponds account for 24.00 % (n = 92) of the farmers interviewed. The study revealed that majority of the households that used household labour to dig their fishponds had household sizes with at least 8 people. Government programmes such as Economic Stimulus Programme (ESP), Kenya Agricultural Productivity Programme (KAPP) and Kenya Agricultural Productivity and Agribusiness Programme (KAPAP) promoted fish farming in the area and, therefore, made fishponds for 37.30 % (n = 143) of the fish farmers interviewed.

Use of household labour reduces production cost and this means that the fish farmer can use the money that he would have used in employing labour in other operations at the fishpond thus increasing production. The results in Table 2 corroborates the findings of Omoregbee *et al.* (2013) and FAO (2015) that rural dwellers, similar to the research area, have large families. Shitote *et al.*, (2013b) reports that there is a high variation in household sizes of fish farmers in Western Kenya and that the large family sizes are due to polygamy and poor adoption of family planning methods. Although a large family size may provide the needed labour at the farm, the impact of the large family size on labour may also be insignificant because of the limited labour needed at the fishpond.

A large family size may also mean reduced economic welfare of the household, especially where dependency from the fish farmer is high (Omoregbee *et al.*, 2013). Dang *et al*., (2002) found out that the availability of family labour and social connections of households were some of the major determinants of successful adoption of a rice-fish system.

3.3 Land Size and Tenure

The average land size of the fish farmers as revealed by the study was 1.2 acres. The smallest total land acreage was 0.132 acre and the largest acreage was 24.5 acres. A Chi-square test ($\chi^2_{3,\ 0.05}$ = 19.56, p = 0.012) of variation showed there was a significant ($p < 0.05$) variation in the land sizes. Similarly, a Chi-square test ($\chi^2_{4,\ 0.05}$ = 29.96, p = 0.041) of association showed there was a highly significant relationship between land size and total area under fishpond. This implies that fish farmers with large pieces of land are most likely to establish big fishpond or many small fishponds that cumulatively add up to a large fishpond area. This improves on the economies of scale of operations/ practices in the fish farming enterprise.

Majority of the fish farmers represented by 96.10 % (n = 369) have exclusive ownership of the land from where they do fish farming compared to only 3.90 % (n = 14) who have leased land from where they do fish farming. However, only 23.21 % (n = 85) of the fish farmers who have exclusive ownership of the land from where they do fish farming have title deeds.

A Chi-square test ($\chi^2_{1,\ 0.05}$ = 3.28, p = 0.411) of association showed there was non-significant ($p > 0.05$) relationship between land tenure and access to credit implying that fish farmers with title deeds are less likely to use them as collateral when accessing loans. Such loans can provide useful capital for fishpond establishment or simply for increasing production at the fishpond.

It was observed that although some of the pieces of land were big, some sections of the land were very steep and therefore would not economically support fishpond establishment, especially in Khwisero Sub-county. Khwisero Sub-county where there is small-scale intensive farming had most of the smaller pieces of land while in Lugari Sub-county where there is small, medium to large-scale intensive farming had most of the larger pieces of land.

The focus group discussion (FGD) at Khwisero reported that most of the farmers in the area do not have title deeds for their pieces of land. The fish farmers also said that population increase in the area has led to land fragmentation and that the expensive succession and land subdivision processes are the main reasons why the farmers are not able to acquire title deeds. The focus group discussion (FGD) at Lumakanda also reported that some financial institutions are reluctant to accept title deeds from fish farmers as collateral for loans until the fish farmers provide additional security. These farmers said that sometimes these financial institutions demand that the farmers wishing to take loans must have saved with them some amount of money before they can qualify for loans.

The Kakamega County Integrated Development Plan (CIDP) 2018-2022 reports an average farm size of 1.5 acres for small-scale holders and 10 acres for large-scale holders. The CIDP further explains that Lugari and Likuyani sub-counties mostly have large parcels of land and that land size reduces gradually towards the Lower Region of the county where Khwisero Sub-county is located due to land fragmentation. Lack of secure land tenure plays a big role in constraining participation and ultimately adoption of sustainable land management technologies (Kiragu and Flohr, 2016).

There are benefits associated with a fish farmer having freehold ownership of land from where he/ she is doing fish farming. First, the farmer will not incur rent expenses that farmers who lease would incur and, therefore, the farmer ploughs much of the capital investment in production rather than rent. Second, the farmer has a strong emotional attachment to the land from where they are doing fish farming and this means that the farmer will comfortably invest in its protection and development through sound management practices which ensure environmental sustainability which is an important factor in environmental conservation and hence sustainable development. Third, where the farmer has documents to prove ownership of the land, he/ she can use such documents as collaterals in financial institutions when he/ she goes for a loan. This means that land will provide the farmer with an assurance of recovery in the event of shocks in fish farming and thus encourages production.

Provided there is adequate financial capital and labour for investment in fish farming, farmers with large pieces of land have the capacity to establish large or more fishponds whereas farmers with small pieces of land have a small area under fishponds unless they lease extra land a situation that adds to the expenditure in fish farming (Osondu and Ijioma, 2014). Exclusive ownership of property such as land means secured property rights that give sufficient incentives to the farmer to increase efficiency in terms of productivity (Dang *et al*., 2002). Jérôme and Lionel (2009) report that land provides security for loans and is an assurance in the event of shocks in farming. Dekker (2017) describes the land as social security and says that land is an incentive for agricultural production. This means that farmers who own land will feel encouraged to establish fishponds more than those farmers who do not own land.

3.4 Experience and Age

The study disclosed that fish farming has been practised by the majority of the fish farming households in Kakamega County representing 79.24 % (n = 304) for more than five years. Other farmers representing 20.76 % (n = 79) have practised fish farming for only five years or less.

Fish farming has attracted middle-aged farmers most of who are between 40 and 60 years. These represent 72.16 % (n = 277) of the household heads interviewed. Other households representing 11.23 % (n = 43) have their household heads between 30 and 40 years age and another 12.56 % (n = 48) have their household heads below 30 years age. Those fish farmer or fish farming household heads who are above 60 years of age represent 4.17 % (n = 16).

There was a significant ($p < 0.01$) positive correlation between the experience of fish farmers and the average yield of fish per hectare ($r = 0.532 \pm 0.25$). There was also a highly positive correlation between the experience of fish farm managers and the average yield of fish per hectare ($r = 0.651 \pm 0.23$). This implies that the average yield per hectare depends on the experience of the fish farmers and the fish farm managers. In an interview with a 75-year old fish farmer (Participant 2 from Khwisero, July 6, 2017), he stated that:

> "As I grow in age my fishpond also tend to age with me. Without remedial actions to clean it by removing silt, my production has decreased. Over the years, I have been experiencing a decrease in labour since my children and grandchildren who provided labour have gone to schools outside the home area and others have gotten involved in their own businesses including their own families."

The experience here connotes a product of a long-term personal encounter with fish farming and does not always depend on age. Osondu and Ijioma (2014) report that there is usually a decline in interest in fish farming as the farmer grows in age and family expenditure increases to a point where the farmer finds fish farming uneconomically rewarding. These field findings are similar to the findings by Oluwasola (2011) who observed that there is no relationship between the production of fish and the age and experience of the fish farmer. Experience affects the production of fish farming because farming with experience depends less on external technical assistance than farming without experience (Huang, 2018). This means that a fish farmer without experience ploughs much of the resources and time in accessing external technical assistance and this affects fish production.

3.5 Pond Ownership

Private entrepreneurs dominate ownership of the fishponds in Kakamega County. However, some institutions own some of the fishponds and fingerlings/ seed stock supply facilities. According to the field data, individually owned fishponds represent 89.70 % (n = 344) of the fish farms of the fish farmers compared to 9.30 % (n = 35) that are jointly owned by groups of either two or more farmers and institutions.

A Chi-square test ($\chi^2_{1,\ 0.05} = 11.32$, $p = 0.034$) of association showed that there was a significant ($p < 0.05$) relationship between pond ownership and the fraction of the household income that is used in upgrading fish farming. This implies that fish farmers who have own fishponds as individuals have stronger emotional attachments to their fishponds than those

who are in groups. This motivates the farmers to invest more of their individual resources and time in fish production.

A Key Informant Interview (KII) with the County Director of Fisheries, Kakamega County revealed that Lutonyi Fish Farm in Kakamega Town that is owned by the County Government of Kakamega (CGK) is used as a learning and demonstration site for fish farmers and students. He also pointed out the advantage of group ownership is that it makes it easy for farmers to mobilize resources and labour.

Kiragu and Flohr (2016) reported that groups have their own challenges such as mismanagement of resources and this discourages farmers to join groups. Fish farmers are more likely to invest more of their individual resources and time in fish production at their own fishponds than at fishponds that they own in groups with other farmers (Wuyep and Rampedi, 2018).

3.6 Social Participation and Membership to Farmers' Group(s)/ Cooperatives and Aquaculture Association of Kenya (AAK)

Few of the fish farmers represented by 35.00 % (n = 134) are leaders in various capacities in the community. 76.70 % (n = 294) of the fish farmers belonged to farmers' groups and/ or fish cooperative societies and 89.11 % (n = 20) of these groups and cooperative societies either wholly or partially promote fish farming activities. There are 9 fish farmers' cooperatives in Kakamega County. These include the Kakamega Fish Farmers Cooperative Society and Khwisero Fish Farmers Cooperative Society. Kakamega Fish Farmers Cooperative has 498 fish farmers. Khwisero Fish Farmers Cooperative has 27 fish farmers registered with Kakamega Fish Farmers Cooperative. Kakamega County has about 500 fish farmers being members of the Aquaculture Association of Kenya (AAK).

A Chi-square test ($\chi^2_{1,\ 0.05}$ = 34.4, p = 0.022) of association showed there was a significant ($p < 0.05$) relationship between the fish farmers' membership to farmers' groups, cooperatives and Aquaculture Association of Kenya (AAK) and access to extension services. This implies that fish farmers who are members of fish farmers' groups and cooperatives are more likely to receive technical assistance and other extension services through the groups or cooperatives.

It was observed that fish farmers can also get extension services during social events such as Agriculture Shows of Kenya (ASK). During the ASK in 2017, there were various demonstrations and teachings in fish farming. These included how to set up a PVC-lined fishpond (Plate 1).

A Key Informant Interview (KII) with the Director Fisheries at the Kakamega County Department of Fisheries said that the Ministry of Agriculture, Livestock, Fisheries, Cooperatives and Irrigation (MoALFCI) has a demand-driven extension kind of agricultural extension. Fish farmers access extension services MoALFCI and from other fish farmers and from project extension officers of projects that promote aquaculture in the area.

These results are similar to the findings by Kiragu and Flohr (2016) that membership to groups and other farmer organizations offers the farmer an opportunity to benefit from the extension services that come through the groups and organizations. Membership in farmer associations enables the farmer to benefit from innovations and easily access to inputs (Nzevu *et al.*, 2018).

Plate 1: A temporary demonstration of a PVC-lined fishpond at the Kakamega County Fisheries Department stand at Kakamega ASK showground

Source: Researcher (2017)

Most of the extension service providers allied to donor-funded projects in Western Kenya reach out to farmers through groups (Kiragu and Flohr, 2016). This makes it easier for farmers who are members of groups and/ or cooperative societies to access these extension services. The advantage of groups is that there is the easy mobilization of resources and labour and easy access to technical and financial assistance (GOK, 2010a)

3.7 Education Level

Fish farmers and fish farm managers who have formal education dominate fish farming in Kakamega County. According to Figure 1, most of the fish farmers represented by 52.04 % (n = 104) of the fish farmers interviewed and most of the fish farm managers represented by 56.55 % (n = 103) had attained formal education to the level of form four Kenya Certificate of Secondary Education (KCSE) respectively.

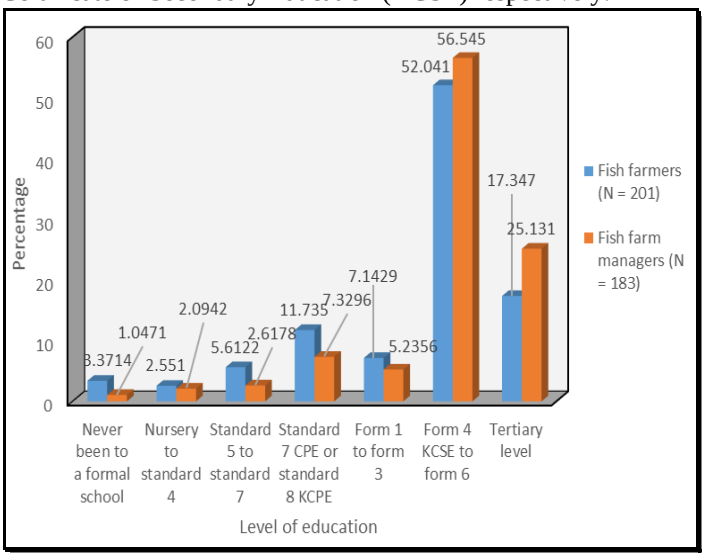

Figure 1: Education levels of fish farmers and fish farm managers in Kakamega County, Kenya

Source: Researcher (2018)

Very few fish farmers and fish farm managers represented by 3.57 % (n = 7) and 1.05 % (n = 1) respectively said that they have never been to a formal school. There is a

significant ($p < 0.05$) positive correlation between the level of education of the fish farmers and the average yield of fish per hectare ($r = 0.673 \pm 0.15$) and between the level of education of the fish farm managers and the average yield of fish per hectare ($r = 0.876 \pm 0.19$). This implies that education enables fish farmers and fish farm managers to easily understand the technical requirements of fish farming and easily apply appropriate innovations and new techniques in the fish value chain. Similarly, there is a non-significant ($p > 0.05$) positive correlation between the level of education of fish farmers and access to credits ($r = 0.567 \pm 0.22$). This implies that educated farmers can easily appreciate credits and easily access them, and can comprehend policy measures for sustainable fish farming.

It was observed that some fish farmers and fish farm managers had certificates in short courses related to fish farming and still others had diplomas and degrees in courses related to fish farming, farm management and agriculture. Similarly, some others reported having attended seminars, workshops and other fora covering matters related to fish farming. These farmers said that because of these academic backgrounds, short courses and seminars, they have been enlightened about fish farming and this has enabled them to improve their fish farming.

These results are similar to the results by Amankwah *et al.* (2018) that an increase in the education level of fi.sh farmers increases the yield of fish from the farms. Being more educated gives a farmer the advantage in understanding improved farming practices with ease and besides, is the accesses to valuable information for effective farm management that will help them increase output and income (Omoregbee *et al.*, 2013). Bosma *et al.* (2012) identified farmer's education and training level as one of the driving factors for adoption of innovations and found out that the level of knowledge on the sub-systems rice and fish was also higher for adopters. Ike and Chuks-Okonta (2014) also point out that education is a necessary tool in aquaculture practices as it affects output.

3.8 Household Income Distribution and Expenditure Pattern

The households' average annual income from fish farming is not a true reflection of the households' average total annual income. Therefore, the two were analyzed separately.

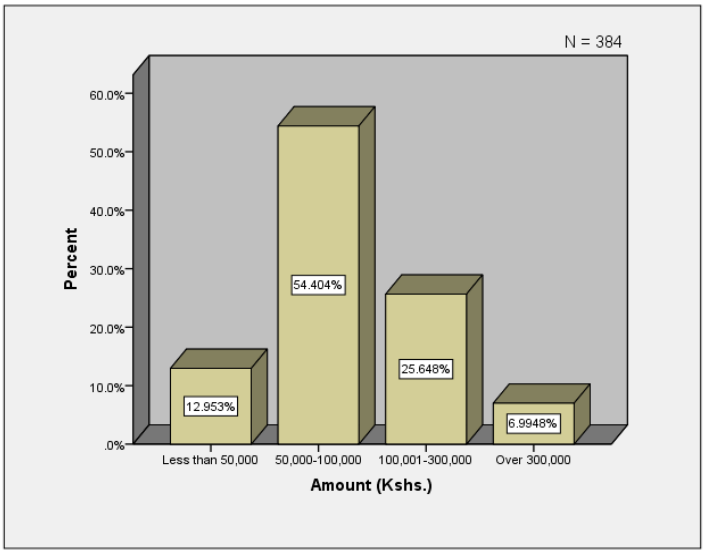

Figure 2: Distribution of the average annual income of fish farming households in Kakamega County, Kenya
Source: Researcher (2018)

Figure 2 presents the distribution of fish farming households' average total annual income. Many of the fish farming households represented by 54.40 % (n = 208) have their average annual income between USD 495.54 and USD 991.08 followed by 25.65 % (n = 98) of the fish farmers whose household average annual income is between USD 991.09 and USD 2,973.24. Fish farmers whose household average annual income is below USD 495.54 and those whose household average annual income is over USD 2,973.24 represent 12.95 % (n = 49) and 6.99 % (n = 26) respectively.

Figure 3 presents the distribution of fish farming households' average annual income from fish farming. Many of the fish farming households represented by 50.65 % (n = 194) have their average annual income from fish farming below USD 495.54. Those with average annual income from fish farming between USD 495.54 and USD 991.08, USD 991.09 and USD 2,973.24 and over USD 2,973.24 represent 22.74 % (n = 87), 13.70 % (n = 52) and 12.92 % (n = 49) respectively. When it comes to the expenditure of the household income, majority of the fish farming households represented by 72.61 % (n = 278) spend more than ¾ of their household income on meeting the household's expenses that do not relate to fish farming.

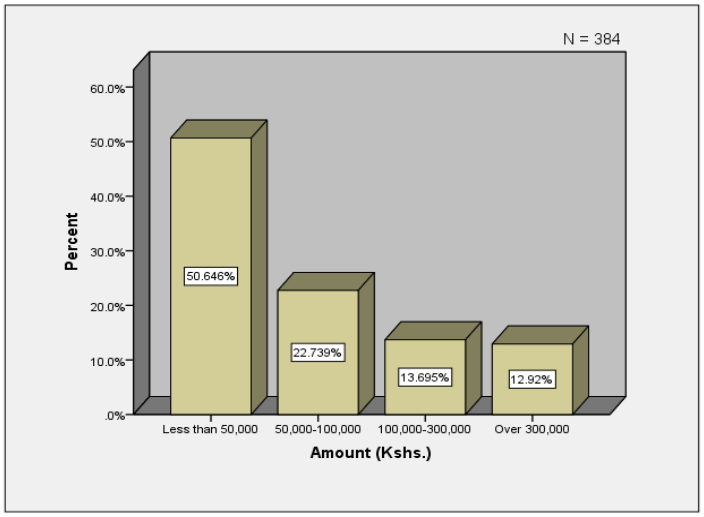

Figure 3: Distribution of fish farming households' average net annual income from fish farming in Kakamega County, Kenya
Source: Researcher (2018)

Another 11.89 % (n = 45), 13.70 % (n = 52) and 1.81 % (n = 6) of the farmers spend between more than ½ to 3/ 4, between more than ¼ to ½ and less than ¼ of their household income on meeting the household's expenses that are not related to fish farming respectively. Figure 4 presents the distribution of household expenditure as a fraction of the household's average annual income.

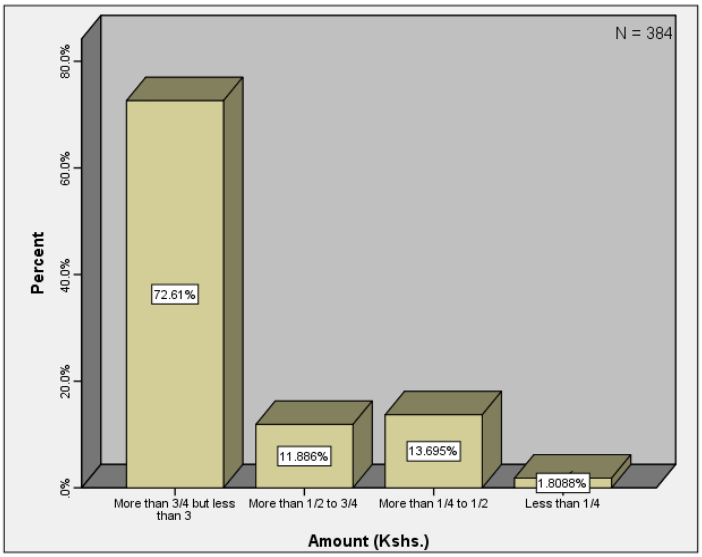

Figure 4: Expenditure as a fraction of the average annual income of fish farming households in Kakamega County, Kenya

Source: Researcher (2018)

Contrary to the above results, majority of the fish farming households represented by 82.95 % (n = 318) spend less than ¼ of their household income in upgrading their fishponds and meeting expenses incurred in fish farming. Another 8.79 % (n = 33), 6.20 % (n = 23) and 2.07 % (n = 7) of the farmers spend between more than ¼ to ½, between more than ½ to ¾ and more than ¾ of their household income in upgrading their fishponds and meeting expenses incurred in fish farming respectively. Figure 5 presents these results.

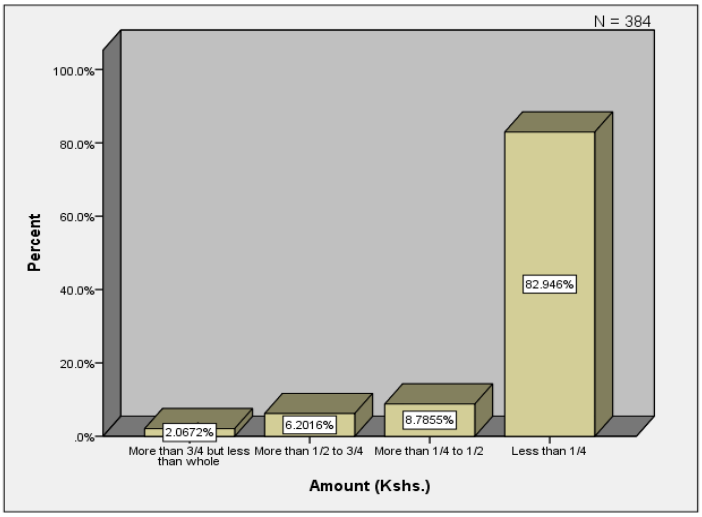

Figure 5: Investment in upgrading fish farming as a fraction of the average annual income of fish farming households in Kakamega County, Kenya

Source: Researcher (2018)

There was no correlation between the amount of average annual income of a household and the average fish yield per hectare. This means that the amount of average annual income of a household cannot precisely determine the success of a fish farming enterprise by that household because of other factors such as the expenses of the household that this income must meet and the distribution pattern of the income as it gets into the household.

However, a Chi-square test ($\chi^2_{3,\,0.05} = 67.4$, $p = 0.032$) of association showed that household investment in fish farming as a fraction of the household's average annual income and the average fish yield of fish per hectare are significantly ($p < 0.05$) related. This implies that the average fish yield per hectare is dependent on the amount of investment that the fish farmer or household uses to improve the fish farming enterprise.

These results connote the findings by Agbei *et al.* (2016) that a higher income is a motivational driver for the adoption of fish farming as a good part of the income is invested in fish farming without the worry of sacrificing other financial needs. Nguka *et al.* (2017) also found out that households with high incomes have no worry about investing in fish farming because of the availability of finances. However, this study presents the fact that it is not the amount of income of the household that determines the success of their fish farming enterprises but how much of the household income that is used to improve fish farming.

3.9 Occupations of Fish Farmers

Fish farmers had varied reasons as to why they started fish farming. It is clear from Figure 6 that majority of the fish farmers represented by 67.44 % (n = 258) started fish farming as a source of income either as the main source of income or as a supplement to other sources of income. These are followed by 26.62 % (n = 102) of the fish farmers who said that they opted to do fish farming because there was no other use for the land where they were doing fish farming. Other farmers representing 2.84 % (n = 10), 2.33 % (n = 8) and 0.78 % (n = 2) said that they started fish farming as a source of food, to manage the environment and for prestige, respectively.

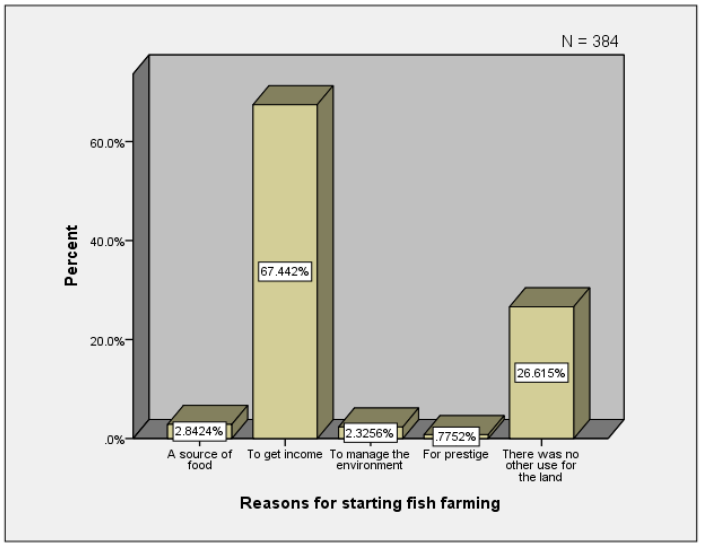

Figure 6: Reasons for starting fish farming by fish farmers in Kakamega County, Kenya

Source: Researcher (2018)

All farmers interviewed had at least one or more of other occupations like permanent employment, business, consultancies and other farming enterprises that they do alongside fish farming. However, fish farming is the main occupation and therefore the main source of income for 7.50 %

(n = 28) of the fish farming households. Other farming enterprises as the main source of income in the household had the highest score of 39.60 % (n = 152), followed by other undefined occupations with 23.90 % (n = 91), then formal employment with 22.50 % (n = 86) and lastly businesses with 14.00 % (n = 53).

A Chi-square test ($\chi^2_{3,\ 0.05}$ = 21.4, p = 0.043) of association showed there was a significant ($p < 0.05$) relationship between the integration of fish farming and other occupations including crop and livestock farming and the fraction of the households' income that is ploughed back into fish farming. This implies that fish farmers who have integrated fish farming and other occupations are more likely to plough back into fish farming much of their net household income. In an interview with one of the fish farmers (Participant 3 from Khwisero, July 6, 2017) she stated that:

> "Some of these fish farmers enter into the business of fish farming because they see other farmers also practising fish farming. Most of these are the ones who face challenges in management."

It was observed from the farms that all the households had integrated fish farming with other farming enterprises. A Key Informant Interview (KII) with the Chairman of Kakamega County Fish Farming Cooperative pointed out that the society encourages its fish farmers to integrate fish farming with other farming enterprises as a way of boosting their household income and as a shock absorber when one enterprise fails, thus taking the advantage of diversification.

This result collaborates the findings by Aurangozeb (2019) that the more enterprises a farmer has at the farm the more production the farmer is likely to get from the individual enterprises because of the large pool of income from the enterprises that are available for improving the farm. The integration of fish farming with other occupations has the advantage of enabling the farmers to create other incomes from a pool of "income-making engagements" which often is economic security that enables the farmers to minimize risks of enterprise collapse at the farm level (Badjeck, 2004). Abiona *et al.*, (2011) however argue that having many farming enterprises on the same small piece of land is associated with keeping the enterprises at small-scale and that the many enterprises divide the farmers' attentions making the farmer non-specialized.

3.10 Consumption of Fish

Most of the fish farming households consume fish. Many of them represented by 54.00 % (n = 207) take fish regularly and at least twice a week including fish harvested from their fish farms. These households have financial capability and, therefore, can afford fish when they need it. In addition, these households do not primarily do fish farming as a source of income but also for subsistence consumption. Another 43.90 % (n = 168) take fish but not regularly and sometimes with several days in between successive days of taking fish. These households have limited financial capability and, therefore, cannot always afford fish when they need it.

In addition, these households mainly do fish farming as a source of income and may eat the fish at harvesting. Another 2.10 % (n = 8) of the fish farming households do not consume fish because of reasons that were not disclosed during the research. The researcher alleges that these could be cultural or religious reasons. Fish farming is, therefore, a household source of food and an economic livelihood activity.

A Chi-square test ($\chi^2_{2,\ 0.05}$ = 17.9, p = 0.041) of association showed there was a significant ($p < 0.05$) relationship between the consumption of fish and the average yield per hectare. This implies that consumption of fish by a fish farming household has an influence on fish production at the household's fish farm. In an interview with one of the fish farmers (Participant 4 from Lugari, July 13, 2017), she stated that:

> "I am a fish farmer and I also ensure that my family appreciates the value of fish. I therefore not only rear the fish for income but I also ensure that the people in my household consume part of the fish harvested from my farm. This often gives me the encouragement and assurance that what I am doing is very important."

An interaction with fish traders on the markets of Kakamega Town reveals that much of the fish consumed in Kakamega County comes from other areas such as Busia, Kisumu, Uganda and Turkana. A fish farmer or fish farm manager whose family consumes fish appreciates the value of fish and, therefore, will have no reservations in investing in the enterprise and managing the same since he/ she has a positive attitude towards the fish (Osondu and Ijioma, 2014). Upadhyay *et al.*, (2014) reinforces that the study of consumer behaviour for fish with respect to consumers' taste, preference, food habits, family income and consumption expenditure on fish and related commodity is essentially important from its production, processing and marketing point of view.

4.0 CONCLUSION AND RECOMMENDATION

Demographic and socio-economic characteristics of fish farmers in Kakamega County affect the application of fish farming management practices and hence the adoption of best practices in fish farming management, which leads to successful fish farming. Demographic and socio-economic characteristics of fish farmers involve the interactions of people and psychological and situational factors and therefore determine investment patterns in the fisheries sub-sector, influence fish farmers' response to changes in technology and affect participation in aquaculture development. Therefore, they have an influence on the designing and successful implementation of a government's development programmes.

There is need to strengthen the capacity of fish farmers irrespective of their demographic and socio-economic status and promote an overall enabling environment in order to increase their response to technological changes and participation in development in fish farming.

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Training Students' Critical Thinking Skills Through Implementation of Problem Solving Models On Reaction Rate Materials

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Abstract- Critical thinking skills are one of the high-order thinking skills that students need for survival living in the 21st century. Critical thinking skills are needed to solve various problems by questioning what they hear and reviewing certain thoughts. The aim of this research is to describe learning activity and students' critical thinking skills through implementation of problem solving models on reaction rate materials. This research used a Pre-Experimental with one-group pretest-posttest design. The subjects were 70 students from the two classes of XI MIPA. The instruments that was used included observation sheet for learning activity with implementation of problem solving models and test sheets of the critical thinking skills. The results showed that: 1) learning activity with the implementation of problem solving model got good category, 2) critical thinking skills after implementation of problem solving model have reached skilled and highly skilled category that was proven by the average score of students at XI MIPA 3 is 80.83 and XI MIPA 4 is 83.10.

Index Terms- Critical thinking skills, problem solving model, reaction rate material

I. Introduction

The development of Science and Technology in the current era requires people to be able to compete through improving their quality so that they can keep up with the demands of the 21st century. Self quality improvement is related to improving the quality of education. Education is designedfor students to be able to solve all the problems by mastering knowledge and skills. Multidimensional problems are likely to arise, so it requires a large number of skilled people who can contribute significantly to provide solutions [1].

Problems cannot be solved without thinking. The meaning of this statement is students need to manage their knowledge in designing the solution. Knowledge acquisition needed by someone to be able to solve problems, so learning is more meaningful [2]. Creative problem solving needs students' critical thinking skills, such as the skills to analyze, evaluate, explain, and make decisions [3].

Critical thinking skills are processes that emphasize a logical and rational basis of trust, and provide a set of standards and procedures for analyzing, testing, and evaluating [4]. There are six main critical thinking skills according to Facione who are involved in critical thinking processes, including: interpretation, analysis, evaluation, inference, explanation, and self-regulation [4].Therefore, critical thinking skills needto be trained in learning activities, especially in science. A learner must accept the existing truth, recognize science as a product and also as a process, a way to prove the truth that explores new scientific knowledge [1]. However, students' critical thinking skills are still low. The statement was supported by research from Rasmawan that the students' critical thinking skills are low with unskilled category has reached 81,25% [5]. The other research also found that the average of students' critical thinking skills is 51.60% in the low category [6]. Besides, the research conducted by Saputra, Hidayat, and Munzil showed that student's critical thinking skills are still low [7]. These results indicate that students are not accustomed to training critical thinking skills in learning.

Critical thinking skills are also needed in Chemistry learning. One chemical topic that requires critical thinking skills is the reaction rate. The reaction rate material has several characteristics, namely: concepts are abstract, mathematical counts, graphs, and involves multiple representations (macroscopic, microscopic, and symbolic [8]. The learning is often done only on the macroscopic and symbolic. In addition, the reaction rate material requires hands-on learning experience through experiments, so students must be able to identify, analyze, evaluate and conclude. Therefore, it takes a critical thinking skill in understanding the material of the reaction rate comprehensively, so that students can solve a problem with the right solution.

One of the strategies to train students' critical thinking skills is by holding variations in learning through the selection of appropriate models, namely problem solving models. The problem solving model is a model in which there are activities of critical thinking skills that begin with confrontation and end with solutions according to the conditions of the problem [9].

In line with the research of Sulistyaningkarti, Budi, and Haryono that problem solving models equipped with worksheet can improve critical thinking skills and student learning achievement seen from 77% in the first cycle to 90% in second cycle [10]. The research conducted by Laila and Azizah also shows that problem solving models can train the skills of planning and evaluating at 80.21 and 79.82 [11]. Problem solving instruction is effective to understanding material, problem solving skills, and using strategies [12]. The facts prove that problem solving models can train critical thinking skills.Based on description above, so the aim of this research is to know students' critical thinking skills through implementation of problem solving models.

II. RESEARCH METHOD

This research used a Pre Experimental with One group pretest-posttest design. Subject were 70 students from two classes XI MIPA.The design can be described as follows [13]:

$$O_1 \ X \ O_2$$

2.1 Analysis of learning activity

The instrument that was used included observation sheets of implementation of problem solving models. Activities of teacher were observed by two observers were sought the mode. Observation of the implementation of the problem solving model was assessed by observers using a score of 0-3. Score 0 if it is not implemented, score 1 if the activities carried out are not good, score 2 if the activities carried out are good enough, and score 3 if the activities are carried out are good.

2.2 Analysis of critical thinking skills

Tests of critical thinking skills were carried out 2 times, namely pre-test (before being treated with problem solving models) and post-test (after being treated with a problem solving model). The instrument used is a test sheet of students' critical thinking skills. Question in the form of essay consists of 12 questions in which it contains phenomena. Then, students were asked to interpret, analyze, explain, infer, and evaluate. The problem solving model belongs to Polya, which has 4 steps, namely (1) understood the problem, (2) a plan device, (3) carry out the plan, (4) look back [9].

Assessment scores used to assess students' critical thinking skills were 1-4. To determine the score, the rubric was employed to assess students' critical thinking skills. The first step is taken o analyze the critical thinking skills test is to calculate the score using the following formula:

$$\text{Critical thinking skills score} = \frac{\sum \text{score obtained}}{\sum \text{maximum score}} x100$$

Then, the scores of students' critical thinking skills is converted into some category will be presented in Table I. Score of critical thinking skills was obtained during posttest have reached the category of skilled and highly skilled.

Tabel I**:** Critical Thinking Skills Category

Score	**Category**
3.0 – 4.0	Very Skilled
2.1 – 3.0	Skilled
1.1 – 2.0	Rather Skilled
0.0 – 1.0	Unskilled

Students' critical thinking skills before and after using problem solving model were analyzed by calculating the difference in average post-test scores and pre-test (n-gain score). Formulation of N-gain according to Hake is:

$$(g) = \frac{posttest\ score - pretest\ score}{max\ score - pretest\ score}$$

Furthermore, the N-gain criteria was used to determine the category of critical thinking skills described as: (1)learning outcome with "high gain" if (g) ≥0,7; (2) learning outcome with "medium gain" if 0,3≤(g)<0,7; and (3) the learning outcome with "low gain" if (g)<0,3 [14].

III. RESULTS

3.1 Learning activity with problem solving models

Observation of the implementation of the problem solving model was carried out for four meetings. The first meeting on the concentration factors affected the reaction rate, the second meeting on the surface area and temperature factors affected the reaction rate, the third meeting on the catalyst factors affected the rate of reaction, and the fourth meeting on the orde of reaction. The results of observation of the implementation of the problem solving model are shown in Table II and Table III.

Table II: Observation of the implementation of the problem solving model on XI MIPA 3

Aspects	Meeting I	Meeting II	Meeting III	Meeting IV
1) Pre	G	G	G	G
2) Phase 1	GE– G	G	G	GE
3) Phase 2	GE	GE – G	G	GE - G
4) Phase 3	GE - G	G	G	GE
5) Phase 4	G	G	G	GE - G
6) Final	G	G	G	G

Pre = Preliminary activities , Final= Final activity, G = Good, GE = Good Enough

Note:
Phase 1= understood the problem
Phase 2= a plan device
Phase 3= carry out the plan
Phase 4= look back

According to Table II, the preliminary activities and final activities got good category. This shows that the management of learning in the preliminary and final activities has been good, coherent, and complete. In the main activities consisted of 4 phases, the observation score is 2 and 3 with good enough until good category. Overall, the increase occurred in first until the third meeting. This is because students have been trained critical thinking skills using problem solving models. But at the fourth meeting, the decrease occurred because the material taught had different characteristics from the previous meeting.

Table III: Observation of the implementation of the problem solving model on XI MIPA 4

Aspects	Meeting I	Meeting II	Meeting III	Meeting IV
1) Pre	G	G	G	G
2) Phase 1	GE – G	GE - G	G	GE– G
3) Phase 2	GE - G	G	G	G
4) Phase 3	GE - G	G	G	GE – G
5) Phase 4	GE - G	G	GE – G	GE – G
6) Final	G	G	G	G

Pre = Preliminary activity , Final= Final activity, G = Good, GE = Good Enough

Note:
Phase 1= understood the problem
Phase 2= a plan device
Phase 3= carry out the plan
Phase 4= look back

The result of observation in class XI MIPA 4 are almost as same as XI MIPA 3. The preliminary activities and final activities got good category. In the main activities consisted of 4 phases, the observation score is 2 and 3 with good enough until good category. Thus, it can be concluded that the learning activity with problem-solving models conducted by teachers is good.

3.2 Critical thinking skills

Critical thinking skills are needed in learning activities, especially chemistry subjects [15]. The material used in this research is the reaction rate. The concept of reaction rate material studied in this research wasthe factorsthat influence reaction rate and orde of reaction [16].

Tests of critical thinking skills were carried out before and after treatment using problem solving models. The score of critical thinking skills of students in class of XI MIPA 3 at the pre-test was in the range of 0.00 - 39.58 (unskilled - rather skilled). Pre-test scores show that students are not familiar with the questions that require critical thinking skills. After getting the pre-test score, then students are trained in critical thinking skills with a problem solving model using worksheets. In contrast to the results of the post-test score, the scores obtained was in the range of 56.25 - 95.83 (skilled - very skilled). The average score of critical thinking skills is 80.83.

A total of 14 students who scored critical thinking skills at the pre-test were in the rather skilled category and the other got the unskilled category. At the post-test, 26 students got scores that were in the high skilled category and the other got the skilled category.

In class XI MIPA 4, the pre-test score of critical thinking skills obtained by students was 0.00 - 39.58. The score is in the category of unskilled to rather skilled. Then, students were trained using a problem solving model and given a test at the end of learning. The score obtained at post-test was 68.75 - 95.83 (skilled - very skilled) and the average score is 83.10.

At the time of the pre-test, as many as 10 students who got the score of critical thinking skills were rather skilled and the other belong to unskilled category. In contrast, 27 students' score of critical thinking skills gained after the post-test were found in the high skilled category, while most of the other studentsother got skilled category.

Nonetheless, after the post-test was conducted, there are few students who got low score. This is because they feel confused with the orde of reaction. This material has little connection with everyday life and has different characteristics from the factors that influence the reaction rate material.Students always assume the function of objects is the same, even though problem solving requires to see things in new ways [17]. The description of the pre-test and post-test scores of students' critical thinking skills will be illustrated in Figure 1.

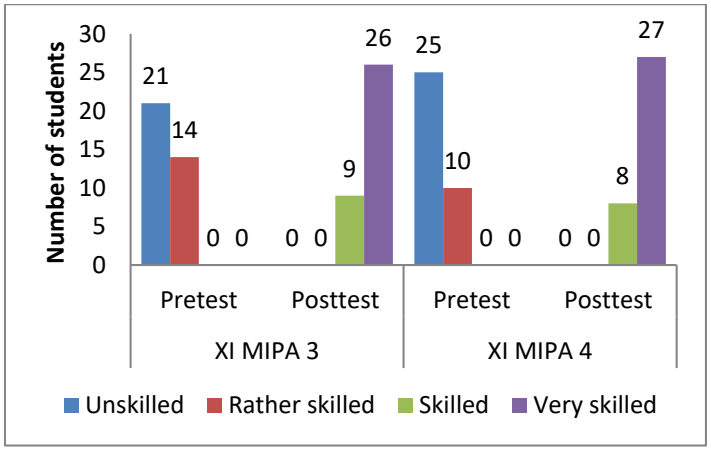

Figure 1: Graph of the number of students with acquisition of critical thinking skills category

Based on the analysis above, it can be seen that there are differences in the scores of critical thinking skills at the pre-test and post-test. A significant increase after the implementation of a problem solving model occured.Students were practiced with worksheets, starting from interpreting problems until evaluating questions. Evaluation part contained questions of the same type and applications in everyday life. Students were initially given a scaffolding to be able to identify problems until they were able toanalyze correctly. Both classes showed good results that critical thinking skills can be trained with problem solving models. Critical thinking skills will increase if you continue to be trained and guided [15].

The difference between pre-test and post-test scores can be used to determine the improvement of students' critical thinking skills after the implementation of problem solving models. In class XI MIPA 3, as many as 25 students received N-gain scores with high criteria, and 10 students got scores with medium criteria. The average N-gain score is 0.75 (high). In class XI MIPA 4 there were 30 students who received high N-gain scores and 5 students got N-gain scores with medium criteria. The average obtained is 0.78 (high). The N-gain score of the two classes is not significantly different.

The results of the calculation on N-gain score of both classes indicate that problem solving models are effective to train students' critical thinking skills. The findings are also in accordance with the results of previousresearchthat students' critical thinking skills with the treatment of problem solving models with video are significantly higher than other learning treatment[18].Critical thinking of students in problem solving increases significantly after students are givencertain problematicsituations [3]. Problem solving learning greatly outperforms traditional learning, where this model can influence knowledge, thinking, and problem solving skills [19].

IV. CONCLUSION

Based on result of research, it can be conclude that: 1) the learning activity with problem solving models got good category, and 2) critical thinking skills can be trained through the implementation of a problem solving model proven by the scores of critical thinking skills of students in class XI MIPA 3 and XI MIPA 4 in skilled and very skilled category.

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Qualitative and Functional Teacher Education: a Viable Tool for Mitigating Economic Recession in Nigeria.

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Abstract

The central focus of this paper is that economic recession in Nigeria which is associated with high rate of poverty, increasing unemployment rate, high inflation and declining gross domestic product could be mitigated by improving the quality of education given to teachers inthe country . This is not far-fetched as teachers are responsible for imparting requisite skills and knowledge to individuals to become self-reliant and positively contribute to the development of the society. The paper started with introduction and thereafter explained the meaning of qualitative and functional education, teachers' education in Nigeria and economic recession. Next, the causes of economic recession and ways of mitigating economic recession were discussed. Finally, the place of qualitative and functional teacher education in mitigating economic recession was discussed and way forward presented. It was concluded that economic recession is not new globally and in Nigeria but requires educated men and women to take the bull by the horn and stir this nation back on the right course toward economic emancipation from the pit of recession as the giant of African and a fast growing and developing nation of the world.

Key words; Economic recession, teacher education, qualitative and functional education,

Introduction

The importance of quality teacher education has been the hallmark of every major discourse among stakeholders of education and the governments of Nigeria. It is generally believed that quality teaching is akin to quality learning and that teacher education should be held accountable for developing quality teachers. Therefore well trained teachers are essential for quality education. This could be the reason the Federal Republic of Nigeria (FRN, 2013) stated that no education system can raise above ion is visited on the learners. This incidence seems to contribute to declining quality of education in Nigeria. In the same vein, Asaju and Adagba (2014) stressed that there has been agreement among scholars and other stakeholders that the education quality and standard in Nigeria has been declining. Asaju and Adagba added that lack of the functional education has placed Nigeria far behind in the modernisation process and the defect has been the mother and father of all evil that follows; poverty, debt burden, conflict, corruption, abuses of human right, abuses of power, killer diseases, epileptic democratic government among others.

Revitalization of qualitative and functional teacher education is a catalyst for reduction of poverty, illiteracy and unemployment in the society. This makes it imperative to x-ray the current economic recession bedeviling the nation in the light of the quality and functionality of its educational system (Teacher education) with a view to finding the way forward. This paper therefore addresses the major concepts of the theme thus: education, qualitative and functional education, teacher education and economic recession. It aims at highlighting the place of qualitative and functional teacher education in mitigating economic recession; conclusion and recommendations are also made.

Concept of Qualitative Functional Education

Qualitative and functional education presupposes that knowledge and skills acquired through education must be employable, useful and functional in the world of work, organizations and industries.

Qualitative Education is multidimensional and lends itself to different interpretation subject to the discussant area of interest. It can be assessed from the point of:
conforming with and meeting the requirement and intended purpose
satisfying the needs of the stakeholders
guaranteed realization of minimal standards and benchmarks (Enaohwo, 2008).

Qualitative education is the education that is relevant to the needs and aspiration of the society or nation. It can be determined by both the status and process variables: Thus

Table 1: Variables of Qualitative Education

Status Variables	Process Variables
Quality of School Facilities e.g. libraries, classrooms, textbooks, class size and school environment. Teacher characteristics, e.g. training, qualification, experience, dedication and commitment. Student characteristics e.g. inate ability, readiness and willingness to learn, health and nutrition status and motivation.	Mechanism of translating the status variable into desirable outcome e.g. method of teaching, supervision and management of human and physical resources, service delivery. Appropriateness, enriched and current relevant curriculum. Adequate funding and accountability.

Functional Education is a practical education that prepares and equips members of the society for an acceptable, profitable and worthwhile life in any community that they may found themselves. Etesike (2012) stated that functional education is practical or pragmatic education rather than decorative.
It empowers the recipients with the ability to sustainably explore, without doubt discover, functionarily derive and maximally utilize the available resources of the nation.
It equips man with appropriate skills and helps him develop his potentials to the fullest for the improvement of his productivity and maximum contribution to the development of his society.
Functional education is capable of producing citizens that are producers and manufacturers of goods (wealth creators) and not merely consumers. Thus, enlightening man to realistically live and appropriately face daily challenges prevalent in one's immediate environment.

Functional education must be geared towards learners area of interest and ability. This becomes the prerogative of a well trained and qualified teacher produced through teacher education programme.

Teacher Education in Nigeria
Teacher education is a process that avails prospective teachers the opportunity to develop cognitive perspective, affective disposition and psychomotor competencies that will infuse with the qualities, capacities and capabilities for teaching. Ogunyinka, Okeke and Adedoyin (2015) defined teacher education as professional education of teachers towards attainment of attitudes, skills and knowledge considered desirable so as to make them efficient and effective in their work in accordance with the need of a given society at any point in time. The focus of teacher education therefore is to professionally train teachers.

Teacher education in Nigeria dates back to 1859 with the establishment of the first teacher training college in Abeokuta by the Church Missionary Society (CMS). Later, advanced teachers colleges were established. From this point, teacher education evolved over the years with series of reforms (in terms of type, certification, training, curriculum, duration, quality control measures and so on) geared toward production of quality teachers. Federal Government of Nigeria (FGN, 2013) recognized the pivotal role of quality teachers in the provision of quality education at all levels of the educational system; and stated that teacher education shall continue to be emphasized in educational planning and development. Hence the statutory responsibility for teacher education in Nigeria is vested in Colleges of Education, Instiutte of Education, Polytechnics, National Teachers Institute (NTI) and Nigerian Universities Faculty of Education.

These educational institutions are charged with the responsibility of preparing and training professional teachers expected to meet the goals of teacher education. They are to be highly motivated, conscious and efficient teachers with the spirit of enquiry and creativity. Teachers that will fit into the social life of the society and effectively harness their intellectual and professional background in the discharge of their assignment. They are to be teachers that are dedicated and committed to the teaching profession. Commitment to the profession is of essence because effective teaching and learning depend on teachers whose influence is felt in every aspect of the society. There can be no meaningful socio economic and political development in any nation without teachers.

Moreover, the effectiveness of all educational programmes activities, development and growth depend on the quantity, quality, devotion and commitment of teachers. Expectations placed on the teachers are varied and vital. Their roles in nation building is never in question but the realization of this goal only becomes a reality through well planned and implemented teacher education. Adewuiyi (2012) asserted that what structurally becomes important in achieving the nations quest for self reliant society imbued with vibrant economy and productive citizenry is to put in place a comprehensive teacher education programme. This type of programme when adequately supported, supervised and managed will produce a crop of teachers well equipped to effectively and

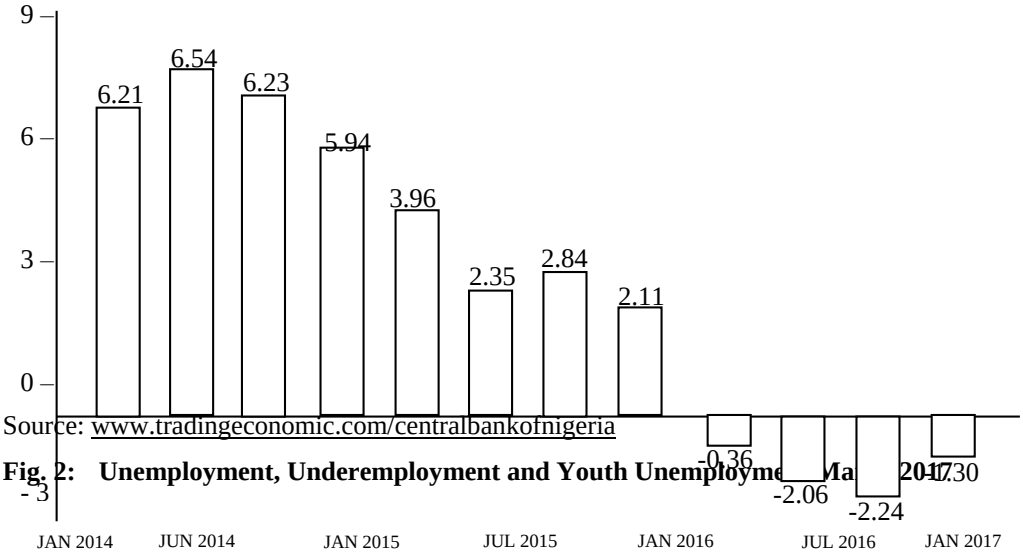
efficiently discharge their duties. These teachers as curriculum implementers ensure that students graduate as good products by applying effective teaching methods, strategies and skills, techniques and approaches in instructional procedure to bring positive change in attitude of learners. The committed efforts of teachers are often times affected by a number of challenges that are either personal or institutional based.

Teacher education institutions in Nigeria are faced with myriad of problems. These include amongst others: inadequate funding, insufficient facilities and infrastructure, non functional ICT facilities, over population of students, low entry requirement, poor mode of admission, incompetent teaching personnel, poor work environment, corrupt practices. These undermine the achievement of goals of teacher education. Consequently the entire educational system is adversely affected as no nation can rise above the quality of its teachers. A nation so adversely affected will definitely experience a lot of anomalies such as poor quality graduates, corruption and inevitably, downturn in economy or economic recession.

Economic Recession

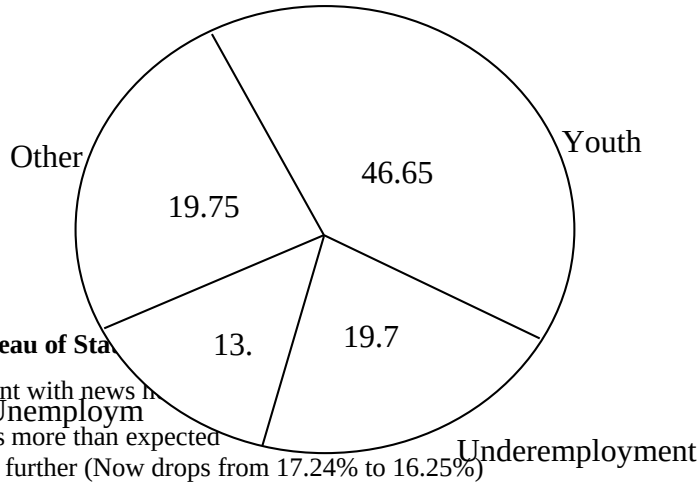
This is a period of general economic decline and is typically accompanied by a drop in the stock market, an increase in unemployment and a decline in the housing market (Mckinney, 2017). It is a decline in gross domestic product (GDP) for two or more consecutive quarters. GDP is the market value of all goods and services produced within a country in a given period of time. Economic boom results from increase in market value but economic recession or downturn of economy is experienced when market value decreases. Economic recession is prevalence, when the economy declines significantly for a period of not less than six months and indicated in fall in real GDP, income, employment manufacturing and retail sales. Decline in these indicators in Nigeria are proof of economic recession. In Nigeria there has been a consistent decline in GDP. Economic output falls continually instead of expanding and increasing resulting in economic recession.

Fig. 1: Nigeria GDP Annual Growth Rate



Source: www.tradingeconomic.com/centralbankofnigeria

Fig. 2: Unemployment, Underemployment and Youth Unemployme Ma 2017



Source: National Bureau of Sta

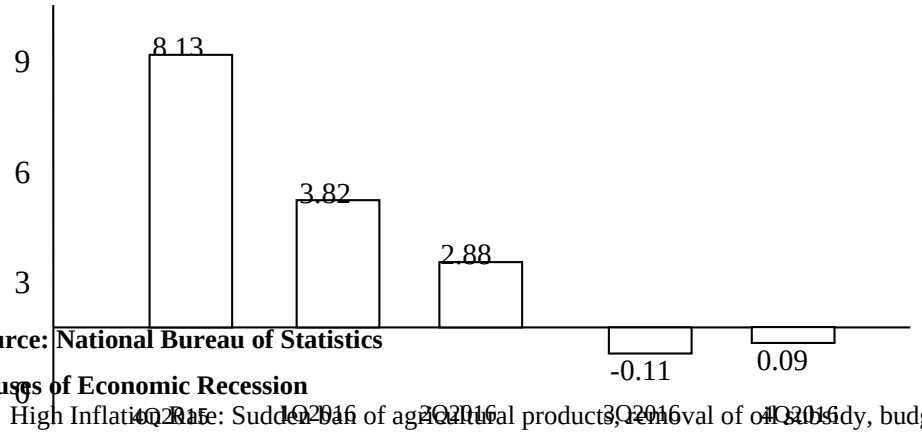
Nigerians are conversant with news h

i. GDP declines more than expected
ii. Inflation rises further (Now drops from 17.24% to 16.25%)
iii. Capital importation declines
iv. Unemployment rate rises (Now 14.2% more than 11.55 million)
v. Foreign investment inflow declines (41% lowest in 10 years) unemployed people as against 9.48 million at the beginning of 2016.
vi. Naira crumbles to ? per $
vii. Trends in poverty rises (From 30.3% in 2010 to 69% in 2014 Nigeria insight 2014

viii. Crime cases increases in different States in Nigeria
ix. Government promises the citizens a brighter future and so on.

The different sectors of the Nigerian Economy are affected by the negative economic growth-recession. Education sector is not an exception. Education consequently contracted by – 0.09% in the fourth quarter of 2016 from 3.82% in the first quarter of the same year.

Fig 3: Growth Rate in Education Sector 2015/2016 Education



Source: National Bureau of Statistics

Causes of Economic Recession

a. High Inflation Rate: Sudden ban of agricultural products, removal of oil subsidy, budget delay etc.
b. High-Interest Rate: Few investors leading to high unemployment and damage to the country's GDP.
c. Debt Accumulation: Foreign debts
d. High taxation: Crippled small businesses
e. Policy conflict: Tight monetary policy measures through high interest and tax rates.
f. Implementation of Treasure Single Account meant to consolidate all funds of the Federal Government.
g. Appointment and employment of uneducated economic managers in leadership, administration and governance.

Ways of Mitigating Economic Recession

Economic Recession can be checked through the following measures:

a. Reduction in tax rate
b. Planned and Strategic spending e.g. Agriculture, manufacturing and most importantly education.
c. Improved consumer access to credit
d. Policies that will restore consumer confidence
e. Responsiveness and sensitivity to data
f. Adequate investment and improvement of the educational system.

The Place of Qualitative and Functional Teacher Education in Mitigating Economic Recession

Education is attributed the best instrument for socio economic emancipation and transformation; reduction of poverty, inequality and ignorance. It is a prerequisite for quality manpower development, health and wealth creation; a sure path to a successful life and service to humanity. Qualitative and functional education ensures the accomplishment of these feats by their recipients. This is possible because of the variant nature of functional education which include:

a. Literacy programmes
b. Vocational education
c. Science education
d. Teacher training and
e. Special education (educating persons that are physically challenged)

These enable the students to acquire relevant knowledge, skills, values, insight and attitude that can be practically employed or applied purposefully. In the context of global economy, functional education succeeds as it seeks to equip learners with a broad array of knowledge, skills, competencies and values as shown in table 3.

Table 3: Skill Requirement Mirror

Skill	Explanations
	Digital Age Literacy
Functional Literacy	Ability to decipher meaning and express ideas in a range of media; this include the use of image, graphics, videos, charts and graphs of visual literacy
Scientific Literacy	Understanding both the theoretical and applied aspects of science and mathematics
Technological Literacy	Competence in the use of information and communication technologies

Information Literacy	Ability to find, evaluate and make appropriate use of information, including the use of ICTs
Cultural Literacy	Appreciation of the diversities of culture
Global Awareness	Understanding of how nations and communities all over the world are interrelated
	Inventive Thinking
Adaptability	Ability to adapt and manage in a complex interdependent world
Curiosity	Desire to know
Creativity	Ability to use imagination to create new things
Risk-taking	Ability to take risks
High Order Thinking	Creative problem-solving and logical thinking that result in sound judgment
	Effective Communication
Teaming	Ability to work in a team
Collaboration and inter-personal skills	Ability to interact smoothly and work effectively with others
Personal and Social Responsibility	Be accountable for the way ICTs are used and learn to use ICTs for the good of the public
Interactive Communication	Competence in conveying, transmitting, assessing and understanding information
High Productivity	Ability to prioritize, plan and manage problems and projects to achieve the desired result. Ability to apply what they learn in the classroom to real life contexts to create relevant high quality products.

Source: Agbaje, 2011

An individual exposed to qualitative and functional education who acquired the requisite skills as enumerated in the table will be well equipped and ready to face the challenges of the present and prepared for that of the future when they manifest. This supports the opinion of Nwaka 2010 that a well administered education would equip individuals with the capacity to understand and adapt to new problems and changing situations, awaken intellectual curiosity, encourage their spirit of inquiry and make them inventive, self reliant and resourceful.

There is therefore no doubt that a well planned, administered and supervised qualitative and functional education will go a long way in reducing and checking economic recession. It is the planned and guided application of qualitative and functional teacher education that engender national development which entails the ability of a country to improve the social welfare of the people, thereby eliminating economic recession.

The Way Forward

No nation can achieve any meaningful social, economic, political, technological, human and over all national development outside education. It is pertinent that the government gives the educational system of this nation the deserved seriousness, attention, commitment and resources necessary to move this nation forward to the fore front in the international world. These recommendations are therefore made. The government should ensure:

1. Improved and adequate budgetary allocation to education and disbursement of such at all levels.
2. Better condition of service for teachers
3. Improved educational materials, equipment, facilities and infrastructure.
4. Recruitment and employment of qualified and competent teachers, educational administrators as well as other educational personnel
5. Training and retraining of serving teachers and other educational personnel
6. One year compulsory teaching practice with pay as a prerequisite for being certified a trained and qualified teacher
7. Properly equipped, furnished and resourceful TRCN outfit for registration, licencing and quality control for teachers.
8. Functional ICT and CET centers in all the higher education institutions.

Conclusion

Education is key to self, economic, social, political and over all national development. To achieve this, the learners must acquire knowledge and skills that will bring about desired changes in behaviour. This implies effective teaching and learning process attainable only with the help of a well trained, qualified and committed teacher. This teacher therefore impacts knowledge and skills in the learner and helps him to develop his potentials to become functional, pragmatic, productive and useful citizen. With this, a generation of critical thinking, hard working, committed and dedicated, virtue packed, accountable, responsible and responsive people emerge who will fearlessly and courageously face the economic crises of this nation. Economic recession is not new globally and in Nigeria but requires educated men and women to take the bull by the horn and stir this nation back on the right course toward economic emancipation from the pit of recession as the giant of African and a fast growing and developing nation of the world. Thus, qualitative and functional teacher education is a milestone toward helping Nigerian economy recover from recession and become buoyant.

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Business Education as an instrument for poverty and unemployment reduction in Lesotho

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Abstract- This study is based on a larger study undertaken by Thaanyane, 2010, whose aim was to investigate the teachers' experiences of implementing Business Education in three secondary schools in Maseru, Lesotho. Lesotho is recently experiencing high rate of poverty and unemployment which impact badly on its economy. This paper tries to bridge the gap between schooling and world of work. It examines how Business Education can be used as an instrument for poverty and unemployment reduction. It, specifically, explores how Business Education teachers equip learners with entrepreneurial skills and allow learners experience the business by running their own projects. Interviews were carried out with Business Education teachers. The results of these interviews revealed that some teachers lack business orientation and may not be able to effectively impart the desired knowledge and entrepreneurial skills to the students. Some parade themselves as Business Education teachers, and have in some cases, as a result of their numbers and the instrumentality of their institutions and don not let students to lay hands or experience running a project. The examinations are major drive of the curriculum to be taught in class. Some teachers are engaged in rote learning in the last days of school. As a result, Business Education does not achieve what is intended to do at schools.

Index Terms- Business Education, instrument, poverty, unemployment, project, entrepreneurial skills.

I. Introduction

Lesotho is recently in the midst of experiencing an increase in the rate of poverty and unemployment. The government of Lesotho, through its Ministry of Education and Training, has sought to use Business Education to increase employment rates to tackle poverty and unemployment. This is because; all people are expecting to be employed by the government, irrespective of its initiatives of introducing practical subjects. Business Education included as a subject to be used to increase self-employment. Business Education has been increasingly accepted as an important means and valuable strategy for job creation.

The Ministry of Education and Training in Lesotho, like any other countries, has recently reconstructed their secondary schools curricula to suit the existing economic and social life by trying to provide students with education that can adequately prepare them for the world of work (MOET, 2008). For the Lesotho's education system to truly respond to the needs of poor and contribute to wealth creation in communities and society at large, like other countries, has to take the issue of poverty into special consideration in the planning of educational services. Essentially, it has to stress the preparation of all children to achieve at school, and empower them by lightening their awareness of their rights and responsibilities, their abilities, and enhance their self-confidence to enable them to improve their lives (UNESCO, 2001).Despite this initiative of Ministry of Education and Training to eradicate unemployment and poverty, the nation's economy is still characterized by high rate of unemployment and poverty. This uncontrolled rate of unemployment and poverty has brought about the need to carry out some modifications in the curriculums in schools so that the students are exposed to creative thinking sufficient enough to establish and run their own businesses. The introduction of Business Education has to influence individuals to contribute meaningfully to economic growth and development of the nation. This is done through the integration of the project into the curriculum of Business Education to provide additional skills, resources, and methodologies appropriate to the teaching of Business Education curriculum (Nketekete & Motebang, 2008). As part of the community, I have observed that there are a lot of students who dropped out of school before even sitting for the Junior Certificate Examinations (JC) because their parents cannot afford to pay school fees .These drop outs are sometimes tempted to idle and involved in some illegal crimes such as theft, hijacking and rape. Some students are seen in streets loitering; some of them end up engaged in robbery and burglary because of unemployment. Ebeigbe and Nwaham (2013) add that Business Education therefore can be said to imply safety from harm, it is the protection of individual, state or organization against criminal activities such as terrorism, kidnapping, stealing, robbery, gangterism, riot, killings, and arson among others. Regarding the current level of unemployment in the country, entrepreneurship Business Education has the potentials to reduce poverty through involvement of business education graduates in small scale business operations (Naboth-Odums, 2012).

This new curriculum was intended to transform and reflect the skills learned and their application in the society or world of work (Majara, 2004).As Setoi (2012) points out, Lesotho faces a big challenge in relation to youth unemployment which is partly a result of the failure of the school system to retain youth and partly the result of global trends that highlight the importance of the knowledge economy. There is a growing concern that schools are not producing citizens that are able to apply their knowledge across a variety of context. Business Education is supposed to solve these problems because it develops learners who are 'job

creators instead of job seekers'. To cater for the nature of Business Education and business knowledge, a number of teaching methods have been suggested. These include action-oriented learning in which students participate in small in-school business projects, virtual and real businesses-like training firms and case study methods and study visits (Hytti and O'Gorman, 2004; Co and Mitchell, 2006).

The few teaching methods that are used by teachers in teaching and learning contexts in Lesotho are found to be teacher dominated, leaving little or no room for learner-centred pedagogies (Nketekete and Motebang, 2008). Studies have been done on similar problem and the results of the study showed that education transforms the raw human beings into productive human capital by inculcating the skills required by both the traditional sector and the modern sector of the economy and makes the individuals more productive not only in the market place but also in the household.In other countries they use Entrepreneurship Education, which is similar to Business Education, as a start-up model to keep at-risk students in school by helping them plan and operate a small school-based or independent business. These programs have the benefits of offering a traditional education of entrepreneurial and business principles, a real-world application in business operation, and the generation of valued income for the students (Riggieri, 2010). Smit and Liebenberg (2003);Yagi, (2001)tested the prediction that unemployment and poverty may be caused by the high rate of learners who drop out of schools at early age of schooling which include a wide variation in the learners' backgrounds, slow progress and irregular attendance of the learners, inadequate infrastructural facilities, lack of basic materials. They also pointed out that learner-centred or constructive learning may be a cure for this problem. Such a teaching-learning environment means that extra support is necessary to enable teachers to build up their motivation, confidence and skills to engage in teaching.

The study used structured interviews, which were open-ended to allow participants to answer in whatever way they chose.Meaning those interviews were conducted in a manner that is similar to a friendly conversation with no predetermined order of questions or specified wording to the questions. The researcher used open-ended questions because they are more important because they solicit more information than closed questions. They are also important because they provided the participants with opportunities to express themselves freely, and they eliminated the possibility of interviewer's bias (Cohen, Manion & Morrison, 2007). After data has been collected by the researcher, it was then analysed. The first step in analysing data was to read and write memos about all field notes, transcripts and observer's comments to get the initial sense of the data. In analysing data the researcher familiarised herself with the audio recordings by listening to the entire audio recordings several times and reading the transcripts a number of times in order to provide a context for the emergence of specific units of meaning and later on themes (Cohen et al, 2007). Analysing raw data requires the researcher to establish categories which were applied on the raw data and then be broken into few manageable groups and given codes. Codes then built relationships or differences supporting or conflicting with original (Thaanyane, 2010).

This is also argued by the teachers that these skills will help students survive even if they drop out of school at any level. But the same policy is silent about the financing of the Business Education Project as a practical subject that equips students with these skills. Therefore, contributing money for the start prohibits students into participating in the project. Some of these students are orphans who are sponsored hence have no money to contribute for the project. They are not allowed to continue with the project for this reason. It was also reported that the training that was offered when this curriculum was first introduced did not adequately guide teachers on how to help students on carrying the project.

II. RESEARCH QUESTIONS OR HYPOTHESES

1. What methods are used by teachers in teaching Business Education?
2. Do Business Education teachers teach businessly?

III. RESEARCH METHODS

The study used the semi-structured interviews as a method of collecting, which involved direct interactions between the researchers and participant. Semi-structured interviews were conducted as methodology allows the researchers to interact with each respondent on the basis of a set of pre-determined questions. It also opens the way for more questioning and negotiation of meaning between researcher and respondent within the context of the research (Minichiello & Kotler, 2010). The researcher preferred semi-structured interviews in administering questions for data collection purposes. Prompt questions were designed to stimulate discussion and elicit teachers' opinions. o avoid free movement of the conversation in covering any issue of interest or going astray guided questions were used. Supplementary questions were also asked to explore participants' opinions in more detail (Wiersma& Jurs, 2009). Manion (2000) maintains that the semi-structured interview which is scheduled enables re-ordering digression and probing further. These questions were open-ended and were used to allow participants to answer in their own way. This implied that those interviews were conducted in a manner that is similar to a friendly conversation with no predetermined order of questions or specified wording to the questions. Each interview was audio-taped, with approximately 30 minutes per interview. Participants were advised of issues ensuring anonymity and confidentiality. All interviews were recorded and transcribed as a way of understanding data for analysis and were subsequently coded. They are also important because they provided the participants with opportunities to express themselves freely, and they eliminated the possibility of interviewer's bias (Cohen, Manion & Morrison, 2007). They are also important because they provided the participants with opportunities to express themselves freely, and they eliminated the possibility of interviewer's bias (Cohen et al, 2007). Probing questions were also be used in the interviews as a guide to allow the participants the freedom of expressing themselves. After data has been collected by the researcher, it was then analysed. The first step in analysing data was to read and write memos about all field notes, transcripts and observer's comments to get the initial sense of the data. In analysing data the researcher familiarised herself with the audio recordings by listening to the entire audio

recordings several times and reading the transcripts a number of times in order to provide a context for the emergence of specific units of meaning and later on themes (Cohen et al, 2007).Analysing raw data required the researcher to establish categories from data which were applied on the raw data and then be broken into few manageable groups and given codes. Codes then built relationships or differences supporting or conflicting with original (Thaanyane, 2010).

IV. PRESENTATION AND DISCUSSION

Lack of business orientation

The results of this study showed that there are some teachers who lack business orientation. Teachers who are mainly not trained for the implementation of the Business Education or not made aware of how to implement it are not informed about business. This is argued by Elena and Markku (2003) that even though teachers awareness of Business Education, has grown and attitudes towards the theme has become more positive but teachers may not know enough about the aims, contents and work method of Business Education and therefore, may not be able to effectively impart the desired knowledge and entrepreneurial skills to the students. So, for quality of education to be guaranteed, emphasis should be placed on the quality of teaching, in order to ensure impressiveness, efficiency and productivity of education (Odunaike, Ijaduola and Epetimehin, 2012).

Lack of practice

Business Education is capital intensive since both teachers and students need money to practicalise the theory of initiating, establishing and running an enterprise some students do not actually do the project part because they do not have capital (money contributed to carry out the project). This may constitute a constraint and will subsequently frustrate the practice of entrepreneurship in Business Education at schools. Some teachers complained that school principals do not provide students with money to start the project as some do not afford paying it. They complained that schools can make students pay special fees paid like other in practical subjects like Woodwork, Agriculture and Home Economics. If properly implemented, the objective of Business Education curriculum is capable of inculcating in learners the ability to float small scale businesses on graduation. In support to this, Agi and Yellowe (2013) also argued that educational managers and administrators are the ones who make education a building block of socio-economic empowerment, prosperity, self-reliance, employment crime reduction and national security, through improved access to quality.

Inadequate training

Most teachers seemed not to have been trained on the new curriculum so much that they were helped by the neighbouring schools with implementation and materials that were used then as not all schools did not received materials the first time.According to Conco (2004), the successful implementation of any new curriculum depends on the orientation, training and support teachers receive, and on the quality and use of learning support materials. He further indicates that if trainers lack confidence, knowledge and understanding to make the training process succeed, the cascading will result in good teaching. The action-oriented learning in which students participate in small in-school business projects, virtual and real businesses-like training firms and case study methods and study visits (Hytti and O'Gorman, 2004; Co and Mitchell, 2006). This is also supported by Asher (1998) outlining that a major factor of any curriculum failure is the lack of regard for the proper role played by teachers in the development of such curriculum. The teachers' role as developers lies in the translation of the conceptions of the society, learners and the subject. Unless teachers are given regular training on the implementation of the Business Education Project teachers will continue disseminating what they think is appropriate for the knowledge of the students and students will continue on failing

Teachers' commitment

Another problem seemed to be teachers who do not commit and engage themselves in helping students solve problems they encounter in running the project; hence they drill students in answering examinations questions. Agi and Yellowe (2013) argued that the problem is not about curriculum or investment in education neither is it non-availability of manpower for the sector, but that many have tended to look in the direction of management of education which include lack of policy analysis to make students to fit into society. This is argued by Okoli (2010) that in Business Education, people have more opportunities to exercise creative freedom, higher self-esteem and greater sense of control over their own lives. This has to be so because entrepreneurship in Business Education serves as an instrument for students through which they are powered to control their future. Other complained that `project is most troublesome and tiresome part to the school as a whole, because students buy and sell during classes. Ekpenyong (2010) explained that the traditional method of instructions in Business Education created a gap between schooling and the world of work. These missing resources in the place of instructions are responsible for the inability of Business Education graduates from venturing into self-reliant employment but instead, prefer to join the endless queue of unemployed graduates.

Assessment driven-curriculum

Teachers reported that Lesotho's curricula is seen driven by assessment body who makes it easy on its part by encouraging examiners to set easy questions to save time and money spend during marking exams(in this case the project as the integral part, carries not even a half of the examination marks. To fit in situation like this, teachers tend to drill their students for examinations instead of following the logic of assessing the implemented curriculum. Examination of project should start as early as the schools begin to find if students really do it. Some teachers showed that Business Education project can be more effective if the appropriate (assessment) can begin as early as Form A so that students are forced to really do it. This would prevent teachers in drilling and doing it as the last item on the curriculum.

Resistance to change

Some teachers are resistant to change their traditional methods of instruction in Business Education which was used in teaching Bookkeeping and Commerce and this still created a gap between schooling and the world of work. This is supported by Ekpenyong (2010) when explaining that the traditional method of

instructions that teachers use in Business Education created a gap between schooling and the world of work. The missing resources in the place of instructions are responsible for the inability of Business Education graduates from venturing into self-reliant employment but instead; prefer to join the endless queue of unemployed graduates.

Some teachers complained that school principals do not give students money they can use to start the project which can be in the form of fees that are paid for other practical subjects like Woodwork, Agriculture and Home Economics. If properly implemented, the objective of Business Education programme is capable of inculcating in learners the ability to float small scale businesses on graduation. Marsh (2001) found that projects receiving the principal's support were more likely to succeed, since the principal's involvement indicates that the project is being taken seriously, and it helps in recruiting both material resources and psychological support). These students would be able to address the emerging issues pertaining to new demands, practices and life challenges of the modern global world.

But even the trained teachers did not have adequate skills to disseminate what they were trained on by other teachers. According to Conco (2004), the successful implementation of any new curriculum depends on the orientation, training and support teachers receive, and on the quality and use of learning support materials. He further indicates that if trainers lack confidence, knowledge and understanding to make the training process succeed, the cascading will result in good teaching. This is supported by Agi and Yellowe (2013) that educational managers and administrators to make education a building block of socio-economic empowerment, prosperity, self-reliance, employment crime reduction and national security, through improved access to quality,

Another problem seem to be that of teachers who do not want to engage themselves in helping students solve problems they encounter in running the project, they drill students in the last days towards examinations. Agi and Yellowe (2013) showed that the problem is not about curriculum or investment in education neither is it non-availability of manpower for the sector, but that many have tended to look in the direction of management of education which include lack of policy analysis to make students to fit into society.Agi and Yellowe (2013) also supports this when they asserted that the goals of wealth creation or generation, poverty reduction and value re-orientation can only be attained and sustained through an efficient education system which impacts the relevant skills, knowledge, capacities, attitudes and values. Evidence can be seen with many primary and secondary schools and tertiary institution's graduates not gainfully employed either by self or government.

Entrepreneurship education is about developing attitudes, behaviours and capacities at the individual level. It is also about the application of those skills and attitudes that can take many forms during an individual's career, creating a range of long-term benefits to society and the economy. If students are not guided or given chance to put the theory learned into practice, still it can be difficult for Business Education to have impact on students.

V. CONCLUSION

Inclusion of business projects in Business Education curriculum was to bring in the aspect of entrepreneurship to the fore. Despite this logical design of the curriculum, it has emerged from experience that projects are not integrated as originally intended but treated as preparing learning for examination by some teachers. The examiner's report states that the project part of the examination is always not well performed by some schools. It is also reflected in the society where poverty is overruling in Lesotho from experience.

It has been a practice to most of the teachers that they do not let students practice or put hands on the project that is proposed to be the integral part of Business Education in equipping students with skills that last longer in life. In applying these skills, these students, in their own communities would create jobs for themselves and for other people. This will in turn, increase economy of the country. It seems it is still a problem that some of the teachers are experiencing problems ort lacking something in their implementation. Not only teachers impact negatively on the results or products (students), but examination body as well does as it seems to be driving the curriculum in determining what to be taught. This is not a normal practice because examinations have follow at the end of the course. There is a growing concern that schools are not producing citizens that are able to apply their knowledge across a variety of context. It is therefore, central to the whole vision of the Ministry of education that Basotho shall be a functionally literate society by the year 2020. This is not encouraging youth and adults to consider entrepreneurship as a viable career path as Business Education expand the pool of potential entrepreneurs but also help trigger wider interest in and support for those seeking to start and grow new companies. Such diversity among potential entrepreneurs means a broader source of ideas and perspectives in opportunity recognition and solution development.

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Assessing the Effect of Incorporating Ethno-Mathematics Strategies on Students' Achievement in Functions.

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Abstract- The aim of this study was to assess the effect of incorporating Ethno-mathematics strategies on students' achievement in functions among the eleventh grade students. In addition, this study sought to examine gender differences on achievement and attitude. The respondents of this study comprised 122 conveniently selected eleventh grade students of Mpongwe Day Secondary school in Mpongwe District, Copperbelt Province, Zambia. A pre-test and post-test Quasi Experimental research design was used by randomly assigning treatment variables to the two classes which were used for the research. The experimental group (N=64) received instructions on functions using ethno-mathematics strategies while the observational group (N = 58) received instructions on functions using conventional teaching methods. The Questionnaire on Student Attitude towards functions (MAS) and Questionnaire on Teachers Approaches (MTAQ) were used to measure students' attitudes towards mathematics whereas achievement was measured using the Ethno-mathematics achievement test on functions (ETHNOMAT). The results showed that students taught functions using ethno-mathematics were associated with a significantly higher mean achievement than those taught using other conventional strategies ($t(120) = 5.669$, $p = 0$). However the research findings, revealed that gender was not associated with any statistically significant effect on achievement in ethno-mathematics ($t(60) = 1.651$, $p = 0.107$). Results from the study also revealed that there was a statistically significant difference in attitudes between the experimental and observational groups of students (F-value =4.271,P<0.041). The study revealed only a weak positive Pearson's Correlation Coefficient between MAS and MTAQ ($r = 0.369$, $p > 0.05$). The corresponding R2 value of 0.136 can be interpreted that the contribution of the teacher's approach on student's attitude towards functions is rather poor (13.6%).

Index Terms- Ethno-mathematics, Ivory Tower, Achievement, Contextualization, Functions

I. Introduction

Background

Lusaka times (2018/11/29) reports that Zambia has continued to rank as one of the lowest in mathematics and science in annual performance assessment reports in the Southern part of Africa. Deficiencies in teaching strategies and methodologies used by teachers were alluded to as the root cause of the pathetic condition. Additionally, Bekalevu (1998) links this problem of continuous low performance in mathematics of students from third world countries in general to lack of cultural consonance in the mathematics curriculum.

The scourge has had been a serious problem of local concern at Mpongwe Day Secondary School where the pass rates in Mathematics at School Certificate level have been oscillating below the targeted provincial pass rate of 70% since the opening of the school six years ago. At the named institution where the research was conducted, symptoms of poor orientation to mathematics learning in general included: inability for the 11th grade students to handle algebraic expressions, graphical representation of quantities and all other interrelated concepts pointing to lack of the background knowledge of functions. Eisenberg (1991) and Carlson, et al (2005) reiterate that it has been widely agreed that the concept of functions is difficult to learn. Eisenberg (1991) further observes that unwillingness to stress the visual aspects of functions by teachers is a serious impediment to students' learning Mathematics in general.

However Yerushalmy and Schwartz (1993) posited that the topic of functions remains to be one of the fundamental concepts of modem day Mathematics, virtually permeating all the areas of the subject. Martin (2003) advocates for good teaching to be supplemented by research by individual teachers in order to validate the effectiveness of their teaching strategies and establish what works well for them. Against this background, therefore, the study was conducted in order to to assess the effect of incorporating ethno-mathematics strategies on students' achievement in functions among the 11th grade students at Mpongwe Day secondary school.

The rationale for the study to incorporate ethno-mathematics in teaching the perceived difficult topic of functions is further championed by Zaslavsky (1991) who suggests that including the cultural aspects of students in the mathematics curriculum in general can deepen students understanding of mathematics, boost their recognition of mathematics as part of everyday life and enhance their ability to make meaningful connections between mathematics and cultural practices. Raussen and Skau (2010) further lament that agents of academic mathematics are usually so encaged in their ivory towers that they don't see the world well enough either. therefore they continue presenting mathematics in form a very cold austere, Rosa (2016) highlight that ethno-mathematics provide the exit way to go out,

gather rich cultural heritage resources and create a perspective of teaching that will bring mathematics closer to reality. Additionally, Rosa (2016) opined that Ethno-mathematics is dynamic or evolutionary, holistic, transdisciplinary and transcultural rendering it more vital for teaching any form of academic mathematics. D'Ambrosio (1987) contends that even before that advent of ethno-mathematics, over three decades ago, there still has had been tendency to peep into culture for solutions. He hypothesizes that harnessing cultural values as a means of conveying mathematical content helps to emphasize the relevance of mathematics to the learners' lives, which in turn makes the lesson more interesting and enjoyable. Everyday applications of culture into mathematics trigger students' curiosity and motivation to learner.

II. Literature Review

Ethno-mathematics, coined by D'Ambrosio (1985), is rather a means than an end in itself. Orey (2000) defines Ethno-mathematics as the sum total of all mathematical concepts embedded in cultural practices that might be characterized as "a tool to act in the world". He maintains that all cultures and all people develop unique methods and sophisticated explications to understand and to transform their own realities. This natural tendency can be harnessed to teach academic mathematics. Barton (1996) described ethno-mathematics as a program that investigates the ways in which different cultural groups comprehend, articulate, and apply concepts and practices that can be identified as mathematical practices. Borba (1997) on the other hand terms ethno-mathematics as a way in which people from a particular culture use mathematical ideas and concepts for dealing with quantitative, relational, and spatial aspects of their lives. Dowling (1991), Rosa and Orey (2007) point out that this way of viewing mathematics validates and affirms all people's experience of mathematics because it demonstrates that mathematical thinking is inherent to their lives. From this perspective mathematics is identified in cultural activities in traditional and non-traditional societies. D'Ambrosio (2001) stated that ethno-mathematics has come to mean the study of how people within various cultural groups develop techniques to explain and understand their world in response to problems, struggles, and endeavours of human survival. This includes material needs as well as art and spirituality through the use of the development of cultural artefacts; objects created by members of a specific cultural group that inherently give cultural clues about the culture of its creator and users. Rosa and Orey (2008) stated that this perspective "provides an important opportunity for educators to link current events and the importance of these artefacts in the context of ethno-mathematics, history, and culture"

Perceived benefits of Ethno-mathematics mathematics education in general include curricular relevance as builds knowledge around the local interests, needs, cultural backgrounds, social interactions, the past and present experiences as well as the immediate environment of students, according to D'Ambrosio (1987, 2001), According to Adam et.al (2003), a culturally relevant mathematics curriculum based on an ethno-mathematical perspective infuses the students' cultural backgrounds in the learning environment in a holistic manner. Vitally, therefore, infusing ethno-mathematics in teaching academic mathematics in general is a practice that is pictured to satisfy the viewpoints of non-zero-some meaningful learning theories such as the Taxonomy of Significant Learning proposed by Finks (2003) which brings on board affective domain and humanising of teaching the academic mathematics. It can also be argued that some of the perceived beneficial attributes of ethno-mathematics posited by D'Ambrosio (1987, 2001) are engrained in the revised model for Bloom's taxonomy of learning done by Anderson and Krathwohl (2001).These attributes include (1) revitalizing the interest for active learner participation, (2) deepening understanding or comprehension of concepts, (3) enhancing learner's responsibility to construct their own new knowledge based on already existing forms of knowledge through contextualization of the lessons and (5) and orienting learners to problem solving skills .

The different researches conducted on ethno-mathematics of in the past three and a half decades have not only insufficiently answered all the questions on the vast and dynamically evolving subject matter but also creating further knowledge gaps as some researches have in produced disagreeing findings. For example Sochima (2013) in his research conducted on 156 Senior Secondary School students from Enugu State of Nigeria found that the ethno-mathematic was effective in enhancing students' achievement in mensuration. On the other hand Amita and Qouder (2016) conducted a research amongst native students from a native Bedouin tribe at a school in Australia but the findings showed that ethno-mathematics had no effect on achievement in tests and the results shocked the two researchers. The other exciting feature of the research findings of Sochima (2013) on ethno-mathematics were that there was a statistically significant difference in the achievement between males and females after exposure to ethno-mathematics materials; a claim which the research aims to either confirm or refute as the findings have serious implications of the choice of ethno-mathematics as a teaching strategy in a co-educational school like Mpongwe Day Secondary School.

There was therefore good motivation to conduct a parallel research in order to fill up the imaging knowledge gaps resulting from such research findings This study is important as it provides lenses to goggle into culture elements in order to pick subtle examples that can be used to improve the quality of teaching and learning of mathematics and in particular functions in classrooms.

Gerdes (2005) and Palares (2012) highlighted further motivational examples of how to translate into classroom applications the study of patterns and symmetry found in daily life items used in particular professional activities of people throughout Africa such as baskets and foremen, masons, or folk dancers.

The study therefore involved finding cultural connections needed for improvement and enrichment of pedagogical strategies meant to help learners face the challenging topic of functions and other related topics squarely.

From the above explanation, two research questions were formulated to guide the study. Firstly, what is the effect of using ethno-mathematics strategies on students' mean achievement in functions? Secondly, what is the effect of gender on the mean achievement among students taught functions using ethno-mathematics?

Attitudes towards Mathematics

Prior to the study, it was observed by the researcher that the general status quo of the students' attitude to learning Mathematics at the institution (Mpongwe Day secondary School) had fitted very well with that outlined by Nostrand (2008), "Many students have erroneous impressions about Mathematics and dislike Mathematical activities; many seem to fear, even hate Mathematics". Hart in Zan and Di Martino (2007) define student's attitudes towards mathematics as the emotional response either positive or negative associated to mathematics, confidence to succeed in studying mathematics, and strategies in coping with mathematical problems. Zan and Di Martino (2007) report that attitudes towards mathematics have an important role in determining learning achievement on mathematics and argue that students with positive attitudes towards mathematic will have higher scores in mathematics achievement.

Contextualization and RME in Ethno-mathematics

Realistic Mathematics Education as an approach was first developed by the Freudenthal Institute in the Netherlands in 1971. The RME approach for mathematics is widely accepted as the best and most detailed approach, which was expanded from the problem-based approach for mathematics education. De Lange (1996) noted this theory has been adopted by a large number of countries all over the world such as England, Germany, Denmark, Spain, Portugal, South Africa, Brazil, USA, Japan, and Malaysia. RME is aimed at transforming mathematics learning into a fun and meaningful experience for students by introducing problems within contexts. The starting point in RME is choosing problems relevant to student experiences and knowledge. The teacher's role in this form of education is to act as a facilitator to help students solve contextual problems. This contextual problem-solving activity brings positive impact to the mathematical representation of students, which is related to their problem solving skills. The best way to teach mathematics is to provide students with meaningful experiences by solving the issues they face every day or by dealing with contextual problems. Realistic mathematics education enables the alteration of the mathematical material concept and its relationship. Realistic mathematics education changes the culture towards a dynamic one, but still in the corridor of the educational process.

Therefore, realistic mathematics education is an innovative learning approach that emphasizes mathematics as a human activity that must be associated with real life using real world context as the starting point of learning. Mathematics education motivates students to become critical and innovative and to cultivate sound reasoning in problem solving. Mathematics education is an active, dynamic and continuous process; activities in mathematics education help students develop their reasoning, to think logically, systematically, critically and thoroughly and to adopt an objective and open attitude when dealing with problems. Problem-solving skills enable students to think creatively and critically by using progressive and challenging thought processes; creative and critical thinking will help develop a nation and address its needs.

Adam (2002) maintains that the one particular approach to teaching mathematics that has been focused in researches over the past three decades which has been postulated to making the teaching of functions in mathematics more relevant, realistic, and meaningful to students and to promote the overall quality of education is incorporating of ethno-mathematics.

Research Questions

The focus of this paper is to answer the following questions Research Questions.

1. What is the effect of using ethno-mathematics strategies on students' mean achievement in functions?
2. What is the effect of gender on the mean achievement among students taught functions using ethno-mathematics?

Research Hypotheses

The following null hypotheses were formulated to guide the study.

$H_0 1$: There is no statistically significant difference between the mean achievement of students taught functions with ethno-mathematics strategies and those taught with conventional strategies.

$H_0 2$: There is no statistically significant difference between the mean achievement of male and female students taught functions using ethno-mathematics strategies.

III. Methods

Sampling procedure

A non-random-convenient sample was drawn out of a total population of 240 eleventh grade students at Mpongwe day secondary School. The Raosoft online sample size calculator was utilized to estimate the thresh-hold at 122. Accordingly, two natural classes were purposefully chosen and randomly assigned to the treatment variables. The Experimental Group, consisted of 64 students (34 boys and 28 girls), was taught functions incorporating ethno-mathematics into lessons. The Observation Group, consisting of 58 students (36 boys and 22 girls) was taught functions other conventional strategies.

Research Instruments

Quantitative data analysis research was used in the study. A proxy pre-test was given, and an ETHNOMAT post-test were given after the experimentation. The mean scores or achievement of the students were recorded. Additional information for the research was obtained from the questionnaires using an adaptation of the 5–point Likert–type scales called Mathematics Attitude Scale (MAS) and Mathematics Teachers' Approaches Questionnaire (MTAQ) which were originally developed by Alkan, Bukova Güzel and Elçi (2004). The MAS was used to determine the students' attitudes towards functions and the MTAQ was utilized for identifying mathematics teachers' approaches during class activities.

The MAS consisted of 21 subdivided into four broader sub-scales, namely: self-confidence in mathematics (6 items), perceived value of mathematics (5 items), mathematics enjoyment (5 items), and mathematics motivation (4 items).The Scores of attitudes towards mathematics is the total score of the four domains in MAS. The scores on self-confidence in mathematics described students' self-esteem and self-concept on their performance in mathematical tasks. The scores on perceived value of mathematics described students' beliefs on the usefulness, relevance and value of mathematics in the present life and the

future. The scores on enjoyment of mathematics described the pleasure of students in learning mathematics in class. The scores on motivation to do mathematics described students' interest on mathematics and willingness to continue their study on mathematics. Prior to the administering of the instrument, a pilot test was carried out on 40 students using simple random selection on eleventh grade students from the Mpongwe day Secondary School. The overall validity of MAS was calculated at 0.517, and the Cronbach α reliability value was 0.798. The internal consistencies of the items ranged from 0.771 - 0.838 as shown in the table 1.

For the convenience of this study the corresponding MTAQ set of instrumentation was adapted to assess the effect of teacher's ethno-mathematics-wise orientation to teaching on the students' attitude towards functions. The internal consistencies of the items ranged from 0.762 - 0.825 and the Cronbach α reliability value was 0.809.

Table 1: *Validity and Reliability of MAQ*

	items	Items no	Cronbach α
1 self-confidence in	4	2, 4, 8, 9, 13, 14	0.771 - 0.797
2 perceived value of	6	1, 5, 6, 10, 15,	0.777 - 0.836
3 mathematics enjoyment	5	3, 7, 20, 21	0.776 - 0833
4 mathematics motivation	5	11,12, 16, 17,	0.794 – 0.838

The response rate from the respondents was 95% and the data collected were analysed statistically using the Statistical Package for Social Science/SPSS version 16.0. Analysis of means differences on mathematics achievement between the experimental and observational groups of students was performed through Independent Samples t-test whilst analysis of variance (ANOVA) was used to establish the effect of gender on achievement. The analysis of correlation among Students' Attitudes and Teachers' Approach was executed through Pearson's Correlation Coefficient in order to predict the Students' Attitudes toward mathematics in relation the Teachers' Approach on mathematics. All results were considered statistically significant at confidence interval of $\alpha = 0.05\%$.

Historical Descriptions of the Interventions
Ethno-mathematics Lesson Plans for the Experimental Group.

To complete this research project, the teacher researcher had to complete certain tasks that included creating lesson plans and actually conducting some lessons as well as assessment of students through common monthly tests. For the Experimental Group, lesson plans were made on relations and functions and integrating ethno-mathematics by the researcher.

Lesson 1
Introduction: Types of Relations and Definition of Functions
Ethno-mathematics: Dramatization of family Role Plays (Ukubuta: In Bemba)

The students acknowledged role plays in childhood and they had to relive their memories. The teacher had students choose family roles to dramatize such as: the child, wife, husband, or grandfather grandmother of 10 selected individuals, so that the classroom was divided into about 10 extended families. The theory behind the use of role-play in science and mathematics teaching and learning revolves around 'active', 'experiential' or 'child-centred' learning. According to Taylor (1987). Role play encourages learners to be physically and intellectually involved in their lessons to allow them to both express themselves in a scientific context and develop an understanding of difficult concepts.

The results of play roles chosen were put in arrow diagrams which pictured various types of relations. Students had to use the results to identify the type of relation such as: one-to-many, many-to-many, many-to many and one-to-one. The students were then tasked to give examples of social relations which were typical examples of relations that were functions and to elaborate their responses in group work. Their findings were document and some of the cases which excited debate among the students have been sketched in figure 1, figure 2 and figure 3 respectively. (Letters and not the real real names of participants have been used for ethical reasons).

Using for example the ethnicity and cultural taboos or cultural norms of the students' backgrounds, students had to identify the familial relations which typically represented functions from the set of relations tabulated from role play drama. An example of a one-to-one relation which typifies a function used for the ethno-mathematics lesson on functions was: "is a child of (the named) mother" in figure 1.

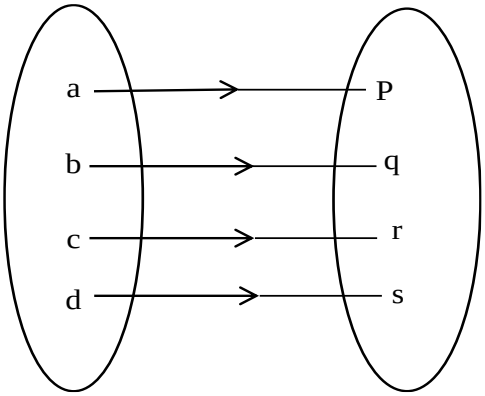

Figure 1 : The relation "is the child of ...mother " typifies a function

Every student was born from one mother. The local Bemba terms used commonly in the area, "bamayo mwaice" or "bamayo mukalamba", literally translated as " my younger mother" and "my older mother" are not real mothers but rather a mere traditional gracious ways of referring to "auntie" and this did not conflict the use of this example as one-to-one relation representing a typical function. One exciting example in this study which arose from the tabulated role play results and triggered debate was the relation depicted by figure 2.

To say decide whether a relation was a function or not involved looking at myths, taboos and society values. Student's responses indicated that barrenness was associated with curses of some kind and that this relation was considered to be "a taboo" in the cultural setting of the students. This relation was therefore used as a counter example of a function.

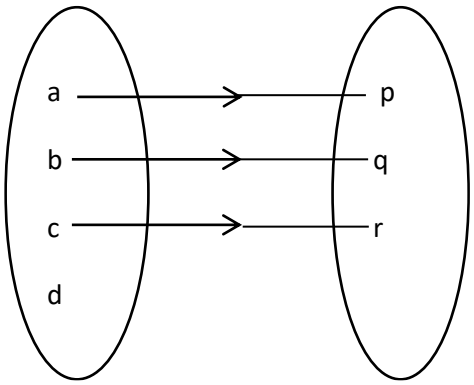

Figure 2: The relation "is the mother of " typifies a relation which is not a function

Student's responses indicated that it was very 'usual" for a woman to be married to one man although the man could be married to other wives. A function can be defined as a relation between two sets which associates to every element of a first set exactly one element of the second set. The contextualization of the definition and examples seemed to give the experimental group an added advantage to the observation group over language barriers in mastering the definition.

While 90% of the pupils experimental group were able to correctly identify a function only 80% of the students in the control group were all able to do so. To justify why for example students in the control group mistook figure 3 as not representing function was because r was not paired.

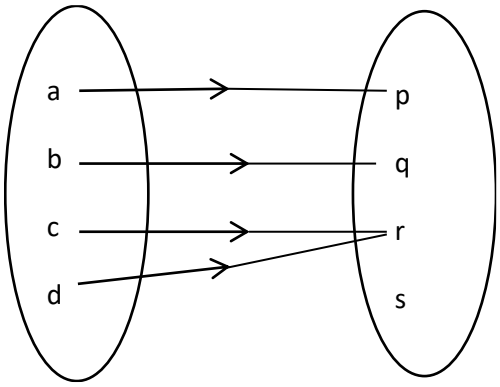

Figure 4.4.3: "is the wife of" typifies a relation which is a function for a group of married women only

To the effect that students were able to construct their own meaning of function composition, this amounted to a meaningful learning experience.

Lesson 2:
Subtopic: Function Evaluation and Function Composition

Ethno-mathematics Elements: Family Heritage or Family Trees

In this lesson genealogy was dramatized. One student had to volunteer to be the first ancestor (named as 1), 1 was allowed to choose his/her child (named as 2) 2 was also allowed to choose a child to beget and so on and until he chain was broken when a student chose to remain childless or when the list was long enough. The genealogy list was summarized as in a figure 4.4.4. (Actual names of the participants were withheld). A corresponding flow chart similar to figure 4.4.5 was used to develop the function notation, evaluation and composition.

Kafula (1)	**is the father of**	**James (2)**
James (2)	**is the father of**	**Mpasela (3)**
Mpasela (3)	**is the father of**	**Alick (4)**
Alick (4)	**is the father of**	**Kapilipili (5)**
Kapilipili (5)	**is the father of**	**Chiyombo (6)**
Chiyombo (6)	**is the father of**	**Dalitso (7)**

Figure 4.4.4: Sketch of data from Dramatization of a Genealogy

Students in the experimental group were asked to identify actual names of for example, the father to Mpasela, the father to Kapilipili, the grandfather to Alick, the father to the grandfather of Dalitso and so forth excitedly and easily.

The names of people in the ancestral tree were replaced by their generational position numbers and the results were put in the arrow diagrams in figure 4.4.4. The notation $f(x)$ was used to represent the expression "the father of the individual named$x$". Similarly, $g(x)$ was used to represent the expression is "the grandfather of the individual named$x$"

Accordingly, the students had to use the arrow diagram on figure 5 to evaluate functions. Names of students were replaced by numbers there by providing a passage way to enter in the formal language of function evaluation and composition within a relaxed environment.

ETHNO-MATHEMATICS EXERCISE

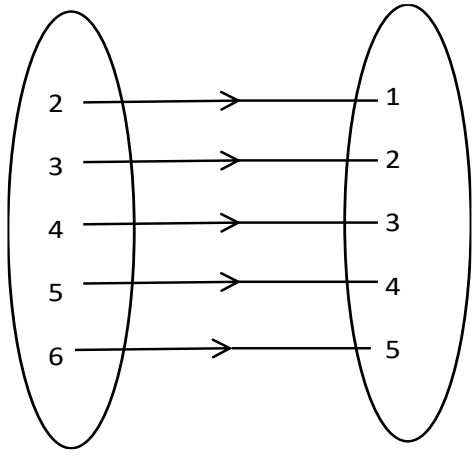

***Figure 4.4.5*: Arrow Diagram of Dramatized Genealogy**

Use figure 5 to evaluate the functions below.

(i) $f(2)$
(ii) $f(3)$
(iii) $f(7)$
(iv) $f(20)$
(v) $f(x)$
(vi) $g(4)$
(vii) $g(50)$
(viii) $g(x)$
(ix) $g(f(3))$
(x) $g(f(x))$

The students had to use the intuition from ethno-mathematics in genealogies to evaluate the functions and compositions of $f(x) = x - 1$ and $g(x) = x - 2$. Students had to construct their own methods two evaluate the functions.

(i) $f(2) = 2 - 1 = 1$
(ii) $f(3) = 3 - 1 = 2$
(iii) $f(7) = 7 - 1 = 6$
(iv) $f(20) = 20 - 1 = 19$
(v) $f(x) = x - 1$
(vi) $g(4) = 4 - 2 = 1$
(vii) $g(50) = 50 - 2$
(viii) $g(x) = x - 2$
(ix) $g(f(5)) = g(5 - 1) = (5 - 1) - 2 = 2$
(x) $g(f(x)) = g(x - 1) = (x - 1) - 2 = x - 3$

For example to explain $f(50)$, the students said the father to a 50th filial generation family member falls in filial generation number (50 – 1). Similarly the explanation for $g(f(x))$ was that the grandfather to the father of a family member x^{th} generation falls in the generation which is earlier by $(x - 1) - 2$ or simply $x - 3$ generations.

An ethno-mathematics related homework activity was given in which students had to estimate the total number of bricks on a traditionally baked kiln near the research site as shown on appendix E.

It was noted that the number of bricks on each layer was a dependent on the position of the layer from the top as indicated in figure 6.

Layer number From the top (N)	Number of bricks on the layer
1	12
2	16
3	28
4	36
.	.
.	.
.	.
N	$2N^2 + 10$

Figure 6: Ethinomathmatics activity to evaluate the function $f(N) = 2\boldsymbol{N^2} + 10$

Students were able countercheck the number of bricks on each layer by comparing their findings with the formula f(N) = $2N^2$ + 10. Therefore the students easily accepted the change from dealing with concrete visual ethno-mathematics object (kiln of traditionally baked bricks) to use of a formal algebraic representation of functions.

Lesson 3:
Subtopic: Function Inverses

Ethno-mathematics Elements: The Academic Tour (visit) to Her Chieftainship Lesa's Palace

In this lesson a walk to Her Royal Chieftainship Lesa's palace was simulated by simple sketch of the route to the place using familiar land marks identified by students from the previous day's academic tour to the palace. Short phrases and antonyms to describe the forward and back or reverse journeys respectively were used. The resulting sketch map resembled figure 7 and corresponding brief descriptions of the journeys were compared for the forward journey and the corresponding return journey..

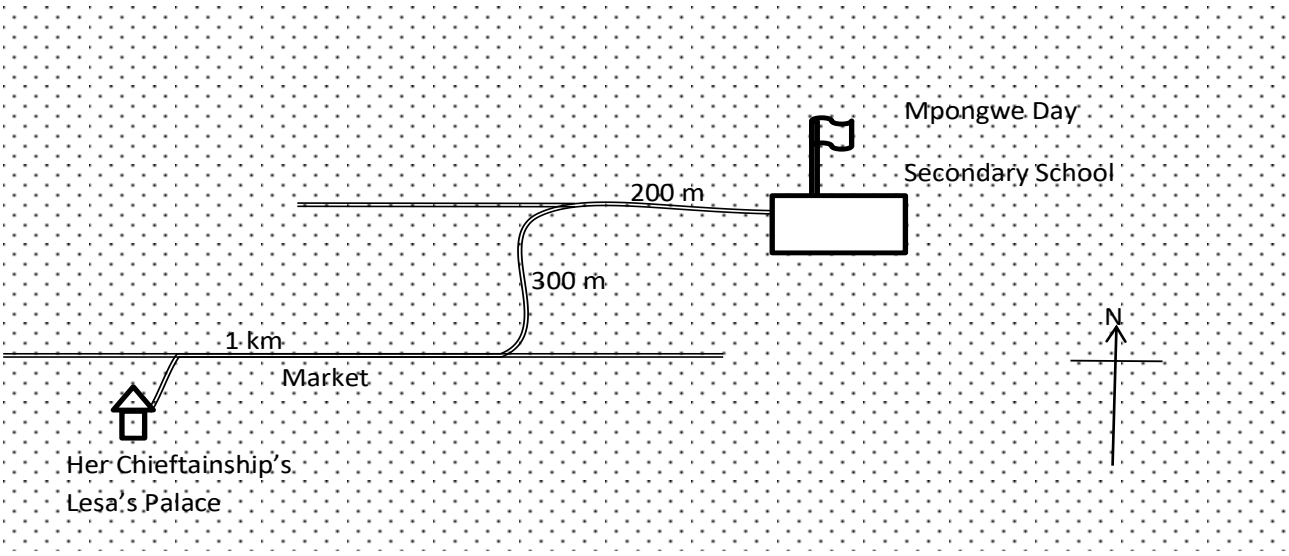

Figure 7: Sketch Map of the route to Her Royal Chieftainship's Traditional Home.

FORWARD JOURNEY

Starting from Mpongwe Day Secondary School, walk westwards 200m, turn left at path-junction, walk southwards 300m to tarmac junction, turn right, walk 1km westwards along tarmac, turn left at the palace junction and arrive Her chieftainship Lesa's Palace.

REVERSE JOURNEY

Depart from Her chieftainship Lesa's Palace walk right to the tarmac, walk 1km eastwards along tarmac Starting, turn right at path-junction walk and northwards 300m, turn right at another and walk eastwards 200m and arrive at Mpongwe Day Secondary School.

The approach was used to develop the concepts of inverses of functions such as
$f(x) = 2x + 1$.
Function: $f(x) = 2x + 1$
Start with a number: x , *multiply* x by 2 and *add* 1
The corresponding inverse function or reverse function is can found using the antonyms for multiply and add respectively and starting from the end of the sentence going backwards.
Start with a number , *subtract* 1 and *divide* x by 2
Therefore the Inverse or reverse process for $f(x) = 2x + 1$ was found as $f^{-1}(x) = \frac{x-1}{2}$

This way of presenting the inverse was more rigorous than the step-by-step method proposed by Chiyaka et al (2013).

To find the inverse for the function $f(x) = 2x - 1$, Chiyaka et al (2013) has proposed for a step-by-step detailed outline of the solution a follows:
STEP1: Let $y = 2x + 1$
STEP1: Interchanging y $i$and ix, we obtain $x = 2y + 1$
STEP1: Making y the subject of the formula, we obtain $y = \frac{x-1}{2}$.
Therefore the inverse of $f(x)$ is $f^{-1}(x) = \frac{x-1}{2}$
This method is of course more practical and can be used to work out inverses for rational functions which are less tractable for descriptive method of ethno-mathematics.

However, this is not surprising. In this regard, "ethno-mathematics can been characterized as a tool to act in the world" according to Orey (2000). It has merely been used to provide insights into the social role of academic mathematics. Ethno-mathematics has been used here to present the mathematical concepts of functions in a way in which these concepts are related to the cultural backgrounds of students. D'Ambrosio (2001) maintains that this approach enhances their ability to make meaningful connections and deepens their understanding of mathematics.

IV. Findings

Demographic Characteristics of the Respondents by Gender

Table 2 shows the genders of the respondents who participate in this study. The data is in form of frequencies and percentages. There were a total of 122 participants with 70 males representing 58.3% and 70 females representing 41.7%. The data show that this study group was male dominated.

The Experimental Group exposed to teaching functions using ethno-mathematics was associated with post-test mean M = 70.4 (S.D = 17.79, N = 64). By making comparisons using the data from table 3 respectively, we can see that the observational group was associated with a numerically smaller post-test mean achievement M = 55.6. (S.D = 17.17, N = 58).

Table 2 : ***Demographic Characteristics of the Respondents by Gender, N=122***

Description	Frequency	Percentages
Male Students	70	58.3%
Female Students	50	41.7%
Totals	120	100%

Table 3: Groups Statistics associated with post-test mean scores, N=122

	N	Mean	S.D	Skewness	Kurtosis
Experimental Group	64	70.4	17.79	0.11	-0.14
Observational Group	58	55.6	17.19	0.57	-0.55

To test the null hypothesis that the observed differences in the post-test means was not statistically significant, an independent samples t-test had to be performed. Preliminaries required conducting the Kolmogorov-Smirnov test for normality as illustrated in table 4. The test, D (122) = .063, p = .200, shows that study sample test scores were significantly normal at $\alpha = 0.5$ for the purpose of conducting the parametric *t*-test.

Table 4: Kolmogorov-Smirnov's test for normality of study groups, N=122

	Kolmogorov-Smirnov		
Variable	Statistic	df	Sig.
Pre-Test Scores	.063	122	.200*
Post-Test Scores	.037	122	.200*

The independent samples t-test conducted was associated with a statistically significant effect of t (120) = 5.669, p = 0 as shown in table 4. Thus students taught functions using ethno-mathematics were associated with a significantly higher test mean than those taught using other conventional strategies.

Table 5: T-Test for post-test means from the two study groups, N=122

Variable	N	Mean	S,D	Df	T-value	*p*-value
Experimental	64	70.4	17.79	120	5.669	0.000
Control	58	55.6	17.19			

Cohen's *d* value was estimated at 0.79 by using the online effect size calculator and this shows a large effect size going by Cohen's (1988) guidelines.

Furthermore, Table 6 shows the results of another t-test which was conducted to compare the effect of ethno-mathematics across gender.

Table 6: T-Test for post-test means across Gender, N= 62.

Variable	N	Mean	S.D	df	T-value	*p*-value
Experimental	38	69.3	15.63	120	1.651	.107
Control	24	72.4	15.88			

The male students exposed to teaching functions using ethno-mathematics were associated with a post-test mean achievement M = 69.3 (S.D = 15.63, N = 62). This mean value is lower than the observed post-test mean M = 72.4 (S.D = 15.88, N = 24) for the female counterparts as shown in table 6. However the T-test t (60) = 1.651, p = 0.107, associates gender with no statistically significant effect on ethno-mathematics teaching strategies.

In the study, a correlation was made to determine the relationship between the attitude of pupil in class and the teachers' approach for teaching using the Pearson Correlation Analysis. Table 7 shows that there was a weak positive relation between the students' attitudes towards functions and the teaching strategy used by the teacher.

Table 7: The Pearson correlation analysis between students' MAQ points and MTAQ .

	MTAQ
MAQ	0.369

The study also showed that there was no statistically significant difference in attitudes of students towards mathematics between the genders. (F- Value=0.018, P=0.894), as shown in Table 8.

Table 8: Group ANOVA of Attitudes towards functions, N = 122

Variable	N	Mean ± SD	t- value	P value	Interpretation
Experimental	64	2.89 ± .875	4.271	< 0.041	Significant
Observational	58	2.57 ± .840			
Total	112	2.74 ±..870			

Based on the analysis of data as presented in this study, the following major findings were made.

1. The mean achievement of students taught with ethno-mathematics teaching strategies was significantly higher than that for students taught with conventional approach.
2. There was no significant difference in mean achievement scores of male students taught using ethno-mathematics strategies and the mean achievement of females taught using the same strategy.
3. There was significant difference in attitudes of students taught using ethno-mathematics strategies and attitudes of students taught using conventional methods.
4. There was a weak positive correlation between the way students viewed the teaching strategies, methods or classroom activities used by their teacher and there attitude towards the topic of functions.

V. DISCUSSIONS

Introduction

This chapter presents discussions of the results from chapter five above in line with the research questions. The questions on the research included:

1. What is the effect of using ethno-mathematics strategies on students' achievement in functions?
2. What is the effect gender on the mean achievement scores of students taught functions using ethno-mathematics teaching strategies?

What effect has ethno-mathematics on students' achievement in functions?

The independent samples t-test conducted was associated with a statistically significant effect t (120) = 5.669, p = 0 as shown in table 5.3.5. Thus students taught functions using ethno-mathematics were associated with a significantly higher test mean than those taught using other conventional strategies. These results correlate with the study conducted by Sochima (2013) in Nigeria meant to ascertain the effect of ethno-mathematics teaching materials on students' achievement in mensuration. The sample for that study was 156 Senior Secondary Schools two (SSS 2) students, who were randomly selected from 16 Senior Secondary Schools in Igbo-Etiti Local Government Area of Enugu State through multi-stage sampling technique. The mean was used to answer the research questions posed, while the ANCOVA statistic was employed in testing the null hypothesis at 0.05 significant levels. Findings of the study showed that the ethno-mathematic

was effective in enhancing students' achievement in mensuration with particular reference to volumes of cylinder and hemisphere. However, the findings from this study contradict those done by Sochima (2013) on issues of gender. In this study, the male students exposed to teaching functions using ethno-mathematics were associated with post-test mean M = 69.3 (S.D = 15.63, n = 62). This mean value is lower than the observed post-test mean M = 72.4 (S.D = 15.88, N = 24) for the female counterparts as shown in *table* 5.3.6. However the T-test t (60) = 1.651, p = 0.107, associated gender with no statistically significant effect on ethno-mathematics teaching strategies contrary to the findings of Sochima(2013) associating gender with a significant effect on achievement.

The findings in this study also contradict to the research findings by Amita and Qouder (2016) on native students from a native Bedouin tribe in Australia. Their findings had shown that that ethno-mathematics had no effect on achievement in tests.

The findings of this research conform to the argument by Davison (1988) that the interaction of native culture and mathematics ideas can be mutually reinforcing. In other words, application of native culture situations to the mathematics classroom could help native students see relevance of mathematics in their culture, and to use this connection as a means of learning formal mathematics according to Aichele & Dawning (1985). Application of ethno-mathematics strategies seemed to motivate students to participate freely without the phobia of strict formalism in teaching mathematics.

Magallanes (2003) also supports the findings from this study. He had also found statistically significant effect that after using ethno-mathematics software in combination with traditional teaching practices there was increase in the students' achievement in coordinate planes and associated concepts.

This finding also confirm NCTM (2013) hypothesis that cultural experience and practices of the individual learners, the communities, and the society at large can be used effectively as vehicles to not only make mathematics learning more meaningful, but provide learners with the insights of mathematical knowledge as embedded in their social and cultural environment.

Conflicts of Interest

The authors declare no conflicts of interest.

VI. Recommendations

Based on the findings from this study, it's recommended that more rigorous studies of ethno-mathematics should be carried out on other topics and sites so that ethno-mathematics can supplement to the mathematics curriculum. More or ethno-mathematics should be used as a springboard for teaching the formal or academic The other recommendation is to regularly make learning settings become more ethno-mathematics friendly as that it is only through the lens of formal, academic mathematics sensitive to cultural differences that the real value of the mathematics inherent in certain cultures and societies be understood and appreciated.

VII. Conclusion

The main purpose of the research was to assess the effect of using ethno-mathematics strategies on students' achievement in functions. The results of this study have shown that the use of ethno-mathematics teaching materials does not only enhance the students' achievement in functions but it also has a positive effect on the attitude of learners. The lesson plans used in the study to enhance achievements in functions are rudimentary and therefore need further research, improvement and possible adaptation for use in other related topics in mathematics education.

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How Gender and Social Class Affect Public Opinion on Social Inequality

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Abstract- All human societies have a social structure that divides people into categories based on a combination of achieved and ascribed traits. The kinds of categories McCall cites gender, race, age, and membership in exclusive social organizations. Most Americans also increasingly disagreeing with the statement "the American Dream has become impossible for most people to achieve" leading to the conclusion that most Americans are increasingly satisfied with the opportunity to get ahead. To answer these questions, data was taken from a survey conducted on Brigham Young University (BYU) students from various class backgrounds. It is interesting to see that 61% of rich people strongly agree that there are still great differences between social levels in the United States. This is against McCall's findings

Index Terms- American Dream, BYU, Human Societies, McCall, social class, social levels

I. Introduction

All human societies have a social structure that divides people into categories based on a combination of achieved and ascribed traits. The kinds of categories he cites include gender, race, age, and membership in exclusive social organizations. Categorical inequality, then, is defined as inequalities of income, wealth, or influence that vary systematically with membership in social categories. (Massey, Categorically Unequal: The American Stratification System, 2008). In the United States, economic disparities began to rise in the mid-1970s, and although the increase may have slowed recently, levels of inequality remain high compared with the three decades after World War II. Among the rich OECD countries, the United States features the highest level of income inequality and, together with the UK, has experienced the sharpest growth in disparities over the past quarter century (Kenworthy 2004, Smeeding 2005). Underlying these broad trends, earnings have changed in diverse ways at different parts of the distribution. During the 1980s, both upper-tail and lower-tail inequality grew. Then these trends diverged. Lower-tail inequality stopped growing around 1987 and contracted slightly during the 1990s, whereas upper-tail inequality continued to rise (Atkinson 2003, Blau & Kahn 2002, Mishel et al. 2005). In this paper, we will try to find out how gender and income affect people's opinions on inequality and the American Dream.

How income is divided:

The share of national income going to families in the bottom 40 percent of the income distribution declined by about one- fifth, from 17.4 percent in 1973 to 13.9 percent in 2001, while the share going to families in the top 5 percent increased by more than one-third, from 15.5 percent to 21.0 percent. Meanwhile, the share of income going to the top one-tenth of one percent quadrupled between 1970 and 1998, leaving the 13,000 richest families in America with almost as much income as the 20 million poorest families. (Homer) In light of these developments, business writer Robert Samuelson argued, "If Americans couldn't abide rising inequality, we'd now be demonstrating in the streets."5 Instead, to the contrary, the past four years have seen a massive additional government-engineered transfer of wealth from the lower and middle classes to the rich in the form of substantial reductions in federal income taxes. In 2001 and 2003, the Bush administration engineered two enormous tax cuts primarily benefiting very wealthy taxpayers. Most Americans supported these tax cuts. Larry Bartels argues that they did so not because they were indifferent to economic inequality, but because they largely failed to connect inequality and public policy. (Homer)

Ordinary Americans supporting tax breaks:

One common hypothesis is that they do so because they embrace an American ideology of opportunity in which economic inequality is natural and unobjectionable. Jennifer Hochschild reported that her rich and poor respondents alike "define political freedom as strict equality, but economic freedom as an equal chance to become unequal." Many—as of 2011, most—adult Americans have become aware of the very real possibility that they may not fare economically any better than did their parents. However, Americans may continue to find solace in the notion of the American Dream, defined as spiritual well-being more than material success, as documented by Hanson and Zogby (2010). According to recent accounts, most Americans are aware of growing income and wealth inequality and remain willing to see government as a vehicle to provide opportunities, despite their tendency to see themselves as ideologically more conservative than liberal. (Shaw and Gaffey 2012)

Role of Democracy and Government:

One of the leading arguments in favor of democracy relates to the distribution of power in society and the benefit that an egalitarian distribution of power has for the poor (Lenski 1966; Lipset 1981). The basic logic of the argument is that those at the bottom of society benefit from redistribution. When those at the bottom are given the franchise and have a formal say about the formation of government policy, redistribution will increase. This increase in redistribution then reduces economic in equality.

Essentially, the argument holds that democracy enhances the absolute and relative well-being of the poor, who demand increased state redistribution and are able to see their demands met when provided with procedural mechanisms for influencing state policy. (Kelly and Enns 2010)

There can be little doubt that the wealthy exert more political influence than the less affluent do. If they tend to get their way in some areas of public policy, and if they have policy preferences that differ significantly from those of most Americans, the results could be troubling for democratic policy making. (Page et al. 2013) We can see here that on one hand, people who are not well off believe that the government is going to take care of them. They have a lot of faith in public policies and on the other hand, the people who are making these public policies are the top one percent. We need to realize that these people will do their best to ensure that the power does not go in the hands of the poor.

Nevertheless, if those with lower incomes are less likely to vote, then the political system will be less responsive to a rise in inequality. Two effects are worth noting. First, higher fractions of the poor are noncitizens. Second, among the poor who are citizens, turnout is very low. Fewer than half the households with incomes under $15,000 reported voting in the presidential election of 2008, even though turnout of the poor increased over the 2000 level, In contrast, over four-fifths of those with incomes over $150,000 reported voting. (Bonica et al 2013)

Public opinion on Social Inequality:

The study done by University of California at Berkeley that showed us that rich people feel entitled and feel that they deserve to win the game of life. The more money you have, chances are that you will run over people at a crosswalk, commit more crimes, cheat on your partner, lie when playing games, a lot more than a poor person who is earning less than $15,000/year. Poor people know that they do not have a lot of opportunities and hence do not even complain. This reminds me of the constrained agency and the two circles. Constrained agency is real when we watch this video. (New and Politics) Hence public opinion on income inequality is shaped by the kind of background a person is coming from. In the canonical model of Meitzer and Richard (1981), increased inequality (in the form of median incomes falling relative to average incomes) leads the median voter to demand more redistribution, so that politics should limit after-tax and -transfer inequality. But as the 1 percent get relatively richer, they turn against redistribution. (Bonica et al 2013)

In addition to economic background, other factors like gender, nationality, ethnic prejudice also contribute towards shaping our views on income inequality. Men get scared when the power goes into the hands of women, so they try their best to keep women at jobs which do not pay as much. Even when a woman gets the same job a man has, she still gets paid less. (Pratto et al. 1994) In today's world, women are paying more than men everyday while buying the same products as shown on Anderson Cooper 360.

Defining the American Dream

From the beginning of American thought, the notion of equality of opportunity was a persistent impression; this American dream is "that dream of a land in which life should be better and richer and fuller for every man, with opportunity for each according to his ability or achievement" (Hauhart 2015, 66). The American Dream is among the United States' most recognizable and revered symbols of our national heritage. Celebrated in popular culture, this statement of national purpose has been analyzed by commentators across the broad range of humanistic and scholarly disciplines, including American sociology. (Hauhart 2015) As described by Adams, American Dream meant a life in which personal fulfillment – or success as one personally defined it – could be pursued.

Most Americans also increasingly disagreeing with the statement "the American Dream has become impossible for most people to achieve" (Hanson and Zogby 2010), leading to the conclusion that most Americans are increasingly satisfied with the opportunity to get ahead. Another study of public opinion polls, however, found that "many Americans are losing confidence in the essential fairness of the system and their opportunities for financial advancement" (Chambers, Swan, Heesacker 2014, 413).

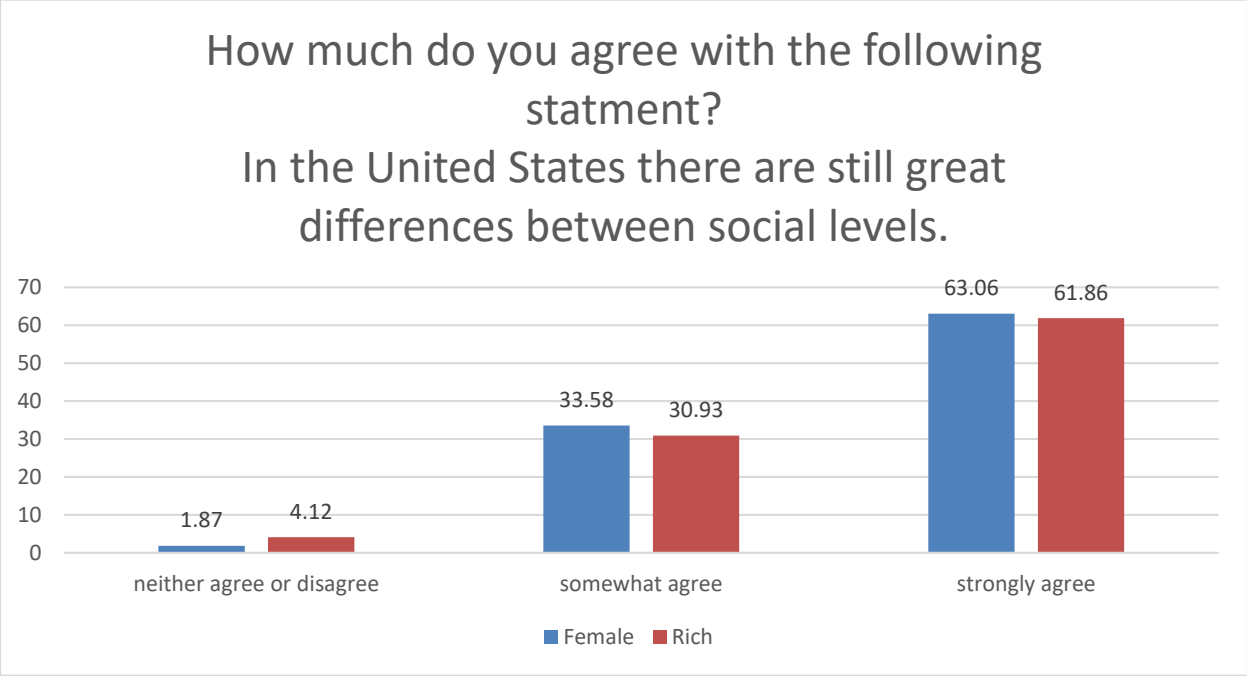
II. Methods

To answer these questions, data was taken from a survey conducted on Brigham Young University (BYU) students from various class backgrounds. Our sample size was 480. The General Social Survey had questions both in regards to opinions and demographics. Questions covered topics such as inequality, government involvement, economic mobility, and the American Dream, as well as demographic questions regarding political affiliation, parental income, religious affiliation, and family structure. While this is not a representative of BYU students, it does provide a starting point for understanding how this group differs from the general population in beliefs on inequality and class.

We need to keep in mind that the same survey would give out different results when we give it to a sample from the general U.S. population because most BYU students come from privileged class backgrounds. STATA software was used for statistical analysis of survey responses. Basic analysis were run correlations between independent (income and social class) and dependent (perceptions about inequality, mobility, and the American Dream) variables. Ordinary least squares regressions was also ran to test our hypothesis.

III. Results

We see in the very beginning that according to most BYU students, i.e. 130 out of 463 believe that living comfortable is the most important thing to their American Dream.



In the above graph we see that 63% of women agree that in the United States, there are still great differences between social levels. This verifies McCall's findings. She also mentioned that women are always looked down upon. Even when a woman gets the same job a man has, she still gets paid less. America is a land of opportunity but lower wages for women and ethnic minorities simply reflect lower skill and education levels as they are not given as many opportunities as men are given. (Pratto et al. 1994)

Variable	Obs	Mean	Std. Dev.
var3	467	3.072805	1.115175
female	465	.5698925	.4956242
rich	468	.207265	.4057808

We also see that females believe that what one can achieve in life depends mainly upon one's family background. 73% of the females said that they come from a middle class background and 43% of them somewhat agreed that family background matters.

Table 2. OLS Model of the Association between Gender, Financial background and Social Differences. BYU Survey 2015.

	Model 1	Model 2
female	-.333 **	-.532 **
	(.101)	(.134)
rich	3.163	-.079
	(.124)	(.406)
dream1	-.076	-.136
	(.306)	-(.016)
_cons	3.048 ***	2.828 ***
	(.097)	(3.268)

***p<.001 **p<.01 *p<.05
Note: Standard errors in paratheses.
N=453

IV. Discussion

It is interesting to see that 61% of rich people strongly agree that there are still great differences between social levels in the United States. This is against McCall's findings. This could be because of the fact that the survey was conducted on the BYU campus where people are humble and they are ready to acknowledge the real problems in this world. 26% of students who have parents making more than $200,000 disagree with the statement that what one can achieve depends upon one's family background. The following statement given by one of the student is a proof. "Yes, I feel the class someone is born into has the potential to start him/her at an advantage or disadvantage, in terms of opportunity. However, it's only the starting point. What you do with it is up to you."

We also see that if a student is LDS, then 58% of them agree that there are still great differences between social levels. On the contrary, if the students are from any other religion, then 100% of them agree with the above statement. This could be again possible because it is a concentrated campus and there was not a huge sample representing other religions. The main problem with this sample is not a lot of diversity is included. Hence we cannot say that this sample represents the entire country because in Utah, 60% of the population is LDS whereas only 2% of the population in the United States is LDS. This explains the sort of biased findings from this set of data.

We also need to realize that all the students that participated in the survey are college going students who have had opportunities all their lives. They are in college because of the opportunities they were provided with. This tells us why students do not have extreme views about inequality in our society because most probably they do not really know what inequality looks like. This answers our question as to why perceptions matter. People who come from a background of advantage have rosy colors glasses on and it is hard for them to see the harsh reality of life. When we are kids, our parents do not tell us the reason behind poor being poor. We have them as servants, drivers, maids and never really care about them. We get lost in our own little bubble and forget that they are humans as well. We need to look closely at inequality in order to feel its impact. We can watch sad videos all day long on television and still be unware of what is going in the real world out there. I met a girl a couple of weeks ago in one my classes and she is going to India in summer to help people in the slums. She came up to me and asked me about slums in India. I just stared at her because I did not have an answer. I have never been to the slums because the society looks down upon people who go and visit the slums. We are taught that people are poor because they are refusing to work. Our parents teach us that the poor keep on having a number of kids because they want more people in their family to beg on the streets. This is how they pay their bills.

Government needs to mend its policies and make them more useful to our unfair society. I have mentioned it before as well that policies need to be changed. For example, a person has applied for social security. The process takes a long time and by the time the case is opened, the person goes homeless. Then the social security office tries to get hold of them, calls them but they do not answer any calls because they do not have money to pay their phone bill. Then they mail them but the person is homeless by now and is never going to receive that mail. Winter comes along and we hear about all these homeless people dying. People who are stuck in poverty are trying to help themselves. It is out turn to help them. Policies need to be changed so that we can prevent people who have shelter from going homeless. This applies to every other policy that exists out there.

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A Study On Environmental Awareness Among College Students

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Abstract- Environmental degradation is the deterioration of the environment through depletion of resources such as air, soil. The destruction of ecosystems and the extinction of wildlife. The United Nation International Strategy for Disaster Reduction defines environmental degradation as "The reduction of the capacity of the environment to meet social and ecological objectives and needs". Today environmental degradation and preservation have emerged as major issues in globalization studies. Our environment is being deteriorated every now and then due to various factors like population explosion, uncontrolled and lavish consumption of precious environmental resources, industrialization, urbanization and exploitation of abiotic and biotic components of environment have resulted in the present day environment crisis condition. We have a deep emotional need to affiliate with the national world for our own happens. With the progress in science and technology man has made a lot of revolution in various field. Man has made a lot of progress in every field through science and technology but at the same time overuse and misuse of environmental resources is destroying the equilibrium of environment. Unfortunately it is human activity including the deserve to improve unequality of life, that lies at the core of environmental degradation. The environment has its own system of recovery but depletion of large amount of resources due to the activities of man has failed the self-recovery system of environment in many areas. So it has led to many adverse impacts on the environment. So this paper is an attempt to find the awareness level regarding environment and its relation with economic status among college students.

Index Terms- Environment, degradation, destruction, human development, life threatening

I. Introduction

Recently due to environmental degradation and hazardous situation in planet earth environmental education has gained drastic attention. Environment has influenced and shaped our lives since the time immemorial. Interaction on between man and the 'environment' has existed since human first appeared on earth. Such interaction is an intrinsic aspect of human development. Man's capacity to adjust his relationship with nature and man-made (i.e. social and cultural) environment and to transform the environment itself has passed through various phases. Environment plays a very important role and influences us in many ways so keeping in to consideration on its preservation on had been the major concern for all. So today the study of the environment have emerged as major concern for all because our environment is being destructed due to various factors, and one of the major cause of environment destruction is human activities. However due to man's activities, environmental degradation is in an alarming rate and it results in various environmental issues such as global warming, ozone layer, depletion, greenhouse effects, raise in sea level, improper monsoon and acid rain. The consequences of environmental degradation would be life threatening. Technology based civilization has led to sophisticated world whereas a large number of environmental problems has also appeared due to misuse and over use of natural resources. Today environment has become the concerns of all; the academician, intellectuals, scientists, policymaker & government across the continents (Kant and Sharma, 2013). Environmental education should lead for gathering mass awareness which should bring environmentally wiser policies. It is in this backdrop the present study, "A Study on environmental awareness among college students in relation to environmental awareness and socio-economic status, environmental awareness of college students in citizen of socio-economic status was undertaken.

II. Objectives

1 To find the level of environmental awareness of college students.

2 To find the level of environmental awareness of students on the criteria of socio-economic status.

3 To find the environmental awareness with regard to their gender.

III. Hypothesis

There will be no significant difference in environmental awareness between undergraduate students regarding gender and socio-economic status.

IV. Method

The investigator adopted survey method and random sampling technique' to collect data. The sample has been taken from Govt. Colleges situated in Patiala and Bathinda district. The population consists 100 girls from Govt. College for Girls Patiala and 100 boys from Baba Siri Chand Ji Govt College Sardargarh Bathinda

The investigator studied the tools available in market. Since there is no standard tool available for assessing the environmental awareness. The investigator worked out strategy to prepare and validate his own research tools studying the environmental awareness .Reliability was established by test-retest method.

The data collected were stastistically analyzed and conclusions were drawn. Stastistical techniques like differentiat analysis mean,standard deviation,and t- valuewere used.

V. Result

The data has been collected randomly based on the stratification given below

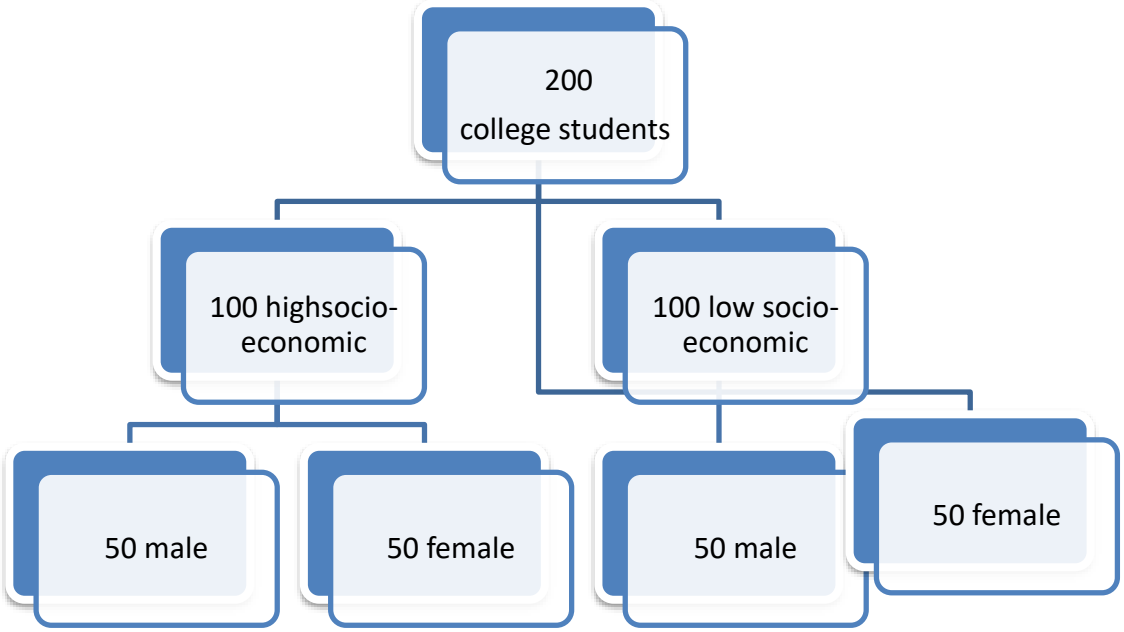

Table 1

Mean and SD of girls and boys students of high and low socio-economic status of college students in regarding environment al awareness.

	Student	Mean	SD
High Socio Economic	**50 Boys** **50 Girls**	**83.79** **84.89**	**9.01** **10.11**
Low Socio Economic	50 Boys 50 Girls	78.84 74.43	8.69 8.21

Table 1 shows that mean score in environmental awareness of boys is 83.79 and that of girls is 84.89. This shows that there is little difference in means scores between boys and girls.Again the mean score in low socio-economic status of boys is 78.84 and that of girls is 74.43. This interprets that comparatively the boys are better aware than that of girls of low socio-economic status.

Level of Environmental Awareness among College Student

There were 110 items in EAS and each item was given a credit of 1 point and zero for wrong answer. The observed mean score of the entire sample of college student of Patiala and Bathinda was 84.34 from high socio-economic of both district which is very high and mean score of low socio-economic group was 76.63

Difference between boys and girls regarding Environmental Awareness

Variables	N	Mean	SD	T Value
Boys	100	81.31	8.89	0.412
Girls	100	79.66	10.01	

Mean (m) environmental awareness score of boys was 81.31 and that of girls 79.66 and t value was 0.412 therefore the hypothesis that no significance difference exist between male and female college students environmental awareness was retained at 0.05 level. It is concluded that gender is not a factor for affecting environmental awareness of college student. The main reason for almost equal environment awareness of boys (m 81.31) and girls (m 79.66) is that are studying in the same class that is undergraduate course of first year of Arts in the Govt .College.

VI. Significance for Further Research

The investigator would like to suggest that similar study can be conducted at the under graduate students of second and final year of Arts level.

Studies may be done to find out the attitude of environmental awareness in college student in relation with rural and urban areas.

VII. Conclusion

The following conclusion can be drawn from the study: The environmental awareness differ with socio economic status for total students and it is also found that the environmental awareness between boys and girls does not differ more.

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Blockchain in Operations Management

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Abstract- This paper presents a study on Blockchain and its application in operations management. Blockchain technology, characterized by its transparent, decentralized and fraud resistant properties, has endless use cases. Different industries ranging from banking, infrastructure, ride sharing, voting to public policy are now using blockchain for greater transparency in digital ecosystem. This study is not limited to a particular industry or function, but it will question the effectiveness of using blockchain in improving efficiency across industries. Research is conducted through multiple in-depth interviews by professionals working on blockchain.

Index Terms- Blockchain, Operations Management, Walmart, IBM Food Trust, Blockchain in Pharma.

I. INTRODUCTION

1.1 OBJECTIVE

Analyze the strengths, weaknesses, opportunities and threats of Blockchain technology specific to operations management, with emphasized focus on its limitations. Highlight the current uses and applications of Blockchain in industries, identify promising areas of adoption for Blockchain, and understand the reasons behind it not being put to use in these areas currently.

1.2 SIGNIFICANCE

Blockchain is the incorruptible and decentralized public ledger of records programmable to automatically record high volume of digital transactions. It gained significant popularity via Bitcoin and other virtual currencies. These virtual currencies led to the realization of the importance of blockchain not only in finance, but various other industries.

Blockchain technology enables a wide variety of business applications, and it promises to completely transform the value chains of organizations. Over the next few years, blockchain will play a critical role in helping businesses unlock value from their partner ecosystems and unleash the full benefits of technologies such as artificial intelligence and IoT.

Businesses are only as strong as their value chains. Often businesses have seen their operations disrupted or slowed down by inefficient processes, and value remains locked within the chain. This is where Blockchain comes in by enabling a new approach to rapid and secure information exchange across the value chain. In effect, blockchain puts an end to data silos, providing a secure and controlled access to a shared copy of the same data to every stakeholder. This results in a seamless and near-instantaneous information reconciliation, which reduces costs and friction across the supply chain.

II. BLOCKCHAIN

2.1 WHAT IS BLOCKCHAIN

Blockchain is a growing list of records, called blocks, that are linked to each other using cryptography. Each block is linked to the previous block using a cryptographic hash. The blocks also contain transaction data, and a timestamp in addition to the hash. It can be described as a digitally distributed ledger for transactions. A blockchain is resistant to data modification, and hence is known for its data immutability characteristic. It is an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way. For use as a distributed ledger, it is typically managed by a peer-to-peer network which collectively adheres to a protocol for inter-node communication and to validate new blocks. The data in any given block once recorded, cannot be altered without alteration of all subsequent blocks, and this process requires consensus of majority participants in the network.

The ledger is stored and maintained on a distributed set of computers that can communicate with one another. The replicated ledger is synchronized via the internet. If the Blockchain is public, then anybody can access the network if they have a device and an internet connection.

Blockchain was invented by an unknown person (or group of people) using the name Satoshi Nakamoto in 2008 to serve as the public transaction ledger of the cryptocurrency Bitcoin. Until the invention of Bitcoin, double-spending was a potential flaw in digital transactions (the same single digital token being spent more than once). The invention of blockchain for bitcoin made it the first digital currency to solve this problem without the need of a trusted authority or central server.

2.2 THE TECHNOLOGY

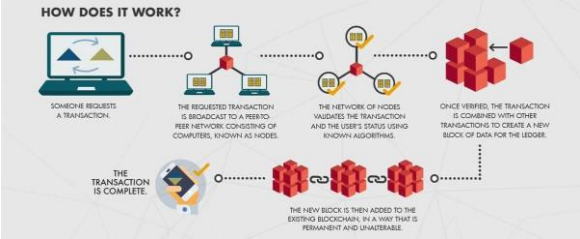

Figure 1 (Source: The Bernie Group)

A block in a blockchain is a collection of data. The blockchain keeps on adding data by connecting the first block (called as Genesis block) with other blocks in chronological order, creating a chain of blocks linked together. Blocks have two parts - header and content. The header includes a unique reference number, the timestamp, and a link to the previous block. The content includes a validated list of the assets. The block size, transaction amount, and addresses of parties involved in the transaction are also included. A node can start a transaction by creating and signing it digitally with its cryptographically created private key. A transaction can represent different actions in a blockchain. Most commonly, it is a data structure which represents transfer of value between peers on the blockchain network. The data structure usually consists of some logic of transfer of value, relevant rules, source and destination addresses, and other validation information.[1]

A transaction is flooded by using a protocol, called Gossip protocol, to peers that validate the transaction based on some criteria that is preset. Once the transactions are validated, data is electronically arranged and stored in cryptographically protected structures known as blocks. The transaction is considered confirmed at this point. These blocks are linked together in a linear, chronological chain. The blocks identify each other with the help of a cryptographic hash from the immediate previous block in the chain. The blocks have a timestamp, and the chain is continuously updated on every ledger on every node. Transactions are reconfirmed every time a new block is created in the chain.

2.3 FEATURES OF BLOCKCHAIN

Below are the key features of blockchain technology.

Decentralized technology

Blockchain is decentralized by design in that the transactions ledger is stored and maintained on a distributed set of computers that can communicate with one another. The network does not have a single governing authority, rather a group of nodes maintain it. This can help avoid the need of a third party in transactions and maintain data transparency.

Data immutability

The blockchain technology is a permanent, unalterable network. One cannot modify the data in any node without corrupting all nodes in the network. This ensures data authenticity and can be used to fight corruption. This feature has a significant use in cybersecurity.

Enhanced security

Blockchain uses encryption to store the data in blocks, which provides an additional layer of security. The technology uses cryptography in comparison with other existing technologies available in the market. Every information on the blockchain is stored using a cryptographic hash.

Faster settlement

This feature is mainly of use in areas like banking where traditional banking systems are quite slow in processing of transactions and final settlement.

Consensus

Consensus helps the decision-making process in the network by coming to a quick and faster agreement. The algorithm is key in making the network trustless. The nodes to do not trust each other, but can trust the algorithm over which blockchain runs.

Increased capacity

Blockchain increases the capacity of the whole network. The computing power is distributed across the devices ensure a better outcome. Supercomputers are used in the mining of blocks for the same reason.

2.4 TYPES OF BLOCKCHAIN

There are 3 types of blockchain networks primarily — public blockchains, private blockchains and hybrid blockchains.

Public blockchains

A public blockchain has no access restrictions. Anyone with an Internet connection can send transactions to it and become a validator. They are fully decentralized by design and transparent in transactions. They are highly censorship resistant, and hence is difficult to shut down. Some of the most popular and largest public blockchains are the Bitcoin and Ethereum.

Private blockchains

The main difference between a public and private blockchain is the level of access. Private blockchains maintain a closed network in which only authorized entities are allowed to participate. It is also referred to as 'Permissioned blockchain' since it grants specific rights and restrictions to participants in a network.

Private blockchains are more centralized since the control lies with a small group of participants. They are valuable for enterprises who want to collaborate and share data, but don't want to display their sensitive business data in public. Examples of private blockchains include Ripple (XRP) and Hyperledger.[9]

Consortium blockchains

They differ from private blockchains in that control is not granted to a single entity, but a group of approved individuals. These types of blockchains could also be described as being semi-decentralized. Consortium blockchains are often associated with enterprise use, with a group of companies collaborating together to leverage blockchain technology for improved business processes. Examples of consortium blockchains would be: Quorum and Corda.[8]

Hybrid blockchains

A hybrid blockchain is a combination of the privacy benefits of a private blockchain with the security and transparency benefits of a public blockchain. It allows the users of the blockchain APIs to determine what information stays private and what information is made public. It is useful for businesses who need flexibility in determining what data stays public and what stays private. Examples of hybrid blockchain are XinFin and Dragonchain.

III. PRIMARY RESEARCH

We conducted in-depth interviews to gather industry insights from professionals who worked in different sectors with blockchain. Key insights from the interviews are listed below with focus on current use cases, future opportunities and challenges of blockchain implementation.

Current use cases

Below are the fields in which blockchain is currently being used, and is known to be a success case.

1. Private sector

Data immutability is a general requirement in private sector. Blockchain is used to implement solutions where data needs to be secure and unaltered.

2. Data processing

Blockchain has significant applications in fields which require a lot of data processing, because of its immutability and faster settlement feature. Below are some use cases.

a. Internal processing in banks
b. Insurance sector - Blockchain is used in processing of insurance claims
c. Data reconciliation
d. Digital onboarding
e. CIBIL Score calculation
f. Smart contracts

A smart contract is a computer protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of a contract. Blockchain is used for market facilitation in energy trading using smart contracts.

3. Supply chain management

Blockchain is used in supply chain management where a continuous record of data needs to be maintained throughout the whole supply chain. Data immutability and decentralized authority are important here.

a. Walmart, Carrefour-French Multinational Retailer, Albertsons (tracking from farmer to store)
b. Pharma industry

In pharmaceutical industry, blockchain is used to track medicine lifecycle from production to pharmacy point.

4. Verification

The technology has applications in areas where data needs to be verified, since it can help maintain authentic data.

a. KYC verification
b. Aadhar verification
c. Hospitality industry - For data verification at hotel reservations etc.

5. Land and property

a. Property registration - Blockchain is used to execute digital ownership. Andhra government has undertaken a project in this field.
b. Deeds transfer – For fast & seamless transfer of records from seller to owner.

6. New product development

Blockchain is highly efficient in applications where new product is being developed, since the fresh data can be stored on blockchain from the start of the development. This has applications in fields like health care.

7. Online transactions

A major application of the technology is in peer-to-peer online transactions.

a. Online gambling
b. Music artist payment on Spotify
c. Over 13 banks in India have implemented blockchain in transactions
d. Carbon trading

8. Decentralized finance

Blockchain is used for cross border payments by Ripple, Facebook global coin, JPMorgan Coin etc.

9. Decentralized internet

Applications include Tron, Web 3.0 etc.

10. Trading Platform

Cross border trading for SMEs by Nordea

11. DAO (Decentralized Autonomous Organization)

It is an organization represented by rules encoded as a computer program that is transparent, controlled by shareholders and decentralized. The organization's financial transaction records and program rules are maintained on a blockchain. Use cases include smart contract auditing services implemented by PwC

12. Healthcare

a. Patient registration system is implemented in blockchain by Alibaba.
b. Hospital records – Medi Chain integrates blockchain with Artificial Intelligence. Medical history of patients is recorded through smart watch, post which AI makes suggestions to the doctor.

13. Smart city

Implementation using blockchain in Ahmedabad with cryptocurrency for transactions

14. Digital Identity Management Network

Sovrin, Evernym (Public + Permissioned Blockchain network), Deloitte is using Verity (Evernym) for onboarding of remote users.

FUTURE OPPORTUNITIES

Below are the areas where block chain can possibly venture. It also mentions some areas that it has started implementing use cases in, and could help the technology in achieving greater success.

1. Customer data handling

Data irreversibility is an issue that is preventing companies from implementing blockchain in customer data handling.

2. Taxation, GST

To ensure authenticity and cross-verification of data.

3. Digital lockers

For maintaining data safe and secure in digital lockers.

4. Transportation segment

To measure the traffic density and implement solutions in the transportation segment.

5. Smart contracts

Smart contracts give programmability to block chain. This is a relatively new application in block chain which will gain popularity in the years to come.

6. Predictive analytics

Blockchain can be used for predictive analytics in combination with technologies like artificial intelligence, robotics and Internet of Things.

7. Trustworthiness in Digital Media
8. Daily Auditing

IV. SWOT ANALYSIS

Below is an analysis of the characteristics of blockchain based on the primary and secondary research undertaken:

STRENGTHS	**WEAKNESSES**
Data immutability & encryption Decentralized control - Has applications in distributed governance No hidden transaction charges like in current legal tenders Worldwide accessibility Transparency and selective visibility No SPOF (Single Point of Failure) Trust - Non reputability Privacy and security	Compliance issues Data backup stored at different locations since it is decentralized No possibility of linking between 2 block chains currently
OPPORTUNITIES	**THREATS**
Irreversibility of blockchain can be overcome by programming the business layer to create reversibility or by keeping data backup in RDBMS Data governance - blockchain will ensure authenticity of the data fed in Scalability is currently an issue which is being resolved with every upgrade. Bitcoin transaction takes up to 30mins and Ethereum up to 10-15mins currently.	Government regulations and policies Quantum computing could be a potential replacement as it can process transactions faster IOTA Tangle which uses DAG (Direct Acyclic Graph) instead of blockchain There is a mass adoption of blockchain by everyone

V. BLOCKCHAIN IN OPERATIONS MANAGEMENT

Blockchain is often thought of as being synonymous with cryptocurrency, but it enables varied business applications while completely transforming value chains of organizations. For efficiently and effectively running operations, organizations need to enable regular and reliable information sharing with value chain partners in their ecosystem i.e. the suppliers, logistics companies, service providers, buyers, etc. This information sharing has been dominantly manual such as documents, point to point communications increasing complexity, time and expenditure.

Blockchain enables an approach to secure, fast information exchange across value chain by providing every partner in the chain, controlled access to a shared copy of the same data. It allows parties to immutably record business transactions with selected visibility across network. Applications where blockchain is being implemented and provides benefits to manufacturers are -

Supply chain optimization

Data which is trustworthy, about inventory levels, track of shipments, status of goods (certificates, temperature, humidity, quality), regulatory requirements, payment processes, etc. is the key for effective coordination of supply chains. DTL - Distributed Ledger Technology establishes this trust to give a single version of truth. Distributed ledger provides cryptographic security, defines shared access and establishes audit trail required by participants to trust.

Companies are leveraging Blockchain's improved trust, transparency to enhance supply chain visibility, track ownership, and streamline manual processes. With shared data across value chain, products, raw materials can be effectively tracked, better forecasted and can enable real-time cross-company planning and decision synchronization. It also reduces the risk of fraud and non-compliance.

Risk reduction in sourcing

Blockchain provides accurate and trustworthy information for screening new vendors and suppliers. Vendors and suppliers profile created on blockchain can be created on blockchain to efficiently grant access to make decisions improving speed, ease and risk of doing business with a company.

5.1 WALMART FULLY TRANSPARENT FOOD SUPPLY CHAIN

During an outbreak of a food borne disease (E.g. Outbreak of E.coli virus in Chipotle stores in 2015 with 500 reported cases 43 restaurants were closed with an 80% drop in Chipotle's Profit - the cause was never identified), it may take weeks to find its source. Companies need to act swiftly by having a better traceability of the food to save lives and livelihoods of farmers by discarding only the affected produce.

Challenges in traditional supply chain (relying on manual processes involving farmers, processors, distributors working in silos and manual record keeping with minimal communication) -

1. Poor communication across multiple parties
2. Low traceability of individual items
3. Variable quality for different food items
4. Limited shelf lives (include time spent during transportation) - Wastage
5. Health implications - possible infestation/contamination by toxins, insects, bacteria, viruses, Spoilage/Expiry of product due to temperature, humidity, etc.

Successful Proof of Concepts (POCs) - Walmart together with IBM started two projects on Blockchain and IoT sensors to implement food traceability system based on Hyperledger Fabric. The shipments were tracked by signing and logging at multiple checkpoints using six-digit IoT numeric identification. Open source, vendor neutral blockchain were the features, Walmart chose Hyperledger Fabric hosted by The Linux Foundation.

Project 1 - Tracing mangoes from Mexico to be sold in US stores. Time to trace the origin of mangoes reduced from 7 days to 2.2 seconds.

Project 2 - Tracing Pork sold in China stores where food safety mandates are known to be frequently violated and a serious issue. Walmart was able to successfully trace pork products from producer to retailer to consumers highlighting high scalability and flexibility of technology.[2]

Key tasks to reap the benefit - Gaining buy-in and cooperation from all involved parties, maintenance of software and hardware, licensing costs, integration across systems.

These successes led to the implementation consideration of **IBM Food Trust**.

Figure 2:
(Source: hyperledger.org/resources/publications/walmart-case-study)

5.2 IBM FOOD TRUST - INTEGRATED ENTERPRISE-GRADE BLOCKCHAIN SOLUTION

Walmart collaborated with IBM and other prominent players in the food industry like Nestle, Dole, Golden State Foods, McLane Company, Kroger, and Unilever to set up IBM Food Trust. Walmart in 2018 could trace over 25 products from different suppliers using Hyperledger Fabric which could visualize the whole supply chain in seconds. Buy-in of all stakeholders in the chain is required, they need to input detailed information about food. All the data is stored on blockchain hyper ledgers fabric which are protected with high encryption to make them tamperproof. Once it is done, all the data can be leveraged to track food freshness, minimize wastage, longer product shelf lives, better access to shared information, etc. It provides participants of the supply chain with permission-based shared view of the information. This solution is to bring back the customers' trust in the food supply chain. It allows the customers to not only track the food ingredients but also check whether the food went through the required safety processing (certifications, test data, temperature) or whether the food item is truly organic in seconds.

'IBM Food Trust creates a secure, shared, and permissioned record of transactions. This enables unprecedented visibility during each step of the food supply chain. IBM Food Trust achieves new levels of trust and transparency, making food safer and smarter from farm to fork.' [3]

EFFECTIVENESS

Pilot Test Case to identify the time taken to trace a sliced mango packet in US to Farm in Mexico proved the possibility of successful implementation of Blockchain in supply chain. The typical mixed manual, paper based and digital method which earlier took **6 days, 18 hours and 26 minutes**, now with IBM Food Trust Digital solution took **2.2 seconds**.

EFFECIENCIES

IBM VP, Brigid McDermott, during demonstration, broke the financial costs of supply chain tracking inefficiencies into three categories.

1. **Cost of Human life and health** - According to the WHO, 420k people die every year due to food poisoning resultant of food contamination.
2. **Cost of recalling affected food item** - To act swiftly entire stock is recalled from all the farms which brings loss to the farmers.
3. **Cost of food wasted because of consumer fears** - Tracking the tainted items would takes weeks resulting in a price drop as people stop buying the item; creating financial cost to owners of even non affected safe products.

These losses together (economic impact of foodborne illnesses) have been estimated to vary around $4.4bn per year **to $93.2 bn per year** for U.S. economy alone.[4]

ADOPTION OF IBM FOOD TRUST

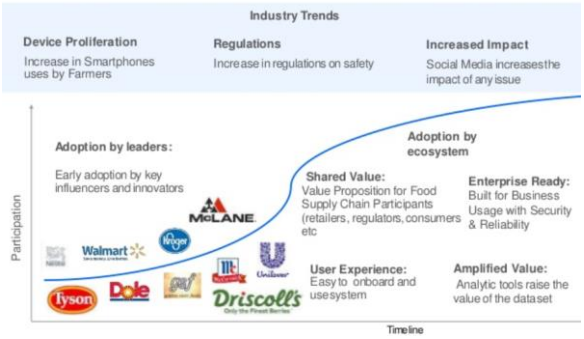

Figure 3 (Source - IBM Food Trust)

5.3 BLOCKCHAIN IN PHARMACEUTICAL INDUSTRY

The pharmaceutical industry is exploring the technology to implement several use cases, the top four of which are mentioned below.

1. Verifying the Authenticity of Returned Drugs

Drugs are frequently returned to the pharmaceutical manufacturers in cases where wholesalers may return unsold excess inventory. Instead of destroying these perfectly good drug shipments, pharmaceutical companies opt to re-sell them. But before they can re-sell them, the pharmaceutical companies have to verify the authenticity of these returned drugs.

In the US, the Drug Supply Chain Security Act (DSCSA) has mandated serialization or barcoding of drugs at a package level. These serial numbers must then be used to verify the authenticity of the returned drugs. Europe has a similar regulatory enactment called the Falsified Medicine Directive (FMD). While the EU has opted for a centralized approach, in the US there is no centralized database regulator. In such a scenario, pharmaceutical manufacturers can record the serial numbers of their packages on a blockchain, which can serve as a decentralized and distributed ledger. Wholesalers and customers can then verify the authenticity of a drug package by connecting to the blockchain. Merck in partnership with SAP has developed the SAP Pharma Blockchain POC app for this use case.

2. Prevention of Counterfeit Drugs and Medical Devices

Blockchain's ability to establish provenance of data makes it suited for prevention of counterfeit drugs & medical devices. Drug companies have a difficult time keeping track of their products because of the large volume, thereby leaving an opportunity for counterfeiters to introduce fake drugs into the system.

The problem of counterfeiting also extends to medical instruments manufacturers. 8% of medical devices are estimated to be counterfeit copies by the World Health Organization. Counterfeit drugs and medical devices are a major risk to consumers, and also result in lost revenue for the manufacturers.

The DSCSA mandate provides a unique product identifier for each drug package, and allow the authenticity verification of every product sold. The transactions at every point of the drug's supply chain can be recorded on a blockchain, thereby providing a distributed provenance ledger. This will make it possible for all involved parties to track drugs through the entire life-cycle of supply chain, and make it harder for counterfeit drugs from being introduced.

Novartis is experimenting with blockchain to identify counterfeit medicines and track their temperature with real-time visibility for all participants in the supply chain, with the use of Blockchain and IoT. Novartis is also engaged in developing a consortium blockchain network between the European pharmaceutical industry and the EU, called the Innovative Medicine Initiative (IMI) Blockchain Enabled Healthcare program. The consortium will comprise SME blockchain companies, universities, clinical labs, hospitals, patient representatives and others. It aims at exploring use cases in counterfeit drug detection, supply chain, patient data, and clinical trials.[5]

3. Compliance in Pharma supply chain

As drugs move through the supply chain, logistics companies need to track several operating constraints in terms of drug handling, transport and storage guidelines. These may include maintenance of temperature range, humidity, air quality, etc.

The quality and efficacy of drugs may be directly impacted by environmental conditions within the supply chain. However, since each participant in the supply chain maintain their own separate ledger, it is difficult to track a problem within any particular segment of the supply chain. Blockchain provides a better way to add compliance and governance in such scenarios.

Additionally, smart contracts can be programmed to alert the relevant parties in the supply chain. For example, if there is a temperature rise during transportation, the consumer can easily see at what point the event occurred with the help of blockchain.

4. Transparency and traceability of consent in clinical trials

Informed patient consent is the process of making the patient aware of each step in the Clinical Trial process including any possible risks involved. Clinical trial consent for protocols need to be transparent for the benefit of patients and traceable for stakeholders. In practice, the informed consent process is difficult to handle in a satisfactory way.

The FDA reports that about 10% of the trials they monitor feature some issues related to consent collection. Blockchain can provide transparency and traceability of consent if used in clinical trials. The technology provides a mechanism for unfalsifiable time-stamping of consent forms, storing and tracking the consent in a secure, and publicly verifiable way, and enabling the sharing of this information in real time.[5] Smart contracts can also be additionally be tied to protocol revisions, such that any change in the protocol requires the patient's consent.

VI. ENTRY BARRIERS

Establishing trust and getting everyone on board, is the fundamental factor for blockchain's successful implementation. Following are the barriers for Blockchain adoption.

1. Trust of Multiple players many wary of sharing data
2. Enforcement or Government policies
3. Standard bodies and their resistance to change
4. Transactions speed, Latency

VII. POTENTIAL REPLACEMENTS

7.1 QUANTUM COMPUTING

The security of a blockchain is guaranteed by standard cryptographic functions which are relatively secure since breaking them requires huge computing resources, which are not easily available. Its validity, however, is heavily dependent on the "state of technology" assumption.

With the emergence of powerful quantum computers which can easily break this kind of cryptographic protection, the security of blockchain is at risk. A quantum computer is any device that uses the principles of quantum mechanics to perform calculations. Regular computers use bits to store and manipulate information. Quantum machines make use of quantum bits (or qubits), which can take the value of both 0 and 1 at the same time. This phenomenon, called superposition, allows quantum computers to perform certain tasks much faster than regular computers.

Experts suggest the architects of blockchain to start taking precautions immediately to address this potential threat. Possible solutions are:

1. Adding quantum cryptography to blockchains might guarantee their security as quantum computers cannot break quantum cryptographic codes.

2. A better and more secure solutions would be to make the entire blockchain a quantum phenomenon

3. Another remedy will only be available with the advent of a quantum internet, which is still several decades away. When implemented, this will unlock a wealth of new blockchain models and designs.

Quantum computing could be the next big future of supply chain. The minimized energy expenditure in this technology will help organizations create more driverless supply chains. It also has the potential to disrupt the way advanced planning and optimization systems work by performing scenario planning on the fly. However, the use of quantum computing in supply chain could be very expensive and therefore impractical.

7.2 IOTA TANGLE TECHNOLOGY AND THE FUTURE OF SUPPLY CHAIN

IOTA Tangle is a set of interlinked, individual transactions. Like blockchain, these transactions are distributed, stored among a decentralized network with access to different participants. Tangle is a DAG with vertices representing transactions and edges representing approvals. A new transaction is added as a new vertex while getting attached to previous two transactions which it approves. A transaction being approved means history being verified. A transaction when approved by a large number of new transactions becomes impossible to change. Every transaction requires participants to do a small proof of work computation which ensures it is expensive to spam or fork after establishment of consensus.

Comparison to Blockchain - With its main motivation is being scalable, IOTA uses DAG (Direct Acyclic Graphs) unlike blockchain to store its ledger. In Blockchain, all participants have to agree on the longest chain creating a transaction limit. Tangle allows branches in DAG to eventually merge into the DAG, resulting in a faster throughput. Tangle overcomes some limitations of blockchain like - Scaling, Fees and Miners Conflict of Interest that slow network to raise fees. It doesn't use blocks or miners. IOTA scale and support millions of transactions of global supply chains today.[6]

In late June 2019, Alyx, a luxury fashion brand, launched a pilot for supply chain implementation of IOTA-Tangle. As for the pilot, digital ID tag is created for every Alyx piece where all the supplier's data (uploaded on ledger) is available to customers on a scannable QR-code.[7]

VIII. CONCLUSION

Blockchain has been successful in reducing costs of supply chain. It is economically viable for small transactions, has low marginal costs if IoT is already in place to detect and track processes. Tracking via IoT in situation of crisis involving food contamination will ensure easy identification of source to remove only affected products. It will eliminate manual keeping of paper records by providing digitally signed contracts with encrypted storage and transmission. Data immutability can help in easy auditing and hence reduce regulatory compliance costs. Transparency minimizes possibilities of frauds. Stored data related to temperature, humidity, motion, chemical compositions captured by IoT devices on equipment and available to consumers and manufacturers, distributers ensures quality check. Blockchain based digital certificates ensures validation, ownership. Shared Permissioned Blockchain with identity validation increases dependability. Thus, Blockchain with its characteristics and various use cases in Operations Management improves the supply chain parameters like cost reduction increased speed, dependability and increased risk reduction.

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The effects of vandalism in the oil industry in Sudan and how to reduce it in power sector Greater Nile Petroleum Operating Co. Ltd (NEEM Field Sample)

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I. I.PERSONAL REFLECTION

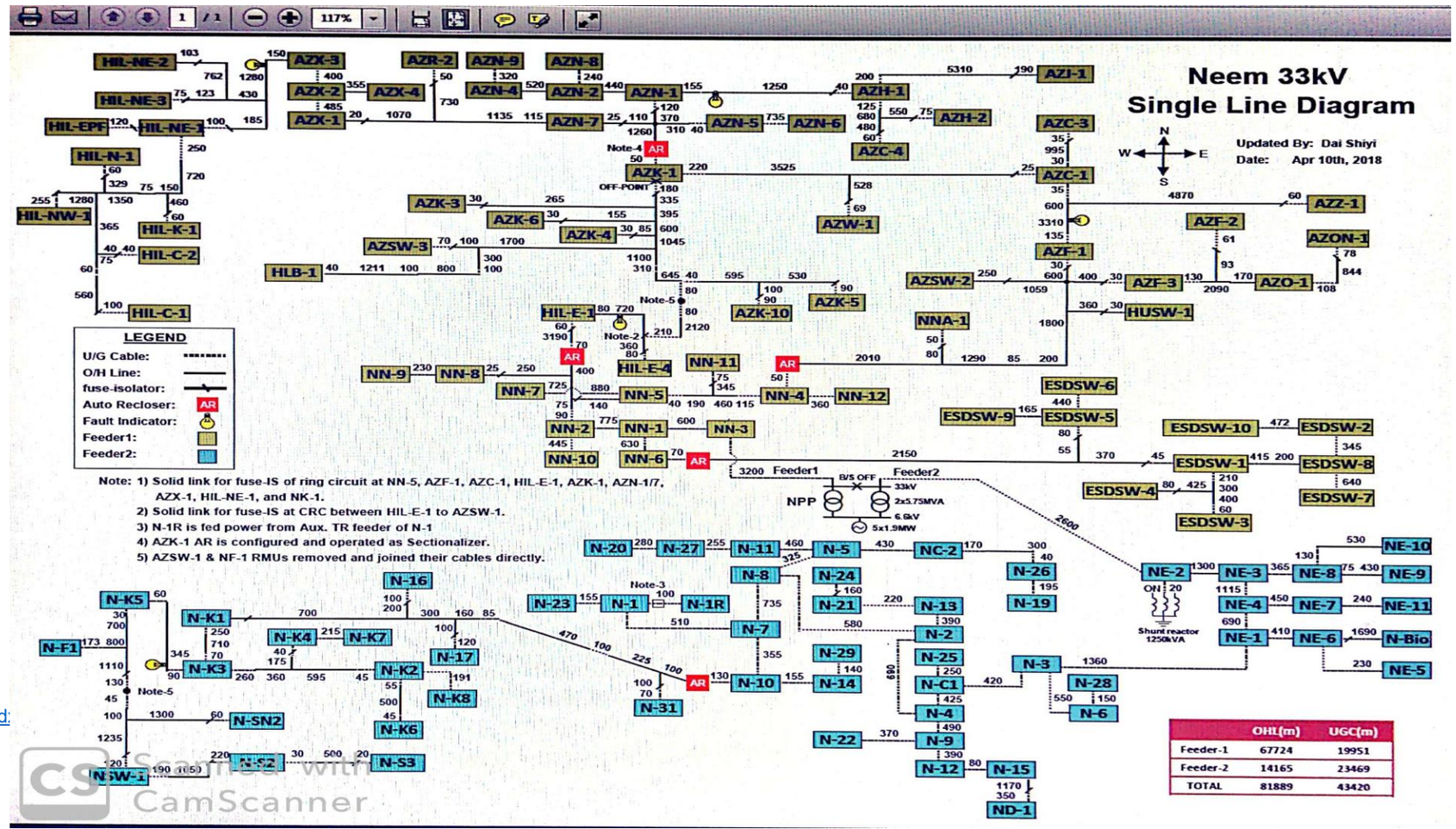
I really enjoyed my experiments **Dr. Zainab Mahmoud university of Bahrey** and other employee even though it was not easy starting for me. Evaluation and control of vandalism impact in oil and gas field were my first trial, and I didn't know how to do my research and who to start my work **(Power plant acting superintendent in NEEM field)** **Mr. Adam Mohmedani** support me and offer all the required information related to power section, I had only a slight understanding of my research topic, the progress of experiments, and data analyzing. **Dr. Zaunab Mahmoud** answered all my questions and helped me to make great progress in my research. Finally, I understand my research topic well and I did my poster presentation.

II. INTRODUCTION AND RESEARCH PROBLEM:

In the beginning, oil fields in Sudan are located in tropical areas very far from the cities and NEEM oil field located in south west Kurdufan It's a troubled area a few years ago, especially in the summer. Most of the population of these areas they are shepherds. Therefore, we find that their awareness and security sense is not sufficient to deal with the entry of the oil industry to their regions; especially this industry has not reflected in positive way of development, education and health on the lives of these nomads. These accumulations formed a kind of clash between some of the population of these areas and the environment surrounding them, as well as the entry of some thieves from outside the region all these things helped in the emergence of systematic vandalism in the power sector, which is motivate me to work in this paper. One of the most important reasons that contributed to the reduction of control of vandalism is the lack of education and the proliferation of weapons, which has contributed to the killing and kidnapping of some employees in oil companies, I have also been shot three times during the last eight years. We are in the process of doing a study that helps in understanding the root causes of the problem and then we seek to do a comprehensive plan can solve the current problem as well as the expected problems. Therefore, the solutions must be concentrated in two parts (technical and developmental aspects) it should be noted that security solutions do not fulfill the purpose, unless they are include technical and developmental solutions, depending on the complexity of the scene here, we should follow the above mentioned methods to stop the vandalism with less cost.

III. Materials and Methods:

An illustration of wells distribution in the Neem field



Map number one

Detailed report about the vandalism and the cost of repair as well as the cost of oil deferment per barrel in USD rate

1) According to the Incident report during 2014

NO	Date	Location	Cable cut /Other damaged	No of well affected	Oil deferment Bbls	Cost of repair	Cost of material
1	10/6/2014	Neem wells	Removing of RMUs' covers by force from (NE-02, NE-03, NE-05, NE-07, NE-011, NE-014, NE-25 & NE-26 and NEK-02 & NEK-06).	10 wells	0	0	* Missing of safely operation * Missing earth switch mechanical interlock
2	11/6/2014	NEK-02 and NEK-06	* Removing of RMU cover plus * Two cartridge fuses by unknown. * HV cable cut from T-P to RMU	Tow suspension wells	0	0	* Missing of HV cable 60M * Missing of safely operation * Missing earth switch mechanical interlock
3	13/6/2014	HLBE-01	HV cable cut at CRC T-P near HLBE-01	23 wells	1181	6000	* Missing of HV cable (25M) * One Straight joint one kit * One Elastic-mould termination kit
4	19/6/2014	NM-11	Removing of RMU cover plus 2 cartridge fuses by unknown	NM-11	64	100	* Missing of safely operation * Missing earth switch mechanical interlock
5	20/6/2014	Neem East wells	Removing of RMUs covers by force by unknown at NEE-03, NEE-04, NEE-06, NEE-07, NEE-08, NEE-11 & NEK-04	7 wells	100	0	* Missing of safely operation * Missing earth switch mechanical interlock
6	21/6/2014	NEC-02 & NM-03	Removing of RMUs covers by force by unknown at NEC-03, NE-03	2 wells	0	0	* Missing of safely operation * Missing earth switch mechanical interlock
7	22/6/2014	NM-23 & NM-25	Removing of RMUs covers by force by unknown at NM-23, NM-25 & AZF-01	3 wells	0	0	* Missing of safely operation * Missing earth switch mechanical interlock.
8	22/6/2014	NEK-04	HV cable cut from RMU to skid S/D TR	One well down	282	1320	* Missing of HV 1Cx70 mm^2 cable 60M * Missing of two cartridge fuses. * Missing of two cartridge fuses. * Missing of two Elastic-mould terminations. * Missing earth switch mechanical interlock

9	6/7/2014	NEK-02	HV cable cut under the RMU at NEK-02	28 wells	420	6000	* Missing of HV cable 60M * Missing of safely operation * Missing earth switch mechanical interlock
10	11/7/2014	T-P near NEK-02	Earth cable cut at terminal pole near NEK-02	28 wells	500	6000	* Missing earth switch mechanical interlock
11	17/7/2014	NEE-07	Removing of the RMU covers	1	5	0	* Missing earth switch mechanical interlock.
12	20/7/2014	Segment between NE-10 & NEK-05	Broken of 50 disc insulators by unknown	28 wells	90	3500	* Neem feeder-02 tripped * Missing of 50 broken disc insulators
13	24/7/2014	Canar feeder-01	Broken of 16 disc insulators by unknown	8 wells	260	1300	* Missing of 13 broken disc insulators
14	14/10/2014	Canar feeder-01	HV cable cut at fuse switch isolator T-Pole supply SUS-03	8 wells	150	4000	* Canar feeder-01 tripped * Missing of HV cable (20M) * One Straight joint one kit. * One heat shrinkable termination kit.
15	16/10/2014	Neem feeder-01	Operation handle removed by force, plus HV & LV cables were cuts by unknown person.	21 wells	137	0	* Neem feeder-01 tripped * Missing operation handle. * Missing of HV & LV cables (88M) * One heat shrinkable termination kit * Major damaged on the auxiliary TR
16	21/10/2014	HAZ-06	L.V cables cuts & taken by unknown	HAZ-06	200	0	□□Missing LV cable 4Cx50 (70M) * Missing PS cable 2x2.5 (70M).
17	21/10/2014	NEE-07	HV single core cable supply Reda ESP skid cut in a theft attempt by unknown	NEE-07	0	0	* Missing two single core cables. * Major damaged on Reda ESP skid
18	24/10/2014	NEE-04	HV single core cable supply Reda ESP skid cut in a theft attempt by unknown.	NEE-07	200	6000	□□Missing two single core cables. * Major damaged on Reda ESP skid
19	23/10/2014	Canar feeder-01	HV cable cut at fuse switch isolator T-Pole supply SUS-03	8 wells	150	6000	* Canar feeder-01 got tripped * Missing of HV cable (20M) * One Straight joint one kit. * One heat shrinkable termination kit.
20	24/10/2014	NEE-09	HV cable cut under the RMU	28 wells	170	6000	* Missing of HV cable 60M * Missing of safely operation * Missing of earth switch mechanical interlock
Summation per USD and barrel							

Table number two

2) According to the Incident report during 2015

NO	Date	Location	Cable cut /Other damaged	No of well affected	Oil deferment Bbls	Cost of repair	Cost of material
1	NA	NA	NA	NA	NA	NA	NA

Table number three

At 2015 the result of vandalism Not Available

***3)** According to the Incident report during 2016*

NO	Date	Location	Cable cut /Other damaged	No of well affected	Oil deferment Bbls	Cost of repair	Cost of material
21	6/2/2016	NMF-01	HV outgoing cable exposed to a theft attempt at T-P near NMF-01.	2	200	6000	* One heat shrinkable termination kit.
22	1/10/2016	ELSANDAL wells	Metal wire thrown at OHL segment by Unknown	6 wells	79	300	* Missing of three broken disc insulators
Summation per USD and barrel							

Table number four

4) According to the Incident report during 2017

NO	Date	Location	Cable cut /Other damaged	No of well affected	Oil deferment Bbls	Cost of repair	Cost of material
23	23/1/2017	HILBA area	Broken of disc insulators by unknown	N/A	0	400	* Missing of four broken disc insulators
24	5/3/2017	CRC Bet.AZSW-01 & AZK-01	HV Cable cut by unknown person	30 wells	100	6000	* Missing of HV cable at CRC near AZSW-01
25	12/4/2017	Neem feeder-01	Broken of disc insulators by unknown	2 wells	20	6580	* Missing of 94 broken disc insulators
26	10/6/2017	Neem feeder-02	Cable cut by thief under NEK-03 RMU	4 wells	100	12000	* Missing of 25 Meter cable. * One straight joint & one termination.
27	29/6/2017	NM-04 & NM-24	Missing of five RMUs' covers at NEM-04 & NM-24 which are dismantled by	N/A	0	0	* Missing of safely operation * Missing earth switch mechanical interlock

			forced by unknown.				
28	27/7/2017	Bet. HLBE-01 & AZK-01	Broken disc insulators	2	110	12600	* Missing of 180 disc insulators
29	15/9/2017	NE-31 RMU	Two covers opened by force by unknown	N/A	0	0	* Missing of safely operation * Missing earth switch mechanical interlock
30	8/12/2017	HLNW-01	HV cable cut by unknown	N/A	0	0	* HV cable cut supply HLNW-01 RMU
31	15/12/2017	NN-11	Two RMU covers	N/A	0	0	* Missing of safely operation * Missing earth switch

5) *According to the Incident report during 2018*

NO	Date	Location	Cable cut /Other damaged	No of well affected	Oil deferment Bbls	Cost of repair	Cost of material
32	21/2/2018	Near HILBA EPF	Earth wires cuts at T-P near HINE-01	8 wells	14.5	0	* Missing of earthing system protection
33	27/2/2018	Near HILBA EPF	Earth wires cuts at T-P near HINE-01	9 wells	17.5	0	* Missing of earthing system protection
34	10/4/2018	HILNW-01	HV cable cut by unknown	5 wells	20	6000	* Missing of HV cable (25M). * Damage of indoor termination. * Damage of cable
			removed by force by unknown				mechanical interlock
Summation per USD and barrel							

Table number five

							support insulators
35	15/5/2018	NE-18	RMU covers removed by force	N/A	0	0	* Missing of 3 RMU covers
36	29/5/2018	AZN-02	HV cable cut by unknown	One well	0	4500	* Termination failure at incomer cable * Missing of HV cable 5 M * One Elastic-mould termination kit
37	19/7/2018	Bet. NEF-01 & NESW-01	13 Broken disc insulators				Waiting for scope of work
38	28/7/2018	HILB-NW-01	L.V cables cuts plus damaged on MDB panel by unknown	One well	80	0	* Missing of L.V cable (25M). * Damaged of MDB panel. * Missing earth switch

							mechanical interlock
39	28/7/2019	NM-16	L.V cables cuts & taken by unknown	One well	0	0	* Missing of L.V cable (25M). * Damage of MDB panel * Missing of PCP VSD panel.
40	20/8/2018	NES-02 & NESN-02	Damage auxiliary TR., cut the H.V. cable at T.P. supply NESN-02	Tow suspension wells	0	6000	Two auxiliary TR. & H.V. cables at NESN-02
41	10/10/2018	Bet. HILBE-01 & AZK-01	35 Broken disc insulators	10 wells	154	6000	WO awarded to HPSIC
42	26/10/2018	NEE-09	L.V cables cuts & taken by unknown	suspension well	0	0	* Missing of L.V cable (25M). * Damaged of MDB panel. * Missing earth switch mechanical interlock
43	29/10/20	HILE-N-03	L.V cables cuts & taken by unknown	One well	80	0	Missing of L.V cable (25M).
44	30/10/2018	AZJ-01	Incomer H.V.cable	suspension well	0	6000	Missing of L.V & H.V. cables
45	2/11/2018	AZO-01	L.V cables cuts & taken by unknown	suspension well	0	0	Missing of HV cables (60M)
46	2/11/2018	AZF-03	H.V.cable cut by unknown	suspension well	0	6000	Missing of L.V & H.V. cables
47	24/12/2018	NEC-01,NE-16	Earth wires cuts RMU building	suspension well	N/A	N/A	* Missing of safely operation * Missing earth switch mechanical interlock
48	15/1/2019	NN-11, HUBSW-01 & HILBE-04	Damaged at 33KV RMU, MDB & TR plus MV & HV cable cut at HUBSW-01 & T-P supply NN-11 respectively.	suspension well	0	0	* Missing of MV & HV cables. * Damaged of RMU, TR, & MDB panel * Missing of PCP VSD panel.
49	16/2/2019	HILBE-04	H.V & L.V cables cut by unknown	suspension well	0	6000	* Missing of MV & HV cables.
50	29/3/2019	NN-03	L.V cables cut by unknown	NN-03 TR	0	0	* Missing of L.V cables.
51	12/5/2019	South field at Neem (K) wells	100 Pieces of Broken disc insulators at 33KV OHL network	6 wells	70	9500	Missing of 100 Pieces of Broken disc insulators. WO awarded to HPSIC
Summation per USD and barrel							

Table number six

1.12 The table region that highlighted by the yellow color referred to high voltage cable termination and repair as you see all most of the price is **6000 USD** (**3000 USD repair cost and 3000 USD termination kits cost)**. So the total cost due to vandalism mentioned in the above reports due to cable cut is 81820 + (2827 x 70$) = **279710 USD**

1.13 Total amount of cost due to RMU partial damage caused oil deferment = **137390 USD**

1.14 Total money of repair is 115650 USD, total oil deferment 5364 multiply into 70$ equal 375480 USD. So the total cost due to vandalism mentioned in the above reports is 115650 + 375480 = **485130 USD**

Note: -

- 70S the price of a barrel of crude oil today.
- The cost of low voltage cables has not been added in this report
- The cost of high-voltage cables will be added to the cable cut paragraph

Additional vandalism of Ring Main Unit, Aux Transformer, cables cut and Overhead Transmission Line

I would like to refer that all the information contained herein has been taken directly from the site of the event and has also been compared with a report of NEEM high voltage technician (NEEM Field General Survey for HV Facilities and Equipment's Data & Record).

NO	Well Name	Company Name	Price	Minimum Connections	Connections Price
1	NENA-01	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
2	NES-01	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
3	NES-03	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
4	NESN-01	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
5	NESN-02	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
6	NESW-03	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**

6) Ring Main Unit (RMU) damage

IV. THE ADVANTAGES OF OUR GAS-INSULATED RING MAIN UNITS

- All components conducting medium voltage are insensitive to
– Air humidity
– Aggressive atmosphere
– Dirt
– Dust
– Vermin and rodents
- SF6 – an insulating gas featuring extremely favorable properties
– Extremely high insulating capacity
– Incombustible
– No contact oxidation
- Maximum operating safety due to
– Low gas pressurization
– Excellent gas-proofing
– High inductive breaking capacity
- Minimum floor space / room requirements due to
– insulating medium SF6
– Compact design
- Maximum personnel safety
– Straightforward and safe operation
– Comprehensive, powerless interlocking system
– tested and approved for behavior in case of an internal fault (PEHLA tested)
- Zero maintenance for life-time (approx. 30 years)

7	NETW-01	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
8	AZK-05	Schneider	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
9	HLE-03	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
10	HLE-04	AREVA	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
11	NEN-11	EFACEC	**40000**	Incomer, Aux and ESP termination	**3x3000 = 9000**
	Six of these RMU has been damaged during two years from 2009 to 2011				
	Total		**440000**	Total	**99000**

Table number seven

22.1 The total amount of RMU cost equal **440000 USD**

22.2 The total amount of cables termination cost equal **99000 USD**

22.3 The total amount cost of RMU partial damage caused oil deferment = **137390 USD** (this information has been collected from table one to table six)

22.4 The total cost of RMU, RMU partial damage and cables termination equal **440000 + 99000 + 137390 = 676390 USD**

Note: -

- Currently there are **seven** damaged RMU available in NEEM FPF yard reaming **four** already there are **four** available in the well side
- Outgoing cables termination isn't included in this list

7) Main Distribution Board (MDB) damage

An MDB is a panel or enclosure that houses the fuses, **circuit breakers** and **ground leakage protection units** where the electrical energy, which is used to distribute electrical power to numerous individual circuits or consumer points, is taken in from the transformer or an upstream panel. An MDB typically has a single or multiple incoming power sources and includes **main circuit breakers** and residual current or earth leakage protection devices

NO	Well Name	MDB Price	MDB installation Price	
1	NENA-01	**10000**		**5000**
2	NES-01	**10000**		**5000**
3	NES-03	**10000**		**5000**
4	NESN-01	**10000**		**5000**
5	NESN-02	**10000**		**5000**
6	NESW-03	**10000**		**5000**
7	NETW-01	**10000**		**5000**
8	HLE-03	**10000**		**5000**
9	HLE-04	**10000**		**5000**
10	NEN-11	**10000**		**5000**
11	Five of these MDB has been damaged during two years from 2009 to 2011			
12	**Total price**	**100000**	**Total price**	**50000**

Table number eight

33.1 The total amount of MDB cost equal **100000 USD**

33.2 The total amount of MDB installation cost equal **50000 USD**

33.3 The total amount of MDB cost and MDB installation cost equal **150000 USD**

Note:-

- Currently there are **seven** damaged MDB available in NEEM FPF yard reaming **three** already there are **three** available in the well side and tow missing

Picture number two *Sample of ten Main Distribution Board (MDB) damage*

8) Auxiliary Transformer failure

V. CONSTRUCTION FEATURES

Description ABB Distribution Transformers manufactures three phase oil type small distribution trans-formers within the range 150 KVA and36 kV.

NO	Well Name	Company Name	Equipment	Price	Remarks
1	NES-01	N/A	Auxiliary Transformer	**20000**	The price include installation price also
2	NES-02	TBEA	Auxiliary Transformer	**20000**	The price include installation price also
3	NES-03	N/A	Auxiliary Transformer	**20000**	The price include installation price also
4	NESN-01	N/A	Auxiliary Transformer	**20000**	The price include installation price also
5	NESN-02	N/A	Auxiliary Transformer	**20000**	The price include installation price also
6	NESW-03	N/A	Auxiliary Transformer	**20000**	The price include installation price also
7	NETW-01	N/A	Auxiliary Transformer	**20000**	The price include installation price also
8	AZK-05	N/A	Auxiliary Transformer	**20000**	The price include installation price also
9	HLE-03	N/A	Auxiliary Transformer	**20000**	The price include installation price also
10	AZF-03	VIJAI	Auxiliary Transformer	**20000**	The price include installation price also
11	NN-011	VIJAI	Auxiliary Transformer	**20000**	The price include installation price also
12	NM-015	VIJAI	Auxiliary Transformer	**20000**	The price include installation price also
	Five of these transformer has been damaged during two years from 2009 to 2011				
	Total price			**240000**	

Table number nine

44.1 The total amount of aux transformer cost equal **240000 USD**

44.2 LV cable termination cost not included

Note:-

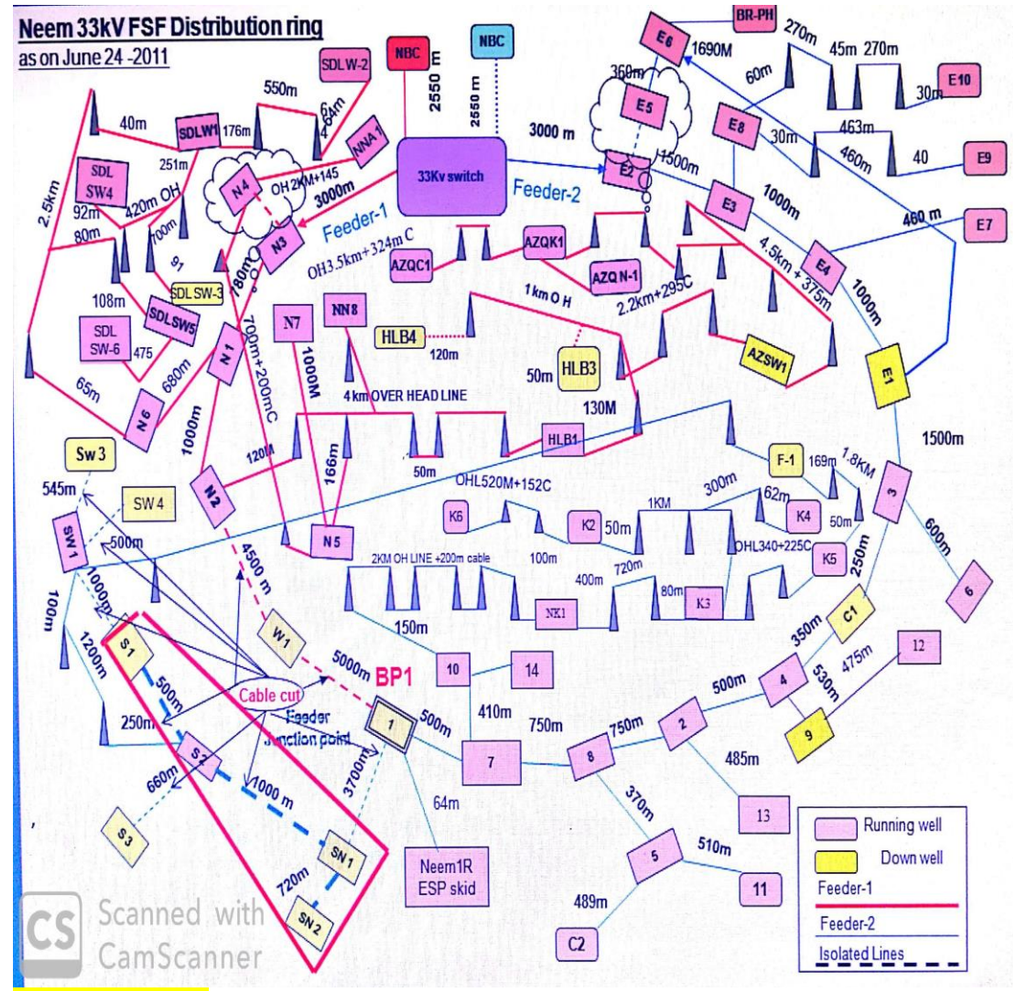
- Currently there are **nine** auxiliary transformers available in the NEEM FPF yard remaining **three** in the well side.

- Transformer price 16000 USD and installation price 4000 USD total price 20000 USD for each one

Picture number Three *Sample of twelve Auxiliary transformer damage*

9) 33Kv Cables cut

An illustration of cables cut in the Neem field



Map number two

Cable specification

- Cable Type: MV HV Power Cables
- Cable Standard: BS6622 BS7835
- Cable Voltage: 33kV
- Insulation: XLPE
- Number Of Cores: 3 Core
- Cross Section Area: 120sqmm Stranded Copper
- Cable Armor: Single Layer of Galvanized Circular Steel Wires
- Minimum Average Thickness Of XLPE Insulation: 8mm
- Nominal Thickness Of PVC LSOH Bedding: 2.0mm

No	From	To	Cable length/ price	Number of cable joint	joint Price	Number of termination	Termination price
1	NS2	NSN1	1000 meter	1	6000	2	12000
2	NSN1	NSN2	750 meter	1	6000	2	12000
3	NSN1	BP1	3700 meter	7	42000	2	12000
4	BP1	NW1	5000 meter	10	60000	2	12000
5	NW1	NN2	4500 meter	9	54000	2	12000
6	NSW 1	NS1	1000 meter	2	12000	2	12000
7	NS1	NS2	500 meter	0	0	2	12000
8	NS2	NS3	660 meter	1	6000	2	12000
9	From tables		210 meter				
10	Total length		17320 meter	15 Km of cable has been cut during two years from 2009 to 2011			
11	Total price		17320000	Total price	186000	Total price	96000

Table number eleven

66.0 Cables cut in the above table has been added to the total cable cut list which is equal 210+17110 = **173200 meter** (1 meter cost 100 USD)

66.1 The total amount of cable termination cost equal **96000 USD**
66.2 The total amount of cable joint cost equal **186000 USD**
66.3 The total amount of underground cable cost equal **17320000 USD**
66.4 High voltage cable termination and repair as you see all most of the price is **6000 USD** (**3000 USD repair cost and 3000 USD termination kits cost**). So the total cost due to vandalism mentioned in the above reports due to cable cut is 81820 + (2827 x 70$) = **279710 USD** (this information has been collected from table one to table six)

66.5 The total amount of cable termination cost, cable joint cost, total amount of cost due to vandalism mentioned in the above reports due to cable cut and underground cable cost equal **96000 + 186000 + 17320000 +279710 = 2293710 USD**

Picture number four *This cable trench is a Sample of 17,32Km of cable cut*

Note: -

- 15Km of this cable has been cut between the years 2006 – 2011
- Oil deferment due to cables cut during this period hasn't been calculated

10) Overhead transmission line vandalism

An overhead power line is a structure used in electric power transmission and distribution to transmit electrical energy along large distances. It consists of one or more conductors (commonly multiples of three) suspended by towers or poles. Since most of the insulation is provided by air, overhead power lines are generally the lowest-cost method of power transmission for large quantities of electric energy.

77.1 Broken disc insulators, cost of repair and oil deferment due to discinsulator equal 24000 +(629 multiply into 70$) equal **71630 USD** (this information has been collected from table one to table six

Picture number five

11) Security department cost optimization

It's responsible to offer escorts, patrolling teams and logistic support for the at police check points.

NO	Supervision by area	Security Patrolling fuel rate per day		Police Patrolling fuel rate per day	
	Area	No of Vehicle	Fuel rate	No of Vehicle	Fuel rate
1	AZRAQ	2	800 liter per month	4	1600 liter per month
2	HELBA				
3	NEEM				
5	Total		800	Total	1600

Table number thirteen

a) The total amount of fuel for security patrolling equal 1600 liter
b) The total amount of fuel for police patrolling equal 800 liter
c) The total amount of fuel for security and police patrolling equal 2400x1x12x5= **144000USD**
d) Diesel fuel rates per liter is 1 USD

Note: -

- The average price of diesel around the world is 1.03 U.S. Dollar per liter. However, there is substantial difference in these prices among countries.

Summary of Results

The total cost due to sabotage in NEEM oil field during five years.

No	RMU cost	MDB cost	Transformer cost	Cable cost	OHL cost	Security cost	Total
1	676390	150000	240000	2293710	71630	144000	3575730

Table number twelve

99.1 Total cost of vandalism in NEEM field within five years in power section equal **3575730 USD**

It's very clear that the cost resulting from this vandalism is very high and there are key factors that enhance the vandalism and they are as follows:-

a) The lack of fine monitoring, which caused the theft of more than **17 Km** of copper cables.
b) Delay of cable termination and joint due to **tender process** which is lead to more oil deferment as well as cable cut.
c) Stop hiring local people to work as **sentries** in oil well causing more outrage against the company and contributed to further vandalism.
d) Using of the modern monitoring system has not drawn the attention of officials in the power department from the beginning so they didn't install OPGW in the transmission line grid, so they can use it in closed-circuit television (CCTV).

Crisis management and cost reduction

We have four basic points that must be solved in order to control vandalism and stop it with the best means.

A. Delay due to tender process

Hiring of two cable jointer in NEEM field to start the work immediately after cable cut or failure to avoid the delay due to tender process

1- Cost of two cable jointer salary should be 1000 USD per month for each one
2- Cost of tools it's about 10000 USD
3- Total cost per five years equal 1000x2x12x5+(10000)= **130000 USD**

B. Sentries

Hiring of local workers creates a friendly relationship between the company and the local thus reducing the lack of tension between the two sides, which is reflected positively in reducing the vandalism.

1- Cost of 30 sentries (to cover 61 running wells) salary would be around 200 per month for each one
2- Total cost per five years equal 200x30x12x5)= **3600000 USD**

C. OPGW installation

Overhead ground wire (OPGW) constructed to obtain precise information on this line for maintenance purposes.

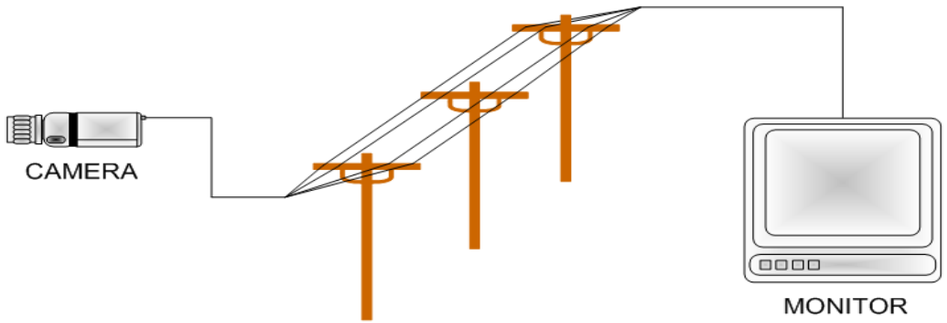
OPGW

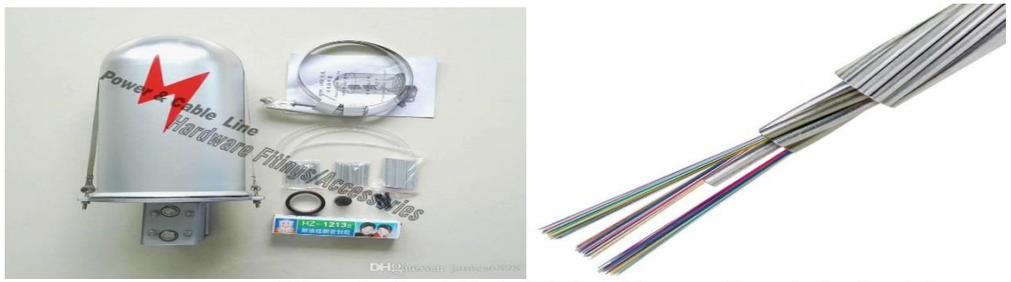
This system comprises three major functions:

a) Internal communications
b) Industrial TV monitoring for visual observation of movement surrounding conditions and site facilities
c) Supervisory control and data acquisition (SCADA)

Wired Transmission

Optical Transmission system normally carrying various payloads including SCADA/Telemetry/ Tele-protection and closed-circuit television (CCTV





Picture number six *Fiber Optical Metal Joint Closure Box & Optical Ground Wire*

Picture number seven

1) 82Km OPGW cost is 1 meter per 1 dollar
2) Total price of OPGW 82000 USD
3) OPGW Joint Box cost 40 USD per box
4) Total cost of OPGW Joint 100 Box 4000 USD
5) Total cost of installation and transportation 50000 USD
6) CCTV camera cost 50x10=500 USD each camera cost 10 USD
7) Total cost **136500 USD**

D. Installation of Silicon rubber Composite insulator instead of glass insulator

The properties of Silicone rubber coating

1) Thermal resistance
2) Bonding properties
3) Mechanical properties
4) Expansion
5) Release properties
6) Permeability to Gas and Water-Vapor
7) Chemical Resistance
8) Radiation Resistance
9) Flame Resistance
10) Optical Properties

Due to all these reasons we can use it instead of glass to avoid disc insulators broken

1) Length of OHL equal 82Km each 100 meter there is suspension insulators
2) 82Km/100m equal 820 point, in each point we have three phase
3) 820x3=2460 insulators
4) Silicon rubber Composite insulator cost equal 4 USD
5) Emergency restoration system about 15% and tension insulators about 10%
6) 2500 transportation + 20000 installation = **37875 USD**

Picture number eight

Note:-

- Silicon rubber Composite insulator already use in cable support and there is no any failure resisted case.
- Silicon rubber Composite insulator also used in PETROENERGY Oil Company BALILA field nearby (10Km far from AZRAQ area) NEEM field and having same weather circumstances.

E. Security cost reduction

Reducing the number of vehicles that used in patrolling and thus can reducing fuel consumption as well as logistical support

NO	Supervision by area	Security Patrolling fuel rate per day		Police Patrolling fuel rate per day	
	Area	No of Vehicle	Fuel rate	No of Vehicle	Fuel rate
1	AZRAQ	1	400 liter per month	2	800 liter per month
2	HELBA				
3	NEEM				
5	Total		400	Total	800

Table number thirteen

10.11 Since there are sentries guarding the wells then we can decrease the patrolling as well as the security and police vehicles. Total cost equal 1200x1x12x5= **72000 USD**

The total cost of solution in NEEM oil field during next five years

The total cost of solution in NEEM oil field during next five years

No	Cost of Jointers	Sentries	OPGW installation	Composite insulator	Security cost	Total cost
	130000	3600000	136500	37875	72000	736375

Table number fourteen

11.1 Certainly there is a big difference between the cost of vandalism and the cost of proposed solutions, and this is a fundamental reason to start working on proposed solutions that would provide a good profit for the company.

11.2 The following comparison can explain the difference.

Comparison between the total cost due to vandalism in NEEM oil field during five years & the total cost of solution in NEEM oil field during next five years

Number	1	Field	NEEM	Vandalism cost	3575730
Number	2	Field	NEEM	Solution cost	736375
Number	3	Duration	Five years	Variation	2839355

Table number fifteen

12.1 We can offer amount of **2839355 USD** per five years if we follow these recommendation, so that mean annually we can offer around **567871 USD** can be used in career development.

Conclusion and Recommendations:

12.1 This paper can prevents or minimizes the vandalism that occurred due to none providing the modern monitoring devices as well as the creation of a healthy

working environment between the company and the local people by employing some of them to work as sentries in the wells.

12.2 If everything goes as planned, we can achieve a success rate that can exceeds seventy five percent.

12.3 Total cost of vandalism in NEEM field within five years in power section equal **three million and five hundred and seventy-five thousand and seven hundred thirty dollars.**

12.4 The total cost of solution in NEEM oil field during next five years should **be seven hundred and thirty six thousand and three hundred seventy-five dollars.**

12.5 If we start activating this plan, we can save **more than two million eight hundred thousand dollars over the next five years.**

12.6 Most of these solutions can continue to more than fifteen years here I mean technical solutions. Other solutions are for five years renewable, so the cost of the solution will decrease much more by the time.

12.7 This work is suitable to be a base for creating other projects in a similar work environment, so we can use OPGW, Silicone rubber insulator and CCTV for monitoring from the beginning hiring the local people in non-educated jobs to make friendly work environment between the company and local people, this work is subject to deletion and addition from all employees of the company without prior permission.

Acknowledgements

I really am very grateful to all those who contributed in directing this work in this way, and especially thanks to the engineer Adam Mohmedani, Dr. Kamal Ramadan and Dr. Zainab Mahmoud (University of Bahrey) as well as the Departments of Power and Security.

References

No	Name	Collected data	Contact details			Position
			Email	Website	Mobile	
1	Adam Mohmedani	Tables 1-6 and drawing	mohmedani@heglig.gnpoc.com		+2491242182479	Power Superintendent
2	Adam Mohmedani	Joint/Termination price	mohmedani@heglig.gnpoc.com		+2491242182479	Power Superintendent
3	Adam Mohmedani	Drawing	mohmedani@heglig.gnpoc.com		+2491242182479	Power Superintendent
4	Hassan Omer	Security cost information	homer@gnpoc.com		+249911146777	Security Supervisor
5	Khalid Abd Elsadig	Cable/RMU/MDB/Transformer price	kelsadig@gnpoc.com		+249916181500 +249123081500	Consultant
6	33kv Suspension/Tension Composite Insulator		https://wzyikun.en.made-in-china.com/product/oNqQLteCCVcx/China-11kv-33kv-Suspension-Tension-Type-Pin-Type-Post-Type-Composite-Insulator.html			
7	12 Core Fiber Optic Cable OPGW Aerial Overhead Fiber Optic Cable		https://wolonfiber.en.made-in-china.com/product/DjGEIILyhvWt/China-12-Core-Fiber-Optic-Cable-Opgw-Aerial-Overhead-Fiber-Optic-Cable.html			
8	CCTV Technology Handbook		https://www.dhs.gov/sites/default/files/publications/CCTV-Tech-HBK_0713-508.pdf			
9	CCTV camera outdoor waterproof		https://www.dhgate.com/product/fake-dummy-security-cctv-camera-outdoor-waterproof/461387343.html#s1-12-1;searl|0112901859			
10	OPGW Joint Box Fiber Optical Metal Joint Closure Box OPGW&ADSS Joint Splice Box OPGW termination Canister		https://www.dhgate.com/product/opgw-joint-box-fiber-optical-metal-joint/405746699.html			
11	Diesel prices per liter		https://www.globalpetrolprices.com/diesel_prices/			
12	Rami Khalid	NEEM Field General Survey for HV Facilities and Equipment's Data & Record	rkhalid@gnpoc.com		HV Tech	
13	NEEM Field Process Facility	Total running wells 61	nfpf@gnpoc.com		Operator	

Table number sixteen

Challenges Facing Telecommunication Firms in E-Marketing of Services: A Survey of Six Selected Tele-Firms in Tanzania

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Abstract: *Despite the success enjoyed by players in Tanzania tele-industry, a number impediments have been drawing back firms' initiatives to realize their goals; that attract scholars' attentions to have a shared understanding for effective strategic formulation in annulling them. In this paper, the main study question was, "what are challenges facing tele-firms in e-marketing of services in Tanzania tele-industry?" The specific research questions were three, namely; what are technological challenges facing tele-firms in e-marketing of services in Tanzania tele-industry; what are socio-marketing challenges facing tele-firms in e-marketing of services in Tanzania tele-industry? And, what are lead generation challenges facing tele-firms in e-marketing of services in Tanzania tele-industry? Three hypothesis considered by the researcher were tested to find the relevance and validity of the findings. A study was a cross-section survey undertaken in five selected tele-firms in Tanzania, namely; Vodacom, Tigo, Airtel, Halotel, Zantel and TTCL. The data were collected by the use of research schedules and telephone interviews. The study employed descriptive and inferential models (namely; Hypothesis Test for Proportions; Proportion Chi Squire Test; Correlation Coefficient, Regression, and t-test models) as the test statistics. Besides all challenges identified through descriptive statistics, inferential revealed the major challenges tele-firms face in Tanzania tele-industry to be; mismanagement e-marketing channels, inapt incorporation of marketing strategies with consumers' social behavior and improper communication of firm's brand. The results in this study were deemed to be a useful source of literature reviews; creating tele-firms' alert on the nature of e-marketing defies in Tanzania tele-industry for strategic remolds.*

Key Words: Challenges, Telecommunication, Marketing, e-marketing, Services.

Background to the Problem

Despite the open environment for technology transfers, as well as readily available markets for services[1] in the globe, employment of e-marketing of services has been the major challenge[2] experienced by most of tele-firms [3](Agwu, 2015). Many firms are still striving to incorporate e-marketing[4] functions with their business strategies (Stevens, 2011). Tanzanian Tele-firms are too the victims of this business dilemma (Lubua, 2017). Businesses are experiencing fundamental changes due to the impact of information technology whereby e-marketing gets in as the business driving machinery (Brown, 2017). The targeted e-market delivery use contextual targeting[5] and behavioral targeting[6] (Deiss, 2017).

Affiliate marketing, email, phones, online contents, search engine, social media and televisions are a few of widely used channels (Hidalgo, 2015). The global changes associated with e-marketing systems in enhancing firms' productivity and world's economy, including: changes in business process and procedures, new roles and responsibilities, firms' restructuring, new facilities, and new skills to learn are common drivers of changes in business strategies in dynamic industrial milieus (Deiss, 2017).

Despite these tremendous changes, the global e-marketing faces several setbacks in a number of varied environmental dynamics. In USA, for example, by the year 2010, such firms as Google, Apple and Microsoft ware in eminent fight with electronic pirates and other web uncertainties (Brown, 2017); whereas China, the major established tele-market, was suffering from strong government monitoring of telecoms information flow to limit private use for sensitive issues (Wirtz, 2016). On the other hand, in Kenya tele-industry, for example, Safari COM firm, such problems as budgetary constraints, high service prices and old technology use were reported as common problems among others (BMI, 2016). Firms in Tanzania tele-industry faced relatively similar problems,

[1] Services: are activities, benefits or satisfactions that are offered for sale (Johann, 2015)

[2] Challenges: are areas of improvement that attract people's attention (Kotler, 2011).

[3] Tele-firms (also telecommunication firms): firms facilitating the exchange of info over significant distances by electronic means through differed types of voice, data and video transmission (Yarrow, 2014).

[4] E-marketing: implies achieving marketing objectives by the use of digital technologies (Deiss, 2017)

[5] Contextual targeting: is the form of contextual advertisement that matches ads to sites in the display network using your key words or topics among other factors (Yarrow, 2014)

[6] Behavioral targeting: refers to technique used by online publishers and advertisers to increase the efficacy of their campaigns via gens collected on an individual's web-browsing behavior (Deiss, 2017).

with more or less differences for which rural infrastructures seem to be the major one among others (Mwakaje, 2010 & Lubua, 2017). However, differences in challenge from one industry to another were clearer and significant enough to compare.

Tanzania tele-industry seem to have positive growth, however. The major rivalry tele-firms with their subscription market share being: Vodacom (33 percent); Tigo (27 Percent); Airtel (26 percent); Halotel (10 percent); Zantel (03percent); and TTCL (1percent) (TCRA, 2019). It is estimated, that only 14 percent tele-services are known and used by average people (non-educated and standard seven), 29 percent by secondary school and 44 percent for those with college education (BMI, 2016). In average, 71 percent of tele-services[7] are inadequately marketed and hence unused by the prospective consumers in the market. And, if this is not keenly resolved, some firms in Tanzania Tele-industry[8] might eventually find themselves placed out competitive edged in international telecommunication business. However, the pertinent question is, "what could be the shared challenges faced by Tanzania tele-firms in e-marketing of services?"

Statement of the Problem

E-marketing of services has been one of the major challenges facing tele-firms not only in Tanzania but also in the entire global service industries. Although firms apply various strategies to acquire large market shares in varied industries, e-marketing programs has never assured tele-firms of their continued survival in Tanzania tele-industry (Agwu, 2015 & BMI, 2016). Tele-firms have been experiencing enormous strategic failures; poor demand creation; and less prospects conversion to actual buyers of e-marketed services, despite massive investment they employ in the context of non-profitable price war's industry (Mwakaje, 2010 & Brown, 2017). Given that e-marketing can directly or indirectly impact firms' and industrial profitability, the proposed study is set to explore the challenges facing tele-firms in e-marketing of services, allied impacts and suitable strategic options; with a specific focus to six selected tele-firms in Tanzania tele-industry, namely: Vodacom, Tigo, Airtel, Halotel, Zantel and TTCL.

The study Question

The overall question in this study was, "What are challenges facing tele-firms in e-marketing of services in Tanzania tele-industry?" And, the proposed specific study questions were;

- What are technological challenges facing tele-firms in e-marketing of services in Tanzania tele-industry;
- What are socio-marketing challenges facing tele-firms in e-marketing of services in Tanzania tele-industry; and,
- What are lead generation challenges facing tele-firms in e-marketing of services in Tanzania tele-industry.

However, it was the researcher's expectation that, if the study is well done, core challenge facing Tanzanian tele-firms in e-marketing of services will be uncovered; profitable strategies to overcome the identified challenges in Tanzania will be generated; scholars will have the ready source of literature for reviews.

Literature Review

Literatures offer a number of conceptual models and theories governing the e-marketing and consumers' behaviors on services marketing. According to marketing theory, to maximize sales, a firm must position its products in the market place in such a way that consumers believe they need a particular product, and that, a product they need has a particular benefit (Kotler, 2011). The success key of the theory lies on the effectiveness of firm's demand creation to consumers on brand appeal (Johann, 2015). That is to say, a successful firm in e-marketing of services is the one adopting marketing philosophy that, products are sold not bought (Kotler, 2011). E-marketing firms can maximize their sales by integrating game theory in their marketing strategies to overcome the conflicting priorities of e-marketing agents wishing to get outcome based on their choices (Blanchard, 2011; Johann, 2015 & Hidalgo, 2015). With this, strategic firms need to apply networking theory on patterns change within social networks, where the use of digital marketing channels that allow marketers to listen what consumers are saying is inevitable (Hidalgo, 2015).

Many tele-firms in Tanzania and the rest of the globe, either explicitly or implicitly employ generation marketing theory (Wirtz, 2016). The theory holds that, consumers born of the same generation … defined as 20-year period – have common attitudes and behavior because of shared experiences influenced by their childhood and shaped by their world (Blanchard, 2011). Overgeneralization of this theory and its applications across different niches of e-marketed service is of practical doubt; as consumers' culture widely vary across social communities with subcultures influencing consumers' behaviors, regardless of age similarities. Moreover, both economic and political inclinations, social upbringings, localities, and genetic predispositions, have also un-denied influences on shaping what an individual has to be; hence, creating the attention for scholarly studies.

Despite a set of 7Ps as the market mix model for service marketing, such unique service features as; intangibility, perishability, heterogeneity and inseparability have never left service e-marketers safe (Berry, 1980; Baron, 2003 & Jha, 2016). With *intangibility a*s a unique feature, service cannot be: inventoried, patented, aptly priced, and be readily displayed (Judd, 1968; Berry, 1980 & Jha, 2016). With, *inseparability* as a unique character, consumers are driven into service delivery process, with snags in centralized mass production (Berry, 1980 & Wirtz, 2019). Moreover, *heterogeneity* renders difficulty in achieving service standardization and quality control (Berry, 1980 & Jha, 2016). Whereas, due to *perishability*, services, cannot be stored (Judd, 1968 & Wirtz, 2019). All these unique characters have enormous effects to consumers' buying behaviors that need to be merged to e-marketers' strategies, tactics and channels.

However, the following strategies have been suggested for solving problems arising out of unique service features. With intangibility problems; stressing tangible cues, the use of personal sources more than non-personal source, creation of strong firm's brand, as well as the post purchase communication are options (Judd, 1968;

[7] Tele-service: Is a TCRA adopted acronym for telecommunication services (TCRA, 2019)

[8] .Tele-industry: is a TCRA adopted acronym for telecommunication industry (TCRA, 2019)

Berry, 1980; Baron, 2003; Jha, 2016 & Wirtz, 2019). With inseparability, selection and training of public contact personnel, managing consumers, and the use of multisided locations are vital (Berry, 1980; 1980 & Jha, 2016). And, with *heterogeneity*, industrialized and customized service are part of strategic fit (Berry, 1980 & Baron, 2003). Whereas, with *perishability*, copying strategies with fluctuating demand as well as simultaneous change in demand and capacity are the suggested strategies (Baron, 2003; Kotler, 2011 & Wirtz, 2019). However, the business settings decides efficacy of a strategy.

Some challenges are more of e-marketing system oriented than services themselves in nature. Every e-marketing operation, being large or small, faces; firms' rivalry; risk of data losing; balancing between efficiency and confidentiality; volume of e-market data; integrating off-line data; and delivering the goods cost-effectively (Hidalgo, 2015 & Stevens, 2011). Others would include illegal access, pillage of electronic channels; and allied cybercrime uncertainties (Mwakaje, 2010; Agwu, 2015 & Lubua, 2017). However, the brand building, customers' retentions, multiple channels use to close the transactions are considered as principle strategies for building customers' strong bases, among others (Stevens, 2011; Dhar, 2015 & Wirtz, 2016). If properly utilized, e-marketing may aptly help to execute firm's strategies, including: business process automations, streamlining businesses, providing information, connecting customers, demand generations and productivity tools (Yarrow, 2014; Dhar, 2015 & Wirtz, 2016). Despite its perceived benefits, e-marketing is inadequately used in both rural and urban milieus due to hostile e-marketing support systems such as; media costs, electric bills as well as unreliable digital connectivity (Mwakaje, 2010 & Agwu, 2015).

Literature Gap of Knowledge

The literature explains various concepts and theories related to services, telecoms, marketing and e-marketing. However, it is from these theories where the researcher raised several questions on their workability. Literatures provide 7Ps as the model for services marketing in overcoming generic services' unique features; and, e-marketing as business driving technology. But why tele-firms are subject to massive e-marketing strategic failures? Why telefirms find it difficult to get large customer basis in multicultural societies? And, why fail to convert reasonable leads to actual buyers despite these expounded models and strategies? All of these elaborates are theoretical and empirical puzzles for which the solutions are needed.

Study Hypotheses

Literatures reveal that, e-marketing challenges in their holistic forms are triggered by complexity of a number of factors. The emerging question is on whether technological volatility, inapt incorporation of marketing strategies with consumers' socio-behavior, and, miscommunication of firms brand values are among of challenges facing e-marketing of tele-services in Tanzania; amide unique service features or not. Therefore, the following hypotheses were considered important for the study:-

H1: Firms in Tanzanian tele-industry face high strategic failure due to their inapt management of e-marketing channels.

H2: Firms in Tanzania Tele-industry create less demand for e-marketed services due to their inapt incorporation of marketing strategies with consumers' socio- behavior

H3: Firms in Tanzania tele-industry convert less of the leads to actual buyers of their products than expected as they fail to communicate values for their brands"

Research Methodology

The study employed both qualitative and quantitative approaches to answer the designed research questions and in testing the guiding hypotheses. A cross-sectional survey research design was considered appropriate in studying challenges facing tele-firms in e-marketing of services in Tanzania (Owens, 2002). The study took place in six giant selected tele-firms operating in Tanzania tele-industry (namely; Vodacom, Airtel, Tigo, Halotel, Zantel, and TTCL). The target population included tele-services consumers and operators. A sample of 30 tele-service operators, and 60 tele-services consumers was obtained for the analysis. Both simple random and purposive sampling methods were used to select study participants (Kothari, 2003). While the dependent variables being; rates of strategic failure, demand creation and lead conversion; the independent variables were; e-marketing channels mismanagement, consumers' social behavior, and brand value communication. Data were collected by using research schedules and documentary reviews; the frequencies and percentage of which were presented in tables. Hypothesis Test for Proportions; Proportion Chi Squire Test; Correlation Coefficient, T-test and Regression models were used to assess variables relations for better understanding of different perceptions of the respondents.

Findings and Discussion

Besides the general study question, findings and discussion on challenges facing tele-firms in e-marketing of services in Tanzanian tele-industry were built on three pre-determined specific study questions. Moreover, given the research hypotheses, high level analyses of data obtained was done by the use of inferential models to testify and generalize the result; before giving the study conclusion and recommendations.

Technological Challenges of Tanzanian Tele-firms in services E-marketing

The study revealed that; quality brand generating, e-marketing management; and, web uncertainties, with 25.6 percent; 25.6 percent; and 17.8 percent respectively are three top technological challenge of telefirms in e-marketing of services in Tanzania. The study also shown that 16.6 percent of dares results from search engine optimization issues, while poor e-marketing support system adding to the hurdle by 14.4 percent (see table 01).

Decreased demand for e-marketed products with 22.2 percent, decreased Return on Investment (ROI) with 24.4 percent; and limited info access with 20 percent were the perceived impacts due to poor brands generated, e-marketing mismanagement and search engine optimization respectively. Whilst loss of customer base adding to a slack by 15.6 percent, the limited access to firms' website system was said to be 15.6 percent (see table 01)

However, respondents rated high quality brand building as the strategy to attract high quality lead by 25.6 percent; investing on

apt and cost effective channels for search engine optimization by 24.4 percent; prioritizing high performing search engines for search engine optimizing by 17.8 percent; investing on innovative ware in curbing web insecurities by 16.6 percent; and, improving e-marketing support systems in promoting rural e-marketing systems 15.6 percent (*see the summary in table 01*).

Table 01: Top Five Technological Challenges, Impacts and Strategies alternatives

Parameter	Parametric expression	Frequency	Percent
Challenges	Generating high quality brand	23	25.6
	E-marketing channels management	23	25.6
	Search engine optimization	15	16.6
	Web uncertainties (Security and privacy issues)	16	17.8
	Poor e-marketing support systems	13	14.4
	Total	**90**	**100.0**
Observed and Expected Impacts	Decreased demand for e-marketed products.	20	22.2
	Decreased Return On Investment.	22	24.4
	Limited information access.	18	20.0
	Lose of customer base.	14	15.6
	Limited access of contacts to company website.	16	17.8
	Total	**90**	**100.0**
Suggested Strategies	Building high quality brands.	23	**25.6**
	Investing on apt and cost effective channels	22	**24.4**
	Prioritizing high performing search engines.	16	**17.8**
	Investing on innovation ware.	15	**16.6**
	Improving web accessibility in rural.	14	**15.6**
	Total	**90**	**100.0**

Source: Survey data, 2019

Nevertheless, HubSpot portrays the top three technological challenges of services e-marketing in Tanzania for the past two years to be; managing company website; identifying the right technology and content targeting (HubSpot, 2017). Non-optimized content; competitive lag and inapt lead conversion to be their common impacts (Wirtz, 2016 & HubSpot, 2017); while, hiring freelancer; the use of marketing automation software as well as customization of contents for specific audience being the applied strategies (HubSpot, 2019). The said differing challenges might be due to global techno-innovations streak commanding industrial challenges in spans of times.

Inferential Implications of Variables Correlations on Technological challenges

The correlations of variables on technological challenges facing Tanzanian tele-firms in e-marketing of services were tested by using hypothesis one *(H1)* stating that;

"Firms in Tanzanian tele-industry face high strategic failures due to their inapt management of e-marketing channels"

This hypothesis was re-stated in both Null *(Ho)* and Alternative *(Hi)* hypotheses thus:-

Ho: Tele-firms' strategic failure and inapt management of e-marketing channels in Tanzania are not correlated

Hi: Tele-firms' strategic failure and inapt management of e -marketing channels in Tanzania are correlated.

Considering e-marketing channels management as one of the key technological variable for apt recital of e-marketing strategies; it was hypothesized that, many tele-firms fail to meet their strategic objectives due to inapt management of e-marketing channels in their industries. This hypothesis aimed to assess the link between firms' strategic failure and inapt management of e-marketing channels in Tanzania tele-industry. The data for relevant variables were tabulated in table 02 to enhance inferential deductions.

Table 02: Variables Relations between Tele-firm's Strategic Failures and e-marketing Channels mismanagement

Rating ranges	Respondents frequencies (fX and fY) on perceived rates for tele-firms';-				
	Strategic Failure (fX)	mismanagement of e-marketing channel (fY)	x^2	y^2	xy
100-81)%	21	19	441	361	399
(80-61)%	33	32	1089	1024	1056
(60-41)%	16	17	256	289	272
(40-21)%	12	13	144	169	156
(20-1)%	8	9	64	81	72
Total	**∑fx = 90**	**∑fy = 90**	**$\sum x^2$= 1994**	**$\sum y^2$= 1924**	**∑xy= 1955**

Source: Survey data, 2019. Degree of freedom (df) =n−2=5−2=3

Substituting data from table 02, in the Pearson Correlation model below, "r-value" could be obtained thus;-

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}$$

$$r = \frac{5(\mathbf{1955}) - (\mathbf{90} \times \mathbf{90})}{\sqrt{5(1994) - (90)^2}\sqrt{5(1924) - (90)^2}}$$

$$r = \frac{1675}{\sqrt{(1870)}\sqrt{(1520)}} = \frac{1675}{\sqrt{1685.94}} = 0.994$$

$$The\ correlation\ coefficient\ (r) = 0.994$$

The calculated r-value (r=0.994) suggests a strong linear positive relationship between tele-firms' strategic failure and inapt management of e-marketing channels in Tanzania tele-industry. The coefficient of determination (r^2) = $(0.994)^2$ = 0.988 denotes that, 98.8 percent of the variation in strategic failure can be explained to the relationship between firms strategic failure and inapt management of e-marketing channels. And, the other 1.2 percent of variation is due to other factors "ϵ". Considering t-test, as shown below, the calculated *"r"* was statistically significant, as the calculated t-value (18.29) was greater than the stated *p-value* at the probability *p=0.* That is, H_0*: p>0 = (18.29>0)*

$$t = \frac{1}{\sqrt{\frac{1-r^2}{n-1}}} = \frac{1}{\sqrt{\frac{1-(0.994)^2}{5-1}}} = 18.29$$

Since the 95 percent critical r-values at α = 0.05 significance level and 3 degree of freedom is ± *0.878* (Kothari, 2003); while the calculated r-value using n=5 (data points) at 3 degree of freedom was *0.994*; and, the calculated t-value being *18.29;* the correlation coefficient (*r*) was deemed significant, as the calculated r-value was greater than critical r-values (lying outside the critical r-values from -0.878 to +0.878), and, significantly different from 0. Hence, statistical evidence was significant enough to reject the null (H_0) hypothesis that; tele-firms' strategic failure and inapt management of e-marketing channels in Tanzania are not correlated

Predicting this strong positive linear relation, the regression analysis model ($y = a + bx + \epsilon$) was employed. Whereas, *y*= dependent variable (strategic failure as defined in the methodology); x=independent variable (also defined in the methodology); *a*= an intercept; and, *b*=slope (variation factor)

But,

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} = \frac{5(1955)-(90)x(90)}{5(1994)-(90)x(90)} = \frac{1675}{1870} = 0.896$$

And,

$$a = \frac{\sum y - b\sum x}{n} = \frac{90 - 0{,}896(90)}{5} = 1.872$$

From the regression equation, "$y = a + bx + \epsilon$",

We have, $y = 1.872 + 0.896x + \epsilon$

As we consider "y" as a dependent variable (firm's strategic failure), the result predicts that, the change in a unit measure of tele-firms strategic failure is influenced by 0.896 units change of firm's inapt management of e-marketing channels. The overall result give the researcher's strength to affirm that, *"Firms in Tanzanian tele-industry face high strategic failures due to their inapt management of e-marketing channels".*

Socio-marketing Challenges for Tanzanian Tele-firms on Services E-marketing.

The study finding reveals that; inconsistence of values across the consumers' culture, strong traditional ties to cultural values; and, selecting the proper strategy to address e-marketing issues with 25.6 percent; 22.2 percent; and 23.3 percent respectively are the three top challenges of telefirms in e-marketing of services in Tanzania. The study also provided that, 20 percent of the said challenges are attributed to poor driving of multicultural consumers to companies' websites, while determining consumers' buying behavior in multi-cultural market adding to the challenge by 8.9 percent (refer table 03).

Difficulties in ascertaining consumers purchasing behaviors with 26.7 percent, income gaps between the haves and have-nots with 22.2 percent; and building bad businesses' images among the consumers with 16.7 percent were perceived impacts of the said challenge as provided in table 03. Whilst driving of multicultural consumers to companies leading to loose of market share in the industry by 18.9 percent, the impact of determining consumers' buying behavior in multi-cultural market was rated to be 15.6 percent (again see table 03 for the results).

However, in the same table 03, respondents rated incorporation of e-marketing strategies with consumers' buying culture as the strategy to overcome inconsistence of values across the consumers culture by 26.7 percent; keen pre-auditing & monitoring of tele-adverts for annulling tradition ties challenges by 20 percent; selecting the proper e-marketing channel for driving of multicultural consumers to companies' websites by 20 percent; on job trainings after detailed business analysis for proper selection of strategy to address marketing issues by 15.6 percent; and investing more on market research for determining consumers' buying behavior in multi-culture by 17.7 percent as their key strategies.

Table 03: The Top Five Socio-marketing Challenges, Impacts and Strategies

Parameter	Parametric expressions	Frequency	Percent
Challenges	Inconsistence of values across consumers' culture	23	25.6
	Strong traditional ties to cultural values among the consumers.	20	22.2
	Driving multicultural consumers to companies' websites.	18	20.0
	Selecting the proper strategy to address e-marketing issues	21	23.3
	Determining consumers' buying behavior in multi-culture.	8	8.9
	Total	**90**	**100.0**
Observed and Expected Impacts	difficulties in ascertaining consumers purchasing behaviors	24	26.7
	Income gaps between the haves and have-nots	20	22.2
	Loose of market share in the industry	17	18.9
	Building bad businesses' images among the consumers	15	16.7
	Poor performance of service product in the market	14	15.6
	Total	**90**	**100.0**

Suggested Strategies	Incorporation of e-marketing strategies with consumers' buying culture	27	30.0
	Keen pre-auditing & monitoring of tele-adverts	17	18.9
	Selecting the proper e-marketing channel	26	28.9
	On job trainings after detailed business analysis	08	18.9
	Investing more on market research	12	13.3
	Total	**90**	**100.0**

Source: Survey data, 2019

However, some studies identify authentic leads connectivity; creating social e-marketing strategies; balancing between paid media and organic reach; and, as the three top social marketing challenges (Wirtz, 2016 & HubSpot, 2019). Poor brand humanization; lack of strategic fit, improper niche selection as the resulted impacts (Yarrow, 2014 & Wirtz, 2016). Whereas, linking audience with free or low-cost brand monitoring tools; creating strong social media marketing strategies, and integrating niche behavior in marketers' strategies being the common strategies Wirtz, 2016 & HubSpot, 2019). These being the global general trends, it may be asserted that, each tele-industry is subject to differed dares, compelling differed impact and strategic needs.

Inferential Implication of Variables' Correlation on Socio-e-marketing Challenges

Higher analysis of variables was done by using hypothesis two (*H2*) stating that; *"Firms in Tanzania tele-industry create less demand for e-marketed services due to their inapt incorporation of marketing strategies with consumers' socio-behavior"*

The hypothesis was re-stated in both of Null (*Ho*) and Alternative (*Hi*) hypothesis thus:-

Ho: Less demand creation for e-marketed services is not related to inapt incorporation of marketing strategies with consumers' socio-behavior in Tanzania tele-industry

Hi: Less demand creation for e-marketed services is related to inapt incorporation of marketing strategies with consumers' socio-behavior in Tanzania tele-industry.

While considering Pareto 80:20 rule stating that, "for many events, roughly 80 percent of the effects come from 20 percent of the causes" (Marshall, 2013), it was hypothized that, 20 percent of inapt incorporation of marketing strategies with consumers' socio–behavior results to about 80 percent failure of tele-firms in creating high demand for e-marketed services in Tanzania tele-industry.

Choosing $\alpha = 0.05$ as the significance level; we can say, with *Ho*: the success rates is not different from 20 percent Pareto efficiency

$$Ho: p_0 = 0.05 = 20\%$$
$$HI: p_0 \neq 0.05 \neq 20\%$$

The hypothesis intended to ascertain whether inapt incorporation of e-marketing strategies with consumers' socio-behavior contribute to failure of tele-firms in generating high demand for e-marketed service or not. As there were a number of factors considered influential, the "hypothesis testing for proportions" was employed (Kothari, 2003). And, the variables in *table 04* were considered important for the hypothesis test

Table 04: Ratings on Proper Strategy to address e-Marketing Issues in Relation to other Social Marketing Challenge

Parameter	Frequency	Percent
Keen pre-auditing & monitoring of tele-adverts; selecting the proper e-marketing channel; on job trainings after detailed business analysis; and, investing more on market research	63	70
Incorporation of e-marketing strategies with consumers' buying culture	27	30
Total	**90**	**100.0**

Source: Survey data, 2019

As indicated in table 04 above, the selection of proper strategy to address e-marketing issues was mentioned at 27 proportion rate compared to other factors carried 73 proportion rate.

A test difference was done thus: - Suppose the proportion of relationship preference was "p" and the proportion for the remaining key factors combined together was "q". Whereas, the sample size of Tele-firms subscribers is "n" and the population estimator, (^p), being p/n.

Then; $\hat{p} = 27 / 90 = 0.3$

Using two tailed population proportion method at 2 degree of freedom; and the critical Z value at 95 percent being 1.96 (Kothari, 2003); number of success (Pareto factor) $p_0 = 20$, with the sample population (n) of Tele-firms subscribers being 90; whereas, $\alpha = 1-\hat{p}$, and P is the estimate of population proportion, then, the statistic estimates provides that;-

$$Z = [\hat{p} - p_0] / [p_0 (1 - p_0) / n]^{1/2}$$
$$= [0.3 - 0.2] / [0.2 (1-0.2)/90]^{1/2}$$
$$= [0.1] / [0.04] = 2.5$$

The calculated Z- value = 2.5

And, the following confidence intervals (CI) were obtained:-

$$CI = \hat{p} \pm Z\,\alpha^{1/2}$$
$$CI = \hat{p} \pm Z\,\alpha^{1/2}$$
$$= 0.3 \pm 1.96\,[0.3(1- 0.3) / 90]^{1/2}$$
$$= 0.3 \pm 0.095$$

CI = (0.205, 0.395)

Based on the given data, we are 95 percent confident that the proportion of tele-firms subscribers*(p)* who firmly believe that firms in Tanzania tele-industry fail to generate high demands for e-marketed services due to their inapt incorporation of marketing strategies with consumers' socio- behavior" lies between 20.5 percent and 39.5 percent (i.e. $20.5\% < p < 39.5\%$). Since the calculated Z-value (Z=2.5) is greater than critical Z-value (Z=1.96) and, 20 percent as Pareto's success rate (p_0) is not included in this intervals; there is significant evidence to warrant the rejection of a null hypothesis claim that, "less demand creation for e-marketed services is not related to inapt incorporation of marketing strategies with consumers' socio-behavior in Tanzania tele-industry". And hence, concluding that, inapt incorporation of e-marketing strategies with consumers' socio-behavior contributes

to tele-firms' failure in generating high demand for e-marketed services in Tanzania tele-industry.

Lead Generation Challenges Facing Tele-firms in E-marketing of Services

As the research findings in table 05 portray, generating high quality lead seem to be on top of the five critical challenges of services e-marketing in Tanzania tele-industry with 22.2 percent contribution; followed by selecting the right tactics to generate quality leads and communicating product value with 21.1 percent each; while converting leads to actual buyers of tele-firms products and adequate resources for carrying out lead generation activities bearing 20 percent and 15.6 percent respectively.

Difficulty in finding the right customers for business needs with 27.8 percent; converting prospect (leads) to actual buyers with 24.4 percent; and building a brand and unique customer experience with 18.9 percent are the perceived impact as result of poor generated lead; selecting the right tactics to generate quality leads; and communicating brand value respectively. Whilst difficult in building a brand and unique customer experience adding to the slack of changing leads to customers by 16.7 percent, the impact of generating low revenue due to adequate resources is said to be 12.2 percent (see results table 05)

However, respondents rated the selection of right social media channel(s) as the strategy to generating high quality lead by 22.2 percent; devising tactics for generating quality leads by 24.4 percent; apt communication of firms product for communicating brand value by 25.6 percent; resource planning for lead conversion by 16.7 percent; and, investing on innovation-ware as a competitive tool by 11.1 percent (see table 05)

Table 05: Top Five Lead Generation Challenges, Impacts and Strategies of e-marketing services in Tanzania's Tele-industry

Parameter	Parametric observation	Frequency	Percent
Challenges	Generating high quality lead.	20	22.2
	Selecting the right tactics to generate quality leads.	19	21.1
	Communicating brand value.	19	21.1
	Converting leads to customers.	18	20.0
	Adequate resources for carrying out lead generation activities.	14	15.6
	Total	**90**	**100.0**
Observed and Expected Impacts	Difficulty in finding the right customers your business needs	25	27.8
	Difficulty in converting prospect to actual buyers	22	24.4
	Difficult in building a brand and unique customers' experiences	15	16.7
	Difficulty in generating high revenue	17	18.9
	Diluted attainment of company targets	11	12.2
	Total	**90**	**100.0**
Suggested Strategies	Select the right social media channel(s)	20	22.2
	Devising tactics for contacts selections	22	24.4
	Apt communication of firm's product	23	25.6
	Investing on resource planning.	15	16.7
	Investing on innovation-ware	10	11.1
	Total	**90**	**100.0**

Source: Survey data, 2019

This study findings are supported by some other studies findings portraying; generating proper lead, selecting apt lead generation strategy and converting leads to customers as the top three lead generation challenges (HubSpot, 2018); with retaining lead, shrinking sales, and lead nurturing as the associated impacts (Salesforce, 2017); while marketing automation platform, mapping the customer experience and use of personalized content to be the common strategies employed by marketers (Ascend2, 2018 & Salesforce, 2017). The impacts and strategic alternatives differ as each segment has its varied needs.

Inferential Implication of Variables' Correlations on Lead Generation Challenges

The higher analysis of variables was done by using hypothesis three (*H3*) stating that; "*Firms in Tanzania tele-industry convert less of the leads to actual buyers of their products than expected as they fail to communicate values for their brands"*

The hypothesis was re-stated in both of Null (*Ho*) and Alternative (*Hi*) hypothesis thus:-

Ho: failure to communicate values of firm's brand does not influence the conversion of leads to actual buyers of their products in Tanzanian tele-industry

Hi: failure to communicate values of firm's brand influence the conversion of leads to actual buyers of their products in Tanzanian tele-industry

It was hypothesized that, "there is a possibility that many tele-firms in Tanzania do not exploit the multitude of leads generated to harness opportunities the industry offers due to their miscommunicated brands. Since firms generate products; whereas, consumers build the brand through their perception to products, communicating to customers what firms offer is something of greater importance. While employees perceive companies' band value in terms of quality of work, and firms in terms of strategic fit; customers measure brands value in terms of: product differentials; quality; price; guarantee; knowledge; response; service and others in the set (Stevens, 2011 & Dhar, 2015). Hence, product differential was considered as the important variable for inferential analysis.

The *"proportions Chi-squire*" was used as a test statistic for this hypothesis (see Kothari, 2003). This *test statistic at 95percent degree of confidence, with Z=1.96* and the significance level of $\alpha = 0.05$, was carried out on scores for tele-firms ability to differentiate its products; in determining the likelihood impact of brand miscommunication on lead conversion to actual product buyers (please, see results in table 06)

Table 06: Analyzed Variables on the Influence of Brand Communication to Telecom Firm's Lead Generation

		Major operating Telecommunication firms in Tanzania					
	Response	**Frequency**	**Airtel**	**Halotel**	**Tigo**	**TTCL**	**Vodacom**	**Zantel**
Tele-firm's Products	**Differentiated**	**(f_O)**	28	16	32	12	35	15
		(f_E)	23	23	23	23	23	23
	Not differentiated	**(f_O)**	62	74	58	78	55	75
		(f_E)	67	67	67	67	67	67
		$\sum(f_O)$ or $\sum(f_E)$	**90**	**90**	**90**	**90**	**90**	**90**

Proportional Scores for Observed and Expected Tele-firm's Levels of Product Differentiation

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
(f_O)	28	16	32	12	35	15	62	74	58	78	55	75
(f_E)	23	23	23	23	23	23	67	67	67	67	67	67
(f_O-f_E)	5	-7	9	-11	12	-8	-5	7	-9	11	-12	8
$(f_O-f_E)^2$	25	49	81	121	144	64	25	49	81	121	144	64
$\frac{(f_O-f_E)^2}{(f_E)}$	**1.09**	**2.13**	**3.52**	**5.26**	**6.26**	**2.78**	**0.37**	**0.73**	**1.21**	**1.81**	**2.15**	**0.96**

df* = [(c-1)(k-1)] = [(6-1)(2-1)] = 05** **Z = 1.96** ***α = 0.05 **$\sum (f_O-f_E)^2 / (f_E) = X^2 = 28.27$**

Source: Survey data, 2018

Whereas: X^2 = the test statistic that asymptotically approaches χ^2 distribution; f_O = observed values; f_E = an expected (theoretical) values, asserted by the null hypothesis; ***df***= Degree of freedom (the number of possible outcomes of each event) "**C"=** the number of Columns, and **"k"** is the number of rows.

The critical *Chi* table value (X^2) for *df=5* at $\alpha = 0.05$ significant level is 11.07 (Kothari, 2003). Since the calculated Chi value ($X^2 = 28.27$) was greater than critical Chi table value ($X^2 = 11.07$), the difference between the observed values and expected values was considered significant. Hence, the null hypothesis *(Ho)* that; failure to communicate values of firm's brand does not influence the conversion of leads to actual buyers of their products in Tanzanian tele-industry was rejected. The rejection of the null *(Ho)* hypothesis is the statistical evidence to the researcher's claim that "Firms in Tanzania Tele-industry convert less of the leads to actual buyers than expected as they fail to communicate values for their brands".

Conclusion

The purpose of this study was to examine the challenges facing Tanzanian tele-firms in e-marketing of services. The study was undertaken in six tele-firms operating in Tanzania, namely: Airtel; Halotel; Tigo; TTCL; Vodacom; and Zantel. Through descriptive and inferential tests, whilst guided with both research question and hypothesis, the study reveals that; many challenges facing firms in Tanzania tele-industry are: those emanating from firm's inability to generate competitive strategies due inapt management of e-marketing channels; inapt incorporation of marketing strategies with consumers' social behavior; as well as tele-firm's inability to communicate their brand values for leads convention to actual buyers. Fifteen of the identified e-marketing challenges, impacts and their strategic alternatives were presented in table 1; 3; and 5 of this paper. It was the researcher's belief that, the results obtained would be reflective enough to help tele-firms be aware of the nature of e-marketing challenges in Tanzania tele-industry and come up with apt strategies to overcome them; despite being the ready source of literature for reviews. It was the researcher's suggestion that similar studies be done to ascertain the magnitude of impacts brought by those challenges for better industrial resolutions.

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Degrees of Freedom **n-1**	**Number of treatments**										
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	39.0	87.5	142	202	266	333	403	475	550	626	704
3	15.4	27.8	39.2	50.7	62.0	72.9	83.5	93.9	104	114	124
4	9.6	15.5	20.6	25.2	29.5	33.6	37.5	41.1	44.6	48.0	51.4
5	7.2	10.8	13.7	16.3	18.7	20.8	22.9	24.7	26.5	28.2	29.9
6	5.82	8.38	10.4	12.1	13.7	15.0	16.3	17.5	18.6	19.7	20.7
7	.99	6.94	8.44	9.70	10.8	11.8	12.7	13.5	14.3	15.1	15.8
8	4.43	6.00	7.18	8.12	9.03	9.78	10.5	11.1	11.7	12.2	12.7
9	4.03	5.34	6.31	7.11	7.80	8.41	8.95	9.45	9.91	10.3	10.7
10	3.72	4.85	5.67	6.34	6.92	7.42	7.87	8.28	8.66	9.01	9.34
Source: Kothari (2003)											

Appendix 02: The Chi Test Table for X^2 Values

Degrees of Freedom	Probability, *p*				
	0.99	**0.95**	**0.05**	**0.01**	**0.001**
1	0.000	0.004	3.84	6.64	10.83
2	0.020	0.103	5.99	9.21	13.82
3	0.115	0.352	7.82	11.35	16.27
4	0.297	0.711	9.49	13.28	18.47
5	0.554	1.145	11.07	15.09	20.52
6	0.872	1.635	12.59	16.81	22.46
7	1.239	2.167	14.07	18.48	24.32
8	1.646	2.733	15.51	20.09	26.13
9	2.088	3.325	16.92	21.67	27.88
10	2.558	3.940	18.31	23.21	29.59

Source: Kothari (2003)

Appendix 03: The correlation Coefficient "r" table

Degrees of Freedom	Probability, *p*		
	0.05	**0.01**	**0.001**
1	0.997	1.000	1.000
2	0.950	0.990	0.999
3	0.878	0.959	0.991
4	0.811	0.917	0.974
5	0.755	0.875	0.951
6	0.707	0.834	0.925
7	0.666	0.798	0.898
8	0.632	0.765	0.872
9	0.602	0.735	0.847
10	0.576	0.708	0.823

Source: Kothari (2003)

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Challenges Facing Telecommunication Firms In E-Marketing Of Services: A Survey Of Six Selected Tele-Firms In Tanzania

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Abstract: *Despite the success enjoyed by players in Tanzania tele-industry, a number impediments have been drawing back firms' initiative to realize their goals; that attract scholars' attentions to have a shared understanding for effective strategic formulation in annulling them. The main study question was, "what are challenges facing tele-firms in e-marketing of services in Tanzania tele-industry?" The specific research questions were three, namely; what are technological challenges facing Tele-firms in e-marketing of services in Tanzania Tele-industry; what are socio-marketing challenges facing tele-firms in e-marketing of services in Tanzania tele-industry? And, what are lead generation challenges facing tele-firms in e-marketing of services in Tanzania tele-industry? Three hypothesis thought of by the researcher were tested to find the validity of the findings. A study was a cross-section survey undertaken in five selected tele-firms in Tanzania, namely; Vodacom, Tigo, Airtel, Halotel, Zantel and TTCL. The data were collected by the use of research schedules and telephone interviews. The study employed descriptive and inferential models (namely; Hypothesis Test for Proportions; Proportion Chi Squire Test; Correlation Coefficient and Regression models) as test statistics. Amide all challenges identified through descriptive statistics, inferential revealed that; the major challenges tele-firms face in Tanzania tele-industry to be; mismanagement e-marketing channels, inapt incorporation of marketing strategies with consumers' social behavior and improper communication of firm's brand. The results in this study are to be a useful source of literature reviews; creating tele-firms' alert on the nature of e-marketing defies in Tanzania tele-industry for strategic remolds.*

Key Words: Challenges, Telecommunication, Marketing, e-marketing, Services.

Background to the Problem

Despite the open environment for technology transfers, as well as readily available markets for services[1] in the globe, the employment of e-marketing of services is a major challenge[2] experienced by most of tele-firms [3](Agwu, 2015). Many firms are still striving in incorporating e-marketing[4] functions with business strategies (Stevens, 2011). Tanzanian Tele-firms are too the victims of this business dilemma (Lubua, 2017). Businesses are experiencing fundamental changes due to the impact of information technology where by e-marketing gets in (Brown, 2017). The targeted e-market delivery use contextual targeting[5] and behavioral targeting[6] (Deiss, 2017).

Affiliate marketing, email, phones, online contents, search engine, social media and televisions are a few of widely used channels (Hidalgo, 2015). The global changes associated with e-marketing systems in enhancing firms' productivity and world's economy, including: changes in business process and procedures, new roles and responsibilities, firms' restructuring, new facilities, and new skills to learn are common drivers of changes in business strategies in dynamic industrial milieu (Deiss, 2017).

Despite these tremendous changes, the global e-marketing met several setbacks in a number of varied environmental dynamics. In USA, for example, by the year 2010, such firms as Google, Apple and Microsoft ware in eminent fight with electronic pirates and other web uncertainties (Brown, 2017); whereas China, the major established tele-market, was suffering from strong government monitoring of telecoms information flow to limit private use for sensitive issues (Wirtz, 2016). On the other hand, in Kenya tele-industry, for example, Safari COM firm, such problems as budgetary constraints, high service prices and old technology use were reported as being problems among others (BMI, 2016). Firms in Tanzania tele-industry faced relatively similar problems, with

[1] Services: are activities, benefits or satisfactions that are offered for sale (Johann, 2015)
[2] Challenges: are areas of improvement that attract people's attention (Kotler, 2011).

[3] Tele-firms (also telecommunication firms): firms facilitating the exchange of info over significant distances by electronic means through differed types of voice, data and video transmission (Yarrow, 2014).
[4] E-marketing: implies achieving marketing objectives by the use of digital technologies (Deiss, 2017)
[5] Contextual targeting: is the form of contextual advertisement that matches ads to sites in the display network using your key words or topics among other factors (Yarrow, 2014)
[6] Behavioral targeting: refers to technique used by online publishers and advertisers to increase the efficacy of their campaigns via gens collected on an individual's web-browsing behavior (Deiss, 2017).

more or less differences for which rural infrastructures seem to be the major one among others (Mwakaje, 2010 & Lubua, 2017). However, differences in challenge from one industry to another were clearer and significant enough to compare.

Tanzania tele-industry seem to have positive growth, however. The major rivalry tele-firms with their subscription market share being: Vodacom (33 percent); Tigo (27 Percent); Airtel (26 percent); Halotel (10 percent); Zantel (03percent); and TTCL (1percent) (TCRA, 2019). It is estimated, that only 14 percent tele-services are known and used by average people (non-educated and standard seven), 29 percent by secondary school and 44 percent for those with college education (BMI, 2016). In average, 71 percent of tele-services[7] are inadequately marketed and hence unused by the prospective consumers in the market. And, if this is not keenly resolved, some firms in Tanzania Tele-industry[8] might eventually find themselves placed out competitive edged in international telecommunication business. However, the pertinent question is, "what could be the shared challenges faced by Tanzania tele-firms in e-marketing of services?"

Statement of the Problem

E-marketing of services has been one of the major challenges facing tele-firms not only in Tanzania but also in the entire global service industries. Although firms apply various strategies to acquire large market shares in varied industries, e-marketing programs has never assured tele-firms of their continued survival in Tanzania tele-industry (Agwu, 2015 & BMI, 2016). Tele-firms have been experiencing enormous strategic failures; poor demand creation; and less prospects conversion to actual buyers of e-marketed services, despite massive investment they employ in the context of non-profitable price wars industries (Mwakaje, 2010 & Brown, 2017). Given that e-marketing can directly or indirectly impact firms and industrial profitability, the proposed study is set to explore the challenges facing tele-firms in e-marketing of services, allied impacts and suitable strategic options; with a specific focus to six selected tele-firms in Tanzania tele-industry, namely: Vodacom, Tigo, Airtel, Halotel, Zantel and TTCL.

The study Question

The overall question in this study was, "What are challenges facing tele-firms in e-marketing of services in Tanzania tele-industry?" And, the proposed specific study questions were;

- What are technological challenges facing Tele-firms in e-marketing of services in Tanzania tele-industry;
- What are socio-marketing challenges facing tele-firms in e-marketing of services in Tanzania tele-industry; and,
- What are lead generation challenges facing tele-firms in e-marketing of services in Tanzania tele-industry.

However, it was the researcher's expectation that, if the study is well done, core challenge facing Tanzanian tele-firms in e-marketing of services will be uncovered; profitable strategies to overcome the identified challenges in Tanzania will be generated; scholars will have the ready source of literature for reviews.

Literature Review

Literatures offer a number of conceptual model and theory governing the e-marketing and consumers' behavior on service marketing. According to marketing theory, to maximize sales, a firm must position its products in the market place in such a way that consumers believe they need a particular product, and that, a product they need has a particular benefit (Kotler, 2011). The success key of the theory lies on the effectiveness of firm's demand creation to consumers on brand appeal (Johann, 2015). That is to say, a successful firm in e-marketing of services is the one adopting marketing philosophy that, products are sold not bought (Kotler, 2011). E-marketing firms can maximize their sales by integrating game theory in their marketing strategies to overcome the conflicting priorities of e-marketing agents wishing to get outcome based on their choices (Blanchard, 2011; Johann, 2015 & Hidalgo, 2015). With this, strategic firms need to apply networking theory on patterns change within social networks, where the use of digital marketing channels that allow marketers to listen what consumers are saying is inevitable (Hidalgo, 2015).

Many tele-firms in Tanzania and the rest of the globe, either explicitly or implicitly employ generation marketing theory (Wirtz, 2016). The theory holds that, consumers born of the same generation … defined as 20-year period – have common attitudes and behavior because of shared experience influenced by their childhood and shaped by their world (Blanchard, 2011). Overgeneralization of this theory and its application across different niches of e-marketed service is of practical doubt; as consumers' culture widely vary across social communities with subcultures influencing consumers' behaviors, regardless of age similarities. Moreover, both economic and political inclinations, social upbringing, locality, and genetic predispositions, have also un-denied influence on shaping what an individual has to be; hence, creating the attention for scholarly studies.

Despite the set 7Ps as market mix model for service marketing, such unique service features as; intangibility, perishability, heterogeneity and inseparability have never left service e-marketers safe (Berry, 1980; Baron, 2003 & Jha, 2016). With *intangibility a*s a unique feature, service cannot be: inventoried, patented, aptly priced, and be readily displayed (Judd, 1968; Berry, 1980 & Jha, 2016). With, *inseparability* as a unique character, consumers are driven into service delivery process, with snags in centralized mass production (Berry, 1980 & Wirtz, 2019). Moreover, *heterogeneity* renders difficulty in achieving service standardization and quality control (Berry, 1980 & Jha, 2016). Whereas, due to *perishability*, services, cannot be stored (Judd, 1968 & Wirtz, 2019). All these unique characters have enormous effects to consumers buying behaviors that need to be merged to e-marketers' strategies, tactics and channels.

However, the following strategies have been suggested for solving problems arising out of unique service features. With intangibility problems; stressing tangible cues, the use of personal sources more than non-personal source, creation of strong firm's brand, as well as the post purchase communication are options (Judd, 1968;

[7] Tele-service: Is a TCRA adopted acronym for telecommunication services (TCRA, 2019)

[8] .Tele-industry: is a TCRA adopted acronym for telecommunication industry (TCRA, 2019)

Berry, 1980; Baron, 2003; Jha, 2016 & Wirtz, 2019). With inseparability, selection and training of public contact personnel, managing consumers, and the use of multisided locations are vital (Berry, 1980; 1980 & Jha, 2016). And, with *heterogeneity*, industrialized and customized service are part of strategic fit (Berry, 1980 & Baron, 2003). Whereas, with *perishability*, copying strategies with fluctuating demand as well as simultaneous change in demand and capacity are the suggested strategies (Baron, 2003; Kotler, 2011 & Wirtz, 2019). However, the business settings decides efficacy of a strategy.

Some challenges are more of e-marketing system oriented than services themselves in nature. Every e-marketing operation, being large or small, faces; firms' rivalry; risk of data losing; balancing between efficiency and confidentiality; volume of e-market data; integrating off-line data; and delivering the goods cost-effectively (Hidalgo, 2015 & Stevens, 2011). Others would include illegal access, pillage of electronic channels; and allied cybercrime uncertainties (Mwakaje, 2010; Agwu, 2015 & Lubua, 2017). However, the brand building, customers' retentions, multiple channel use to close the transaction are considered as principle strategies for building customers' strong bases, among others (Stevens, 2011; Dhar, 2015 & Wirtz, 2016). If properly utilized, e-marketing may aptly help to execute firm's strategies, including: business process automation, streamlining business, providing information, connecting customers, demand generation and productivity tools (Yarrow, 2014; Dhar, 2015 & Wirtz, 2016). Despite its perceived benefits, e-marketing is inadequately used in both rural and urban milieus due to hostile e-marketing support systems such as; media costs, electric bills as well as unreliable digital connectivity (Mwakaje, 2010 & Agwu, 2015).

Literature Gap of Knowledge

The literature explains various concepts and theories related to services, telecoms, marketing and e-marketing. However, it is from these theories where the researcher raised several questions on their workability. Literatures provide 7Ps as the model for services marketing in overcoming generic services unique features; and, e-marketing as business driving technology. But why tele-firms are subject to massive e-marketing strategic failures? Why telefirms find it difficult to get large customer basis in multicultural societies? And, why fail to convert reasonable leads to actual buyers despite these elaborated models and strategies? All of these elaborates are theoretical and empirical puzzles for which the solutions are needed.

Study Hypotheses

Literatures reveal that, e-marketing challenges in their holistic forms are triggered by complicity of a number of factors. The emerging question is on whether technological volatility, inapt incorporation of marketing strategies with consumers' socio-behavior, and, miscommunication of firms brand values are among of challenges facing e-marketing of tele-services in Tanzania; amide unique service features or not. Therefore, the following hypotheses were considered important for the study:-

H1: Firms in Tanzanian tele-industry face high strategic failure due to their inapt management of e-marketing channels.

H2: Firms in Tanzania Tele-industry create less demand for e-marketed services due to their inapt incorporation of marketing strategies with consumers' socio- behavior

H3: Firms in Tanzania Tele-industry convert less of the prospects to actual buyers of their products than as they fail to communicate values for their

Research Methodology

The study employed both qualitative and quantitative approaches to answer the designed research questions and in testing the guiding hypotheses. A cross-sectional survey research design was considered appropriate in studying challenges facing tele-firms in e-marketing of services in Tanzania (Owens, 2002). The study took place in Arusha city where almost all giant tele-firms in Tanzania (Vodacom, Airtel, Tigo, Halotel, Zantel, and TTCL) operate. The target population included tele-services consumers and operators. A sample of 30 tele-service operators, and 60 tele-services consumers was obtained for the analysis. Both simple random and purposive sampling methods were used to select study participants (Kothari, 2003). While the dependent variables being rates; of strategic failure, demand creation and lead conversion; the independent variables were; e-marketing channels mismanagement, consumers' social behavior, and brand value communication. Data were collected by using research schedules and documentary reviews; the frequencies and percentage of which were presented in tables. Hypothesis Test for Proportions; Proportion Chi Squire Test; Correlation Coefficient and Regression models were used to assess variables relations for better understanding of different perceptions of the respondents.

Findings and Discussion

Besides the general study question, findings and discussion on challenges facing tele-firms in e-marketing of services in Tanzanian tele-industry were built on three pre-determined specific study questions. Moreover, given the research hypotheses, high level analyses of data obtained was done by the use of inferential models to testify and generalize the result; before giving the study conclusion and recommendations.

Technological Challenges of Tanzanian Tele-firms in services E-marketing

The study reveals that; quality brand generating; e-marketing management; and, web uncertainties, with 25.6 percent; 25.6 percent; and 17.8 percent respectively are three top technological challenge of telefirms in e-marketing of services in Tanzania. The study also tells that 16.6 percent of dares results from search engine optimization issues, while poor e-marketing support system adding to the hurdle by 14.4 percent (see table 01).

Decreased demand for e-marketed products with 22.2 percent, decreased Return on Investment with 24.4 percent; and limited info access with 20 percent are perceived impact due to poor brands generated, e-marketing mismanagement and search engine optimization respectively. Whilst loss of customer base adds to a slack by 15.6 percent, the limited access to firms' website system is said to be 15.6 percent (see table 01)

However, respondents rates high quality brand building as the strategy to attract high quality lead by 25.6 percent; investing on

apt and cost effective channels for search engine optimization by 24.4 percent; prioritizing high performing search engines by for search engine optimizing by 17.8 percent; investing on innovative ware in curbing web insecurities by 16.6 percent; and, improving e-marketing support systems in promoting rural e-marketing systems 15.6 percent (*see the summary in table 01*).

Table 01: Top Five Technological Challenges, Impacts and Strategies alternatives

Parameter	Parametric expression	Frequency	Percent
Challenges	Generating high quality brand	23	25.6
	E-marketing channels management	23	25.6
	Search engine optimization	15	16.6
	Web uncertainties (Security and privacy issues)	16	17.8
	Poor e-marketing support systems	13	14.4
	Total	**90**	**100.0**
Observed and Expected Impacts	Decreased demand for e-marketed products.	20	22.2
	Decreased Return On Investment.	22	24.4
	Limited information access.	18	20.0
	Lose of customer base.	14	15.6
	Limited access of contacts to company website.	16	17.8
	Total	**90**	**100.0**
Suggested Strategies	Building high quality brands.	23	**25.6**
	Investing on apt and cost effective channels	22	**24.4**
	Prioritizing high performing search engines.	16	**17.8**
	Investing on innovation ware.	15	**16.6**
	Improving web accessibility in rural.	14	**15.6**
	Total	**90**	**100.0**

Source: Survey data, 2019

Nevertheless, HubSpot portray the top three technological challenges of services e-marketing in Tanzania for the past two years to be; managing company website; identifying the right technology and content targeting (HubSpot, 2017). Non-optimized content; competitive lag and inapt lead conversion to be their common impacts (Wirtz, 2016 & HubSpot, 2017); while, hiring freelancer; the use of marketing automation software as well as customization of contents for specific audience being the applied strategies (HubSpot, 2019). The said differing challenges may be due to global techno-innovations streak commanding industrial challenges in spans of times.

Inferential Implications of Variables Correlations on Technological challenges

The correlations of variables on technological challenges facing Tanzanian tele-firms in e-marketing of services were tested by using hypothesis one *(H1)* stating that;

"Firms in Tanzanian tele-industry face high strategic failures due to their inapt management of e-marketing channels"

This hypothesis was re-stated in both Null *(Ho)* and Alternative *(Hi)* hypotheses thus:-

Ho: Tele-firms' strategic failure and inapt management of e-marketing channels in Tanzania are not correlated

Hi: Tele-firms' strategic failure and inapt management of e -marketing channels in Tanzania are correlated.

Considering e-marketing channel management as one of the key technological variable for apt recital of e-marketing strategy; it was hypothesized that, many tele-firms fail to meet their strategic objectives due to inapt management of e-marketing channels in their industries. This hypothesis aimed to assess the link between firms' strategic failure and inapt management of e-marketing channels in Tanzania tele-industry. The data for relevant variables were tabulated in table 02 to enhance inferential deductions.

Table 02: Variables Relations between Tele-firm's Strategic Failures and e-marketing Channels mismanagement

Rating ranges	Respondents frequencies on perceived rates for tele-firms';-				
	Strategic Failure (X)	**mismanagement of e-marketing channel (Y)**			
100-81)%	21	19	441	361	399
(80-61)%	33	32	1089	1024	1056
(60-41)%	16	17	256	289	272
(40-21)%	12	13	144	169	156
(20-1)%	8	9	64	81	72
Total	**$\sum x = 90$**	**$\sum y = 90$**	**$\sum x^2 = 1994$**	**$\sum y^2 = 1924$**	**$\sum xy = 1955$**

Source: Survey data, 2019. Degree of freedom (df) =n−2=5−2=3

Substituting data from table 03, in the Pearson Correlation model below, "r-value" could be obtained thus;-

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}$$

$$r = \frac{5(\mathbf{1955}) - (\mathbf{90} \times \mathbf{90})}{\sqrt{5(1994) - (90)^2}\sqrt{5(1924) - (90)^2}}$$

$$r = \frac{1675}{\sqrt{(1870)}\sqrt{(1520)}} = \frac{1675}{\sqrt{1685.94}} = 0.994$$

$$The\ correlation\ coefficient\ (r) = 0.994$$

The calculated r-value (r=0.994) suggests a strong linear positive relationship between tele-firms' strategic failure and inapt management of e-marketing channels in Tanzania tele-industry. The coefficient of determination (r^2) = $(0.994)^2$ = 0.988 denotes that, 98.8 percent of the variation in strategic failure can be explained to the relationship between firms strategic failure and inapt management of e-marketing channels. And, the other 1.2 percent of variation is due to other factors "ϵ". Considering t-test, as shown below, the calculated *"r"* was statistically significant, as the calculated t-value (18.29) was greater than the stated *p-value* at the probability *p=0.* That is, H_0*: p>0 = (18.29>0)*

$$t = \frac{1}{\sqrt{\frac{1-r^2}{n-1}}} = \frac{1}{\sqrt{\frac{1-(0.994)^2}{5-1}}} = 18.29$$

Since the 95 percent critical r-values at 0.05 significance level and 3 degree of freedom is ± *0.878* (Kothari, 2003); while the calculated r-value using n=5 (data points) at 3 degree of freedom was *0.994*; and, the calculated t-value being 18.29; the correlation coefficient (r) was deemed significant, as the calculated r-value was greater than critical r-values (lying outside the critical r-values from -0.878 to +0.878), and, significantly different from 0. Hence, statistical evidence was significant enough to reject the null (H_0) hypothesis that; tele-firms' strategic failure and inapt management of e-marketing channels in Tanzania are not correlated

Predicting this strong positive linear relation, the regression analysis model ($y = a + bx + \epsilon$) was employed. Whereas, *y*= dependent variable (strategic failure as defined in the methodology); x=independent variable (also defined in the methodology); *a*= an intercept; and, *b*=slope (variation factor)

But,

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} = \frac{5(1955)-(90)x(90)}{5(1994)-(90)x(90)} = \frac{1675}{1870} = 0.896$$

And,

$$a = \frac{\sum y - b\sum x}{n} = \frac{90 - 0{,}896(90)}{5} = 1.872$$

From the regression equation, "$y = a + bx + \epsilon$",

We have, $y = 1.872 + 0.896x + \epsilon$

As we consider "y" as a dependent variable (firm's strategic failure), the result predict that, the change in a unit measure of tele-firms strategic failure is influenced by 0.896 units change of firm's inapt management of e-marketing channels. The overall result give the researcher's strength to affirm that, *"Firms in Tanzanian tele-industry face high strategic failures due to their inapt management of e-marketing channels"*

Socio-marketing Challenges for Tanzanian Tele-firms on Services e-Marketing

The study finding reveals that; inconsistence of values across the consumers' culture, strong traditional ties to cultural values; and selecting the proper strategy to address e-marketing issues with 25.6 percent; 22.2 percent; and 23.3 percent respectively are the three top challenges of telefirms in e-marketing of services in Tanzania. The study also provides that, 20 percent of the said challenges are attributed to poor driving of multicultural consumers to companies' websites, while determining consumers' buying behavior in multi-cultural market adding to the challenge by 8.9 percent (refer table 03).

Difficulties in ascertaining consumers purchasing behaviors with 26.7 percent, income gap between the haves and have-nots with 22.2 percent; and building bad business images among the consumers with 16.7 percent are perceived impacts of the said challenge as provided in table 03. Whilst driving of multicultural consumers to companies leads to loose of market share in the industry by 18.9 percent, the impact of determining consumers' buying behavior in multi-cultural market is rated to be 15.6 percent (again see table 03 for the results)

However, in the same table 03, respondents rates incorporation of e-marketing strategies with consumers' buying culture as the strategy to overcome inconsistence of values across the consumers culture by 26.7 percent; keen pre-auditing & monitoring of tele-adverts for annulling tradition ties challenges by 20 percent; selecting the proper e-marketing channel for driving of multicultural consumers to companies' websites by 20 percent; on job trainings after detailed business analysis for proper selection of strategy to address marketing issues by 15.6 percent; and investing more on market research for determining consumers' buying behavior in multi-culture by 17.7 percent.

Table 03: The Top Five Socio-marketing Challenges, Impacts and Strategies

Parameter	Parametric expressions	Frequency	Percent
Challenges	Inconsistence of values across consumers' culture	23	25.6
	Strong traditional ties to cultural values among the consumers.	20	22.2
	Driving multicultural consumers to companies' websites.	18	20.0
	Selecting the proper strategy to address e-marketing issues	21	23.3
	Determining consumers' buying behavior in multi-culture.	8	8.9
	Total	**90**	**100.0**
Observed and Expected Impacts	difficulties in ascertaining consumers purchasing behaviors	24	26.7
	Income gap between the haves and have-nots	20	22.2
	Loose of market share in the industry	17	18.9
	Building bad business images among the consumers	15	16.7
	Poor performance of service product in the market	14	15.6
	Total	**90**	**100.0**

	Incorporation of e-marketing strategies with consumers' buying culture	27	30.0
Suggested Strategies	Keen pre-auditing & monitoring of tele-adverts	17	18.9
	Selecting the proper e-marketing channel	26	28.9
	On job trainings after detailed business analysis	08	18.9
	Investing more on market research	12	13.3
	Total	**90**	**100.0**

Source: Survey data, 2019

However, some studies identify authentic leads connectivity; creating social e-marketing strategies; balancing between paid media and organic reach; and, as the three top social marketing challenges (Wirtz, 2016 & HubSpot, 2019). Poor brand humanization; lack of strategic fit, improper niche selection as the resulted impacts (Yarrow, 2014 & Wirtz, 2016). Whereas, linking audience with free or low-cost brand monitoring tools; creating strong social media marketing strategies, and integrating niche behavior in marketers' strategies being the common strategies Wirtz, 2016 & HubSpot, 2019). These being the global specific trends, it may be asserted that, each tele-industry is subject to differed dares, compelling differed impact and strategic needs.

Inferential Implication of Variables' Correlation on Socio-e-marketing Challenges

Higher analysis of variables was done by using hypothesis two (*H2*) stating that; *"Firms in Tanzania Tele-industry create less demand for e-marketed services due to their inapt incorporation of marketing strategies with consumers' socio-behavior"*

The hypothesis was re-stated in both of Null (*Ho*) and Alternative (*Hi*) hypothesis thus:-

Ho: Less demand creation for e-marketed services is not related to inapt incorporation of marketing strategies with consumers' socio-behavior in Tanzania tele-industry

Hi: Less demand creation for e-marketed services is related to inapt incorporation of marketing strategies with consumers' socio-behavior in Tanzania tele-industry.

While considering Pareto 80:20 rule stating that, "for many events, roughly 80 percent of the effects come from 20 percent of the causes" (Marshall, 2013), it was hypothized that, 20 percent of inapt incorporation of marketing strategies with consumers' socio–behavior results to about 80 percent failure of tele-firms in creating high demand for e-marketed services in Tanzania tele-industry.

Choosing $\alpha = 0.05$ as the significance level; we can say, with *Ho*: the success rates is not different from 20 percent Pareto efficiency.

$$Ho: p_0 = 0.05 = 20\%$$
$$HI: p_0 \neq 0.05 \neq 20\%$$

The hypothesis intended to ascertain whether inapt incorporation of e-marketing strategies with consumers' socio-behavior contribute to failure of tele-firms in generating high demand for e-marketed service or not. As there were a number of factors considered influential, the "hypothesis testing for proportions" was employed (Kothari, 2003). And, the variables in *table 04* were considered important for the hypothesis test

Table 04: Ratings on Proper Strategy to address e-Marketing Issues in Relation to other Social Marketing Challenge

Parameter	Frequency	Percent
Keen pre-auditing & monitoring of tele-adverts; selecting the proper e-marketing channel; on job trainings after detailed business analysis; and, investing more on market research	63	70
Incorporation of e-marketing strategies with consumers' buying culture	27	30
Total	**90**	**100.0**

Source: Survey data, 2019

As indicated in table 05 above, the selection of proper strategy to address e-marketing issues was mentioned at 26.7 percent rate compared to other factors carried 73.3 percent..

A test difference was done thus: - Suppose the proportion of relationship preference was "p" and the proportion for the remaining key factors combined together was "q". Whereas, the sample size of Tele-firms subscribers is "n" and the population estimator, (^p), being p/n.

Then; $\hat{p} = 27 / 90 = 0.3$

Using two tailed population proportion method at 2 degree of freedom; and the critical Z value at 95 percent being 1.96 (Kothari, 2003); number of success (Pareto factor) $p_0 = 20$, with the sample population (n) of Tele-firms subscribers being 90; whereas, $\alpha = 1 - \hat{p}$, and P is the estimate of population proportion, then, the statistic estimates provides that;-

$$Z = [\hat{p} - p_0] / [p_0 (1 - p_0) / n]^{1/2}$$
$$= [0.3 - 0.2] / [0.2 (1-0.2)/90]^{1/2}$$
$$= [0.1] / [0.04] = 2.5$$

The calculated Z- value = 2.5

And, the following confidence intervals were obtained:-

$$CI = \hat{p} \pm Z\, \alpha^{1/2}$$
$$CI = \hat{p} \pm Z\, \alpha^{1/2}$$
$$= 0.3 \pm 1.96\, [0.3(1- 0.3) / 90]^{1/2}$$
$$= 0.3 \pm 0.095$$

P = (0.205, 0.395)

Based on the given data, we are 95 percent confident that the proportion of tele-firms subscribers who firmly believe that Firms in Tanzania Tele-industry fail to generate high demands for e-marketed services due to their inapt incorporation of marketing strategies with consumers' socio- behavior" lies between 20.5 percent and 39.5 percent (i.e. $20.5\% < p < 39.5\%$). Since the calculated Z-value (Z=2.5) is greater than critical Z-value (Z=1.96) and, 20 percent as Pareto's success rate (p_0) is not included in this intervals; there is significant evidence to warrant the rejection of a null hypothesis claim that, "less demand creation for e-marketed services is not related to inapt incorporation of marketing strategies with consumers' socio-behavior in Tanzania tele-industry". And hence, concluding that, inapt incorporation of e-marketing strategies with consumers' socio-behavior contributes

to tele-firms failure in generating high demand for e-marketed service in Tanzania tele-industry.

Lead Generation Challenges Facing Tele-firms in e-Marketing of Services

As the research findings in table 05 portray, generating high quality lead seem to be on top of the five critical challenges of services e-marketing in Tanzania tele-industry with 22.2 percent contribution; followed by selecting the right tactics to generate quality leads and communicating product value with 21.1 percent each; while converting leads to actual buyers of tele-firms products and adequate resources for carrying out lead generation activities bearing 20 percent and 15.6 percent respectively.

Difficulty in finding the right customers for business needs with 27.8 percent; converting prospect to actual buyers with 24.4 percent; and building a brand and unique customer experience with 18.9 percent are the perceived impact as result of poor generated lead; selecting the right tactics to generate quality leads; and communicating brand value respectively. Whilst difficult in building a brand and unique customer experience adding to the slack of changing leads to customers by 16.7 percent, the impact of generating low revenue due to adequate resources is said to be 12.2 percent (see results table 05)

However, respondents rates the selection of right social media channel(s) as the strategy to generating high quality lead by 22.2 percent; devising tactics for generating quality leads by 24.4 percent; apt communication of firms product for communicating brand value by 25.6 percent; resource planning for lead conversion by 16.7 percent; and investing on innovation-ware as a competitive tool by 11.1 percent (see table 05)

Table 05: Top Five Lead Generation Challenges, Impacts and Strategies of e-marketing services in Tanzania's Tele-industry

Parameter	Parametric observation	Frequency	Percent
Challenges	Generating high quality lead.	20	22.2
	Selecting the right tactics to generate quality leads.	19	21.1
	Communicating brand value.	19	21.1
	Converting leads to customers.	18	20.0
	Adequate resources for carrying out lead generation activities.	14	15.6
	Total	**90**	**100.0**
Observed and Expected Impacts	Difficulty in finding the right customers your business needs	25	27.8
	Difficulty in converting prospect to actual buyers	22	24.4
	Difficult in building a brand and unique customers' experiences	15	16.7
	Difficulty in generating high revenue	17	18.9
	Diluted attainment of company targets	11	12.2
	Total	**90**	**100.0**
Suggested Strategies	Select the right social media channel(s)	20	22.2
	Devising tactics for contacts selections	22	24.4
	Apt communication of firm's product	23	25.6
	Investing on resource planning.	15	16.7
	Investing on innovation-ware	10	11.1
	Total	**90**	**100.0**

Source: Survey data, 2019

This study findings are supported by some other studies findings portraying; generating proper lead, selecting apt lead generation strategy and converting leads to customers as the top three lead generation challenges (HubSpot, 2018); with retaining lead, shrinking sales, and lead nurturing as the associated impacts (Salesforce, 2017); while marketing automation platform, mapping the customer experience and use of personalized content to be the common strategies employed by marketers (Ascend2, 2018 & Salesforce, 2017). The impacts and strategic alternatives differ as each segment has its varied needs.

Inferential Implication of Variables' Correlations on Lead Generation Challenges

The higher analysis of variables was done by using hypothesis three (*H3*) stating that; "*Firms in Tanzania Tele-industry convert less of the leads to actual buyers of their products than expected as they fail to communicate values for their brands"*

The hypothesis was re-stated in both of Null (*Ho*) and Alternative (*Hi*) hypothesis thus:-

Ho: failure to communicate values of firm's brand does not influence the conversion of leads to actual buyers of their products in Tanzanian tele-industry

Hi: failure to communicate values of firm's brand influence the conversion of leads to actual buyers of their products in Tanzanian tele-industry

It was hypothesized that, "there is a possibility that many tele-firms in Tanzania do not exploit the multitude of leads generated to harness opportunities the industry offers due to their miscommunicated brands. Since firms generate products; whereas, consumers build the brand through their perception to products, communicating to customers what firms offer is something of greater importance. While employees perceive companies' band value in terms of quality of work, and firms in terms of strategic fit; customers measure brands value in terms of: product differentials; quality; price; guarantee; knowledge; response; service and others in the set (Stevens, 2011 & Dhar, 2015). Hence, product differential was considered as the important variable for inferential analysis.

The *"proportions Chi-squire*" was used as a test statistic for this hypothesis (see Kothari, 2003). This *test statistic at 95percent degree of confidence, with Z=1.96* and the significance level of $\alpha = 0.05$, was carried out on scores for tele-firms ability to differentiate its products; in determining the likelihood impact of brand miscommunication on lead conversion to actual product buyers (please, see results in table 06)

Table 06: Analyzed Variables on the Influence of Brand Communication to Telecom Firm's Lead Generation

		Major operating Telecommunication firms in Tanzania					
	Response	**Frequency**	**Airtel**	**Halotel**	**Tigo**	**TTCL**	**Vodacom**	**Zantel**
Tele-firm's Products	**Differentiated**	**(f_O)**	28	16	32	12	35	15
		(f_E)	23	23	23	23	23	23
	Not differentiated	**(f_O)**	62	74	58	78	55	75
		(f_E)	67	67	67	67	67	67
		$\sum(f_O)$ or $\sum(f_E)$	**90**	**90**	**90**	**90**	**90**	**90**

Proportional Scores for Observed and Expected Tele-firm's Levels of Product Differentiation

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
(f_O)	28	16	32	12	35	15	62	74	58	78	55	75
(f_E)	23	23	23	23	23	23	67	67	67	67	67	67
(f_O-f_E)	5	-7	9	-11	12	-8	-5	7	-9	11	-12	8
$(f_O-f_E)^2$	25	49	81	121	144	64	25	49	81	121	144	64
$\frac{(f_O-f_E)^2}{(f_E)}$	**1.09**	**2.13**	**3.52**	**5.26**	**6.26**	**2.78**	**0.37**	**0.73**	**1.21**	**1.81**	**2.15**	**0.96**

df* = [(c-1)(k-1)] = [(6-1)(2-1)] = 05** **Z = 1.96** ***α = 0.05 **$\sum (f_O-f_E)^2 / (f_E) = X^2 = 28.27$**

Source: Survey data, 2018

Whereas: X^2 = the test statistic that asymptotically approaches χ^2 distribution; f_O = observed values; f_E = an expected (theoretical) values, asserted by the null hypothesis; ***df***= Degree of freedom (the number of possible outcomes of each event) "**C"=** the number of Columns, and **"k"** is the number of rows.

The critical *Chi* table value (X^2) for *df=5* at $\alpha = 0.05$ is 11.07 (Kothari, 2003). Since the calculated Chi value ($X^2 = 28.27$) was greater than critical Chi table value ($X^2 = 11.07$), the difference between the observed values and expected values was considered significant. Hence, the null hypothesis *(Ho)* that; failure to communicate values of firm's brand does not influence the conversion of leads to actual buyers of their products in Tanzanian tele-industry was rejected. The rejection of the null *(Ho)* hypothesis is the statistical evidence to the researcher's claim that "Firms in Tanzania Tele-industry convert less of the leads to actual buyers than expected as they fail to communicate values for their brands".

Conclusion

The purpose of this study was to examine the challenges facing Tanzanian tele-firms in e-marketing of services. The study was undertaken in six tele-firms operating in Arusha region of Tanzania, namely: Airtel; Halotel; Tigo; TTCL; Vodacom; and Zantel. Through descriptive and inferential tests, whilst guided with both research question and hypothesis, the study reveals that; many challenges facing firms in Tanzania tele-industry are: those emanating from firm's inability to generate competitive strategies due inapt management of e-marketing channels; inapt incorporation of marketing strategies with consumers' social behavior; as well as tele-firm's inability to communicate their brand values. Fifteen of the identified e-marketing challenges, impacts and their strategic alternatives were presented in table 2; 4; and 6 of this paper. It was the researcher's belief that, the results obtained would be reflective enough to help tele-firms be aware of the nature of e-marketing challenges in Tanzania tele-industry and come up with apt strategies to overcome them; despite being the ready source of literature for reviews. It was the researcher's suggestion that similar studies be done to ascertain the magnitude of impacts brought by those challenges for better industrial resolutions.

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Degrees of Freedom **n-1**	**Number of treatments**										
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	39.0	87.5	142	202	266	333	403	475	550	626	704
3	15.4	27.8	39.2	50.7	62.0	72.9	83.5	93.9	104	114	124
4	9.6	15.5	20.6	25.2	29.5	33.6	37.5	41.1	44.6	48.0	51.4
5	7.2	10.8	13.7	16.3	18.7	20.8	22.9	24.7	26.5	28.2	29.9
6	5.82	8.38	10.4	12.1	13.7	15.0	16.3	17.5	18.6	19.7	20.7
7	.99	6.94	8.44	9.70	10.8	11.8	12.7	13.5	14.3	15.1	15.8
8	4.43	6.00	7.18	8.12	9.03	9.78	10.5	11.1	11.7	12.2	12.7
9	4.03	5.34	6.31	7.11	7.80	8.41	8.95	9.45	9.91	10.3	10.7
10	3.72	4.85	5.67	6.34	6.92	7.42	7.87	8.28	8.66	9.01	9.34
Source: Kothari (2003)											

Appendix 02: The Chi Test Table for X^2 Values

Degrees of Freedom	Probability, *p*				
	0.99	**0.95**	**0.05**	**0.01**	**0.001**
1	0.000	0.004	3.84	6.64	10.83
2	0.020	0.103	5.99	9.21	13.82
3	0.115	0.352	7.82	11.35	16.27
4	0.297	0.711	9.49	13.28	18.47
5	0.554	1.145	11.07	15.09	20.52
6	0.872	1.635	12.59	16.81	22.46
7	1.239	2.167	14.07	18.48	24.32
8	1.646	2.733	15.51	20.09	26.13
9	2.088	3.325	16.92	21.67	27.88
10	2.558	3.940	18.31	23.21	29.59

Source: Kothari (2003)

Appendix 03: The correlation Coefficient "r" table

Degrees of Freedom	Probability, *p*		
	0.05	**0.01**	**0.001**
1	0.997	1.000	1.000
2	0.950	0.990	0.999
3	0.878	0.959	0.991
4	0.811	0.917	0.974
5	0.755	0.875	0.951
6	0.707	0.834	0.925
7	0.666	0.798	0.898
8	0.632	0.765	0.872
9	0.602	0.735	0.847
10	0.576	0.708	0.823

Source: Kothari (2003)

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CHALLENGES OF GROUP LENDING ON MFIs LOANS SECURITY: A CASE OF FOUR SELECTED MFIs IN ARUSHA, TANZANIA.

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***Abstract**: In the evolution of global business, a number micro-financing players have faced many defies in due course of their lending-borrowing interrelations. The group lending by MFIs has been one of the model perceived to guarantee the security of loans provided by the said funding institutions. This study aimed "to determine the challenges of group lending on MFIs loans security in Tanzania". The specific objectives of the study were: to examine the challenges of diluted group norms on MFIs loans defaulting; and, to examine the contribution of deferred group interests on MFIs loans defaulting. A research was a multiple case study in nature undertaken in four selected MFIs (FINCA, BRAC, NMB and CRDB) based in Arusha– Tanzania. The use of purposive and stratified sampling techniques enhanced the collection of data from the field by using research schedules. The collected data were analyzed and coded by using Excel. Descriptive statistics such as frequencies and percentages; as well as Proportion Chi Test, Pearson Correlation Coefficient, Regression Analysis and T-Test Inferential Models were used to determine the relevance of data, and hence drawing the conclusion. The study results meant to help in judging whether MFIs group lending is an ideal model to be solely relied on or not. The study findings revealed that, the security of MFIs loans is impaired by; diluted group norms and deferred lonee interests in groups, among other factors.*
Key words: Challenge, Group lending, MFIs, Loan Security

Background to the Problem

Group lending has been the common financing framework in a number of micro-finance institutions (MFIs) on earth; ever since it's evolvement in Asia and spreading to Latin America, and Africa (Haldar, 2016). A number of depository and non-depository MFIs have considered the framework as their number one solution to overcome loans defaults that seem to endanger firms' loans security in micro financing industry. Considering the greater demand for business financing, there is no way that microenterprises can stand out without commensality business relation with MFIs; despite unjustified long term loan deliquescence and defaults intoxicating this relations.

Microfinance institutions are said to be key drivers of the global business growths in a number of ways. The steady portfolio increase of about 30 percent annual world record in Micro-financing services in between 1997 and 2007, for example, lead these financing bodies to continually diversify to commercial banks (Toussant, 2017 & Mohd, 2018). To date, small business with over 95 percent of the total global enterprises, hiring about 70 percent of global workforce, receive about 58 percent of their net operating capital from the said MFIs (TANCAD, 2018). As per Microcredit Summit survey undertaken in 2007; with about 154.8 million business served worldwide by over 3,350 MFIs, nearly 106.6 million enterprises financed were sole proprietors classified to be at the bottom half of those living below their nation's poverty line (Bernhard, 2017).

In the developed world for example, USA, Canada, and China, where small and medium enterprises are adequately funded (Mori, 2015), small and medium enterprises (SMEs) are considered to be the innovative pools, food securers, job creators and economic shock resilient (Dumo, 2015; Standing, 2017 & Standing, 2018). Likewise, about 30-60 percent of the said business are profound novelty brand builders with marked proficiency in; demand generations, productivity triggering, sales expansions, as well as technical and technological change agents (Makorere, 2014 & Dumo, 2015). On the other hand, despite their major partaking in global economy, about 43 percent of SMEs in the developing world with 20 to 49 employees have faced difficulties in accessing finance for their operations; irrelative to 11 percent of the same business size in the developed world (Sharma, 2016; Bernhard, 2017 &Standing, 2018). The financing gap to SMEs in low income countries is as high as US$700-850 billion (twice as much as in large firms) (Baldwin, 2015; Scott, 2017). High collateral needs due to undue loan defaults; lack of skills within financial intermediaries, and non-liquidity of the finding institution are some of common dares in most of micro-financing industries in Africa, including Tanzania (Karlan, 2011; Mader, 2016; Sharma, 2017 & TANCAD, 2018)

Despite their long term identification as the entrepreneurs financing vehicles, and economic elevators in the developing world (including Tanzania), MFIs have never been perceived to be pro-poor by the majority of economic players due to their inability to reach the most vulnerable and weak sections in the society (Ayyagari, 2012; Gbandi, 2014 & Bernhard, 2017). Moreover, besides the enjoyed financing opportunities available, MFIs suffer acute losses due to a number of loan defaulters. Loans default rates in developing world is as high as 4.5 percent while in the developed world, the said default rate is recorded to be 3 to 4 percent (Korankye, 2014 & Makorere, 2014). Since the evolvement of gramen bank by Prof. Yunus in Bangladesh, group lending model has been the common practice in overcoming loan

defaults (Khan, 2010; Mader, 2016 & TANCAD, 2018). However, the pertinent question is on whether the said model is appropriate in ensuring MFIs loan security; that all financing firms should solely rely or not.

Statement of the problem

Though group lending seem to be the most opted model in the vast of global micro-financing industries, the said framework has never ensured the best of financial security as expected by lenders due to endless loan defaulting facets. Different studies have been done on long-term relation between MFIs and its clients in Tanzania (Makorere, 2014 & Mori, 2015); however, little have been revealed on dares impairing the value of group lending on MFIs loan security. Therefore, the current study seeks to determine challenges of group lending on MFIs loan security; with specific focus to group norms and differed interest within the loan groups in relation to loans default rates in Tanzania.

The study objectives

The general objective of this study was "to determine the challenges of group lending on MFIs loans security in Tanzania. The specific objectives of the study were: to examine the challenges of deferred interests in MFIs loan groups on loans defaults; and, to examine the effect of group norms[1] on MFIs loans defaults. It was the researcher's expectation that, if the objectives are equitably met, MFIs players will be aware of the key defies for MFIs loan security; and hence, generate the profitable strategies for apt recital of industrial loaning systems.

Literature review

The literature presents the key concepts and terms as used in the study, namely: Microfinance institutions[2] (MFIs); loans defaulting[3]; loan security[4]; and, group lending[5]. It too offers some theories governing MFIs operations to include: classic microfinance theory of change and Social-Collateral (group micro-lending theory). The group lending[6] principles are too explained in the section.

Micro financing theories and operating principles

According to classic microfinance theory of change, a poor persons go to a microfinance provider and take a loan to start or expand a microenterprise yielding enough net revenue to repay the loan with large interest and still have sufficient profit to increase personal or household income enough to raise the person's standard of living (Erica, 2012 & Scott, 2017). The theory adhere to three steps, namely**:** taking a loan from a microfinance institution; investing the money in a viable business, and; managing the business to yield more return on investment (Erica, 2012 & Standing, 2017). However, the model gives inapt details on futile trends arising out of borrowers' bleak behavior, interests and business environmental volatility.

On the other hand, according to Social-Collateral (group micro-lending or social capital), "MFIs should lend to groups and not to specific individuals" (Khan, 2010 & TANCAD, 2018). Borrowers should select themselves into clusters of the same risk levels and hold each other accountable (Karlan, 2011 & Sharma, 2017). Intra-group lenders become self-driven to monitor and exclude risky-borrowers who might take them into unbearable risky situations by defaulting (Gbandi, 2014 & Haldar, 2016). The theory is built on the grounds of trust, concern for one's friendships, preparedness to live the norms of one's group and to chastise those who do not (Khan, 2010; Erica, 2012). The question is on whether there befalls ample time for the stated groups' common understanding.

Moreover, the group lending theory is governed by the principle of group solidarity; which holds that, the more solidary the group is, the greater the influence it casts upon its members (Khan, 2010 & Haldar, 2016). The principle measures the capacity of a group to influence member's behavior. With normative school of thought, the group become more cohesive as its members internalize the group norms (Dumo, 2015 & TANCAD, 2018). On the other hand, with structuralism ideas, the group becomes more solidary cohesive not because of internalization, rather, because they share the common interest (Mader, 2016 & TANCAD, 2018). However, the extent to which lack of members' internalization to norms or diverse group interests contributes to higher MFIs default rate is not clearly defined.

Nevertheless, the defaulting experience in MFIs group-lending can be explained by the concepts related to group cohesiveness (Gbandi, 2014 & Mohd, 2018). Some scholars argue that, MFIs provide loans to borrowers without considering the impacts of group cohesiveness driving factors, to include; similarity in members' characteristics, group size; goal congruence; group interests; as well as group entry difficulty (Karlan, 2011; Erica, 2012 & Scott, 2017). When the listed are not well considered, the possibility of borrowers to repay their loans become minimal.

Micro-financing Institutions' Focus and Lending practices

The fundamental intention of MFIs were to finance the poor communities in sustaining lives, build better houses, acquire basic education and fight against poverty (Khan, 2010 Haldar, 2016). Adhering to the said primary mission, the performance of MFIs projects have been continuously measured through their social warfare impacts to the community (Bernhard, 2017 & Mohd, 2018). Since the foundation of MFIs services in Bangladesh, a number of microfinance projects have evolved and grown to traditional commercial banks for which the major loaned clients being SMEs (Ayyagari, 2012). The 1990's MFIs change of focus in Latin America, spread to the rest of the world, about the turn from service for poor to the multitude of business financing has shown that, MFIs can be profitable undertakings whilst keeping on track to its primary focus of service for poor (Toussant, 2017; Sharma, 2017 & Standing, 2018*)*. However, the degree to which MFIs balance between financial and nonfinancial mission has never been explicitly recognized.

[1] Group norms are general acceptable standards of behavior shared by the group members (Mori, 2015)

[2] Microfinance; refers to financial services for poor and low-income clients offered by different types of service providers commonly known as MFIs (Gbandi, 2014 & Baldwin, 2015);

[3] Loan defaulting refers to failure to meet legal obligation of a loans (Mori, 2015).

[4] Loan security are pledges of assets ensuring low chances of loan defaults or deliquescent (Scott, 2017)

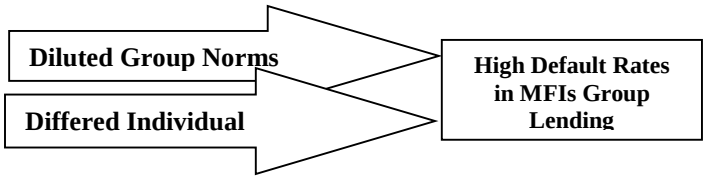
[5] The group lending refers to the practice in which small group borrows collectively and members encourage one another to repay (Haldar, 2016).

Despite an increasing growth of micro-financing industry in Tanzania, social-economic impacts to the targets is still low (Dumo, 2015 & Mori, 2015). Like other developing countries, in Tanzania, small entrepreneurs cannot save enough resources to finance their business (Baldwin, 2015; Gibson, 2016 & Bernhard, 2017). Financial services needs are still high as the greater population is still excluded from credit facilities due to the recorded industrial loan evasion risks of about 4.5 percent; as opposed to 3 percent global accepted rate (Makorere, 2014 & Mori, 2015). Lack of collateral; lack of apt financial record; and inability to prepare the proper business plan among others are named to be major business dares (Erica, 2012 & Mader, 2016).

Literature Gap of knowledge

From *classic microfinance theory of change and Social-Collateral theory*, the literature review provides that, MFIs need to optimize financial discipline, with clear lending models. It too portrays the *principle of group solidarity* as the behavior measure in promoting group cohesiveness. The pertinent research gap rests on inapt fact to whether MFIs group lending is worth enough to eliminate defaulting risks associate to diluted group norms as provided by normative school of thought; and, on borrowers' differed interests as stipulated in structuralism school of thought or not.

Conceptual Framework



Study hypothesis

It is all known that, loan defaulting in MFIs is attributed to a number of factors. But, group norms and individuals' interests in lending groups were considered worth for analysis. And hence, developing two postulates as stated hereunder for the study:-

H1: Tanzanian MFIs experience high loans default rates as they face the competing differed individuals' interests in their lending group.

H2: Tanzanian MFIs experience high loans default rates as they are confronted by diluted group norms in their lending group

Research Methodology

The study was both qualitative and quantitative in approach; with one main objective intended to determine the challenges of group lending on MFIs loans security in Tanzania. A multiple case study design conducted in ten loan groups from four selected MFIs based in Arusha - Tanzania (namely; CRDB; NMB; FINCA and BRAC) was deemed suitable to enhance in-depth and intensive assessment of the dares of group lending on the MFIs loans security. Multiple case is the study examining two or more related cases to gain the detailed understanding of a phenomenon by studying how and why the phenomenon occurs (Kombo, 2006). The target population included MFIs services providers and borrowers groups. Both simple random and purposive sampling techniques were used to select the study participants (Kothari, 2003). A sample of 30 operators, and 60 borrowers groups' members was obtained from four selected MFIs services providers. The research schedules and documentary reviews were used to gather the study data; for which frequencies and percentages were presented in tables. Using non-parametric measures, loan default rate as a dependent variable; as well as individual interests and group norms as independent variables were tested. The Proportion Chi Test, Pearson Correlation Coefficient, Regression Analysis and T-Test Inferential Models were used to assess variables' relations for better knowing the respondents' views (Kombo, 2006 & Kothari, 2014). Universal research principles and ethical issues were firmly adhered to (Kumar, 2011 & Kothari, 2014).

Results and Discussion

The findings and discussion on "the challenges of group lending on MFIs loans security in Tanzania" was presented by adhering to two pre-determined specific study objectives and the set hypotheses for which high level analyses of data obtained was done by the use of inferential models to testify and generalize the result's validity and reliability.

The General MFIs and Borrowers Information

After satisfactory analysis, the study directs the researcher to generalize that, the greater proportion of MFIs borrowers are individuals aged between 21 to 60 years with cumulative percent of 85.5; and, about 55.5 percent of them are women. The active partakers in MFIs group lending are individual with primary and secondary school education; occupying about 30 and 36.7 percent respectively; whose large proportion (61.1 percent) use non-depository MFIs, relative to 38.9 percent users of depository firms with micro-financing status. About 60 percent of MFIs borrowers comprise of small business, start-up aspirants and varied firm's employees collectively (***see table 01***)

Table 01: General MFIs and Borrowers Information

Parameters	Frequency	Percent
Age group		
01-20	05	05.6
21-40	40	44.4
41-60	37	41.1
61 +	08	08.9
Total	**90**	**100**
Sex of identified respondents		
Male	40	44.4
Female	50	55.6
Total	**90**	**100**
Education level of respondents		
Non-formal educated	**10**	**11.1**
Primary Education	**27**	**30.0**
Secondary Education	**33**	**36.7**
Post-secondary Education	**20**	**22.2**
Total	**90**	**100**
The Well Known and Ideal MFIs Operators		
Depository (NMB, CRDB, BOA, Twiga Corp, etc)	35	38.9
Non-depository (BRACK, FINCA, SEDA, HAKIKA etc)	55	61.1
Total	**90**	**100**
Nature Of Borrowers in MFIs Groups		
Start-up Aspirants	26	28.9
Small Business Owners	28	31.1
Employees from both public and private firms	20	22.2
Others	16	17.8
Total	**90**	**100**
Rated Effectiveness of MFIs lending group on loan security		
(00-25)	14	15.6
(26-50)	38	42.2
(51-75)	30	33.3
(76-100)	08	08.9
Total	**80**	**100**

Source: Survey data, 2019

The large involvement of individuals aged 21 to 60 year could be driven by two main factors. First, individual aged 21 to 40 years are said to be dynamic economic actors as though argued by Scot (2017); and secondly, those with 41 to 60 are family laboring individuals; mixed with business pursuit that compel them to find more funds in meeting their pressing onuses as though also supported by TANCAD (2018). The study results concurs with Mori's view that, women are active partakers in micro-lending than men not because they are active business machinery, but because they are heavily subjected to families bills (Mori, 2015).

The study reveals that, individuals with primary education (30 percent) and secondary educations (36.7 percent) are major users of MFIs. This may be because the said groups are largely absorbed in commercial sectors than in formal employments (Mader, 2016). While most of depository financial institutions are known to fund large and medium business, non-depository MFIs are said to be favored by majority of small business and start-up partakers (Sharma, 2016 & Bernhard, 2017). This scholars' argument is also revealed in this study as the differed non-depository MFIs absorb about 60 percent of all actors.

Moreover, as also explained by (Standing, 2017), the study finds employees included in the group of MFIs borrowers with 22.2 percent as they borrow funds to diversify their inadequate primary incomes, and adding-on their allied non-commercial staffs. Due to their empirical absence in business cycles, their ventures pay less to none. However, the group may render financial delinquency with less to non-defaults as their debts may be covered through their wages (Baldwin, 2015). The start-up aspirants with 28.9 percent in this study is perceived to be the most default riskier group as their experiential absence in business cycles leads their ventures to pay lesser than expected (Scott, 2017). As though it is for the start-up aspirants, small business with 31.1 percent in most cases suffers the effect of economies of scale in their ventures; and about 40 to 68 percent of them are prone to business failure (Gibson, 2016). This is counted as the second most default riskier group. Nerveless, about 91.1 percent of partakers in micro-financing industry view group lending to be less than 75 percent effective. This may be due to a number of dares including; improper selection of group, high interests attached to loans, dynamic business environments, and lack of loan monitoring as pointed out in some literatures (Haldar, 2016 & TANCAD, 2018). However, cohesiveness deterring factors in table 02 are too significant.

Clients Factors Fueling Loans Default Rates in MFIs Loan Groups

From the study, table 02 indicates the key borrowers' factors for loans default rates in percentage to be; diluted MFIs group norms (24.4 percent), differed group goals (22.2 percent), size of MFIs Lending groups (17.8 percent), Differed interests in MFIs loan groups (26.7 percent), and MFIs Group entry (08.9 percent)

Table 02: Members Factors Fueling Loans Default Rates in MFIs Loan Groups

Ranks	Frequency	Percent
Diluted norms in MFIs lending groups	22	24.4
Differed group goals in MFIs Lending Groups	20	22.2
The Large Size of MFIs Lending Groups	16	17.8
Differed Interest in MFIs Lending Groups	24	26.7
Easy of entry into MFIs Lending Groups	08	08.9
Total	**90**	**100.0**

Source: Survey data, 2019

As it may be seen in table 2 above; and supported by some scholars (Karlan, 2011; Erica, 2012 & Scott, 2017), the diluted group norms; differed group goals; large group sizes; differed individual interest in groups; and, easiness to group entry impacts the group cohesiveness by reducing members powers to condemn deviants. When this happens, individuals in groups are likely to default their loans. Many MFIs face high loan defaults beyond the normal acceptable rate (3 percent) as they underrate the said personal and psychological factors while working on the formulaic macro-institutional and industrial challenges (Dumo, 2015 & TANCAD, 2018). Hence, for apt recital of loan security, all loans risky exposing dimensions need to be ably addressed.

The Link between Deferred Individuals Interests and MFIs Loans Defaults

The data in table 03 portrays that, about 60 cumulative percent of differed individual interest influence decisions making in MFIs groups by 41 to 80 percent (i.e. from medium to high level); while their corresponding default rate being about 56 percent cumulatively. In establishing the link between individual's interest and loan defaults, using the field data provided, rearrangement for inferential statistics in table 04 was a compelling affair.

Table 03: Rated Extents of Deferred Interests and Loan Defaults in MFIs Loan Groups

Categorical Ranking of parameters	Level at which individuals' Interests Influence MFIs Group Decisions (x)		MFIs Loan Default Rates (fy)	
	Frequency (fx)	Percentage (Px)	Frequency (fy)	Percentage (Py)
Very Low (01 -20%)	07	08	11	12
Low (21 -40%)	18	20	20	22
Medium (41 -60%)	29	32	27	30
High (61 -80%)	25	28	23	26
Very high (81 -100%)	11	12	09	10
Total	**∑fx = 90**	**∑x = 100**	**∑fy = 90**	**∑y = 100**

Source: Survey data, 2019

Inferential implications on the relationship between Group Interests and MFIs Loans Defaults

The higher analysis of variables was carried by using hypothesis one *(H1)* stating that; "*Tanzanian MFIs experience high loans default rates as they face the competing differed individuals' interests in their lending group".*

The hypothesis was re-stated in both of *Null (Ho)* and *Alternative (Hi)* hypotheses thus:-

H_0: High MFIs loans defaults rates in Tanzania do not relate to differed individuals' interests.

H_I: High MFIs loans defaults rates in Tanzania relate to differed individuals' interests.

That is; Ho: p=0; and, H_I: p≠0

It was hypothized that, having congruent interests among MFIs loans' group members influence greater cohesiveness in taking collective errands for deviant behaviors. MFIs face high default rates as discrete members bear differed interests on loans they acquire from what they advocate during their entry in loan groups; hence giving no apt room to ascertain its security for decision taking. The hypothesis aimed to assess the correlation between the levels at which ones "interest influence decisions making" and "loans default rates" in MFIs loan groups.

Table 04: Correlation between Individuals Interests and MFIs Loans Defaults

Categorical Ranking of parameters	Level at which individuals' Interests Influence MFIs Group Decisions (x)	MFIs Loan Default Rates (y)	x^2	y^2	Xy
Very Low (01 -20%)	08	12	64	144	96
Low (21 -40%)	20	22	400	484	440
Medium (41 -60%)	32	30	1024	900	960
High (61 -80%)	28	26	784	676	728
Very high (81 -100%)	12	10	144	100	120
Total	**∑x = 100**	**∑y = 100**	**∑ x^2 =2416**	**∑ y^2 = 2304**	**∑ xy = 2344**

Source: Survey data, 2019 **Degree of freedom (*df*) = n-2= (5-2) =3**

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}$$

$$r = \frac{5(2344)-(100)(100)}{\sqrt{5(2416)-(100)^2}\sqrt{5(2304)-(100)^2}} r = \frac{1720}{\sqrt{2080}\sqrt{1520}}$$

$$r = \frac{1720}{45.61 \times 38.99} = 0.967$$

$$The\ correlation\ coefficient\ (r) = 0.967$$

The calculated r-value (r=0.967) suggests a strong positive *linear* relationship between MFIs loan defaults and individuals' interest in influencing MFIs group decisions making.

The coefficient of determination (r^2) = $(0.967)^2$ = 0.935 implies that; 93.5 percent of variation in loans defaults can be explained to the relationship between high loan default rates and deferred individuals interests in MFIs loan groups. While the remaining 6.5 percent being due to other varied factors "ϵ". With t-test, as shown below, the calculated *"r"* is statistically significant, as the calculated t-value (7.85) is greater than the stated *p-value* at the probability *p=0*. That is, *H_0: p>0 = (7.85>0)*

$$t = \frac{1}{\sqrt{\frac{1-r^2}{n-1}}} = \frac{1}{\sqrt{\frac{1-(0.967)^2}{5-1}}} = 7.85$$

Considering the 95 percent critical *r-values* at *ά=0.05* and, three (3) degree of freedom *(df)* to be ± 0.878 (Kothari, 2003); whereas, the calculated r-value using n=5 data points to be *0.967*, at *df=3*; and, the calculated *t-value* being *7.85*; the statistical evidence was significant enough to reject the null *(H_0)* hypothesis that; High MFIs loans defaults rates in Tanzania do not relate to differed individuals' interests as the calculated r-value was greater than the critical table *r-values (*beyond critical r-values limits -0.878 to +0.878). Please, see the r-value in appendix 2.

In predicting this strong positive linear relationship, the regression analysis model (y = a + bx+ ϵ) was employed. Whereas, y= dependent variable (MFIs loan defaults as defined in the methodology); x=independent variable (also defined in the methodology); a= an intercept; and, b=slope (variation factor)

But,

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} = \frac{5(2344)-(100)(1000)}{5(2416)-(100)(100)} = \frac{1720}{2080} = 0.827$$

And,

$$a = \frac{\sum y - b\sum x}{n} = \frac{100-0.827(100)}{5} = 3.460$$

From Regression equation "y=a+bx+∈",

$$We\ have,\ y = 3.460 + 0.827x + \in$$

Considering "y" as a dependent variable (MFIs loan default rate), the study result predict that, the change in a unit measure of MFIs loan default rate is influenced by 0.827 changes in units degree of individual's interest. The overall result give the researcher's right to conclude that, "*Tanzanian MFIs experience high loans default rates as they face the competing differed individuals' interests in their lending group".*

The Effect of Diluted Group Norms on MFIs Loans Default Rates

The field result in table 05 indicates that, the average responses for AGREE; DISAGREE; and UNDECIDED were 38.9; 47.4; and 13.7 percent respectively.

Table 05: The Effect of Diluted Group Norms on MFIs Loans Defaults

Parameters	Responses From Respondents						Total	
(Statements)	Agree	Percent	Disagree	Percent	Undecided	Percent	Total Frequency	Percent
There is an adequate conformity of loaned members of MFIs to their group norms in overcoming loan defaulters	34	37.8	46	51.1	10	11.1	90	100
Members in MFIs loans groups are of equal status in the light of their group norms in overcoming loan defaulters.	36	40.0	46	51.1	08	08.9	90	100
Decision made by members in MFIs loans groups are free from groupthink that could influences loan defaulting	35	38.9	42	46.7	13	14.4	90	100

Decision made in MFIs loans groups are fairly free from group shift that could trigger defaulting among members	35	38.9	40	44.4	15	16.7	90	100
MFIs loans groups manage social loafing in ascertaining the security of MFIs lent money by other members	33	36.7	40	44.4	17	18.9	90	100
The defaulting rate is not fueled by production blocking tendency of some persons in MFIs Group	37	41.1	42	46.7	11	12.2	90	100
Total	**21**	**233.4**	**256**	**284.4**	**74**	**82.2**	**540**	**600**
Average score	**35**	**38.9**	**42.7**	**47.4**	**12.3**	**13.7**	**90**	**100**

Source: Survey data, 2019

The study considered measuring the effects of diluted norms in MFIs lending Groups on loans default rates by assessing such norms inducing parameters as; conformity to norms[7], members equality in status[8]; groupthink[9], group shift[10], social loafing[11]; and production blocking[12] aspects. The responses were scaled on **"Agree", "Disagree",** and **"Undecided"** (neutral state). With Agree retorts, it could mean norms inducing variables are in favor of strong group cohesiveness building; leading to less MFIs loan defaults, and the "disagree" response would mean the opposite of "agree". Hence, the greatest scores for "disagree" retorts in this study denotes that high loans default rates in MFIs is the result of diluted norms in their lending groups.

Inferential Implications on the Relationship between Diluted Group Norms and MFIs Loans Defaults

The higher analysis of variables was carried by using hypothesis two *(H2)* stating that;

"*Tanzanian MFIs experience high loans default rates as they are confronted by diluted group norms in their lending group"*

The hypothesis was re-stated in both of *Null (Ho*) and *Alternative (Hi)* hypotheses thus:-

H_0: *High loans default rate in Tanzanian MFIs is not related to dilute group norms*

H_I: *High loans default rate in Tanzanian MFIs is related to diluted group norms.*

Since micro-landing groups are more built on norms than on governing laws, there is a likelihood that the diluted norms triggers loans defaulting among members as a result of weakened cohesiveness in MFIs lending group. Hence, the group norm was considered the important variable for higher level analysis.

Since norms cannot be internalized alike, the magnitude of dilution was assessed by the use of three scale of responses (Agree, Undecided and Disagree) to give individuals' freedom in assessing on whether diluted norms contributes to MFIs loans default rates or not. The *"proportions Chi-squire*" was employed as a test statistic (see Kothari, 2003) *at 95percent degree of confidence, with Z=1.96* and the *significance level* of $\alpha = 0.05$, using scores for variables influencing norms to testify the hypothized likelihood (*See results in Table 06*)

Table 06: Proportion Chi squire test on the likelihood that diluted group norms influence MFIs loans default rates

	The proportional scores for					
Parameters	Agree Answer (X)	Plus (+)	Disagree Answer (Y)	Plus (+)	"Undecided" Answer (X)	Total ($\sum f$)
Observed Value (O)	35	+	42.7	+	12.3	90
Expected Value(E)	30.0	+	30.0	+	30.0	90*1
O – E	5.0	+	12.7	+	-17.7	00*
$(O-E)^2$	25		161.29		313.29	--
$(O-E)^2 / E$	0.83	+	5.38	+	10.44	$16.65 = X^2$

Source: Survey data, 2019. Degree of freedom (df) = *C-1 = (3-1) = 2*

Whereas: X^2 = the test statistic that asymptotically approaches χ^2 distribution; o = an observed value (frequency); E = an expected theoretical value (frequency) asserted by the null hypothesis; *df*= degree of freedom (Number of Columns "C"- One = 3-1 =2)

The critical *Chi* table value (X^2) for *df=2* at $\alpha = 0.05$ is 5.99 (Kothari, 2014). Since the calculated *Chi value* ($X^2 = 16.65$) was greater than *critical Chi table value* ($X^2 = 5.99$) *as read in appendix 1*, the difference between the observed (*O*) and expected (*E*) values was considered significant. Then there is a statistical evidence to reject the null *(Ho)* hypothesis asserting that, *"high loans default rate in Tanzanian MFIs is not related to diluted group norms".*

The rejection of the null *(Ho)* hypothesis is a statistical proof to affirm that "Tanzania MFIs face high loans default rates as they are confronted by diluted group norms in their loan groups"

[7] Conformity to norms: the process of adhering to group norms (Dumo, 2015)

[8] Status: a socially defined position or rank given to groups or group members by others (Mader, 2016)

[9] Groupthink: fall of mental efficacy and moral decree due to in-group pressures (Haldar, 2016)

[10] Group shift: a special case of group think in which conservatives shift to more risk taking (Haldar, 2016)

[11] Social loafing: group members rely on the efforts of others fail while reserving their own (Dumo, 2015)

[12] Production blocking: limiting another person's output by getting in his or her way (Haldar, 2016)

Conclusion

The purpose of this study was to examine the challenges of group lending on MFIs loan security in Tanzania. The study was undertaken in four selected MFIs operating in Arusha region of Tanzania, namely: CRDB; NMB; FINCA and BRAC. Using descriptive and inferential tests, while guided with both research questions and hypothesis, the study discloses that; *the security of MFIs loans is impaired by; diluted group norms and deferred lonee interests in groups, among other factors*. This could imply that, instead of considering group lending as an ideal mechanism for loan security, MFIs should also think of behavioral targeting in abating defaulting chances; as the observed evasion behavior is the result of individual's and group attitudes fueled by differed drives ranging from personal to psychological predispositions. Some of the said drives are beyond the control by the group members themselves. Despite being the ready source of literature for reviews, it was a belief that, the results obtained would be reflective enough to create awareness on the pertinent challenges of group lending to MFIs loans security in Tanzanian micro-financing industry; and, come up with apt strategies to overcome them. It was the researcher's suggestion that similar studies be done to establish the magnitude of impacts associated with named MFIs loans security challenges for better micro-financing industrial modeling in alleviating loan defaulting chances.

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Appendix 1: The Chi Test Table for X^2 Values

Degrees of Freedom	Probability, *p*				
	0.99	**0.95**	**0.05**	**0.01**	**0.001**
1	0.000	0.004	3.84	6.64	10.83
2	0.020	0.103	5.99	9.21	13.82
3	0.115	0.352	7.82	11.35	16.27
4	0.297	0.711	9.49	13.28	18.47
5	0.554	1.145	11.07	15.09	20.52
6	0.872	1.635	12.59	16.81	22.46
7	1.239	2.167	14.07	18.48	24.32
8	1.646	2.733	15.51	20.09	26.13
9	2.088	3.325	16.92	21.67	27.88

Source: Cohen, 1988

Appendix 2: The correlation Coefficient "r" Table Value

Degrees of Freedom	Probability, *p*		
	0.05	**0.01**	**0.001**
1	0.997	1.000	1.000
2	0.950	0.990	0.999
3	0.878	0.959	0.991
4	0.811	0.917	0.974
5	0.755	0.875	0.951
6	0.707	0.834	0.925
7	0.666	0.798	0.898
8	0.632	0.765	0.872
9	0.602	0.735	0.847
10	0.576	0.708	0.823

Source: Cohen, 1988

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CHALLENGES OF GROUP LENDING ON MFIs LOANS SECURITY: A CASE OF FOUR SELECTED MFIs IN ARUSHA, TANZANIA.

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***Abstract**: In the evolution of global business, a number micro-financing players have faced many defies in due course of their lending-borrowing interrelations. The group lending by MFIs has been one of the model perceived to guarantee the security of loans provided by the said funding institutions. This study aimed "to determine the challenges of group lending on MFIs loans security in Tanzania". The specific objectives of the study were: to examine the challenges of diluted group norms on MFIs loans defaulting; and, to examine the contribution of deferred group interests on MFIs loans defaulting. A research was a multiple case study in nature undertaken in four selected MFIs (FINCA, BRAC, NMB and CRDB) based in Arusha– Tanzania. The use of purposive and stratified sampling techniques enhanced the collection of data from the field by using research schedules. The collected data were analyzed and coded by using Excel. Descriptive statistics such as frequencies and percentages; as well as Proportion Chi Test, Pearson Correlation Coefficient, Regression Analysis and T-Test Inferential Modals were used to determine the relevance of data, and hence drawing the conclusion. The study results meant to help in judging whether MFIs group lending is an ideal model to be solely relied on or not. The study findings revealed that, the security of MFIs loans is impaired by; diluted group norms and deferred lonee interests in groups, among other factors.*
Key words: Challenge, Group lending, MFIs, Loan Security

Background to the Problem

Group lending has been the common financing framework in a number of micro-finance institutions (MFIs) on earth; ever since it's evolvement in Asia and spreading to Latin America, and Africa (Haldar, 2016). A number of depository and non-depository MFIs have considered the framework as their number one solution to overcome loans defaults that seem to endanger firms' loans security in micro financing industry. Considering the greater demand for business financing, there is no way that microenterprises can stand out without commensality business relation with MFIs; despite unjustified long term loan deliquescence and defaults intoxicating this relations.

Microfinance institutions are said to be key drivers of the global business growths in a number of ways. The steady portfolio increase of about 30 percent annual world record in Micro-financing services in between 1997 and 2007, for example, lead these financing bodies to continually diversify to commercial banks (Toussant, 2017 & Mohd, 2018). To date, small business with over 95 percent of the total global enterprises, hiring about 70 percent of global workforce, receive about 58 percent of their net operating capital from the said MFIs (TANCAD, 2018). As per Microcredit Summit survey undertaken in 2007; with about 154.8 million business served worldwide by over 3,350 MFIs, nearly 106.6 million enterprises financed were sole proprietors classified to be at the bottom half of those living below their nation's poverty line (Bernhard, 2017).

In the developed world for example, USA, Canada, and China, where small and medium enterprises are adequately funded (Mori, 2015), small and medium enterprises (SMEs) are considered to be the innovative pools, food securers, job creators and economic shock resilient (Dumo, 2015; Standing, 2017 & Standing, 2018). Likewise, about 30-60 percent of the said business are profound novelty brand builders with marked proficiency in; demand generations, productivity triggering, sales expansions, as well as technical and technological change agents (Makorere, 2014 & Dumo, 2015). On the other hand, despite their major partaking in global economy, about 43 percent of SMEs in the developing world with 20 to 49 employees have faced difficulties in accessing finance for their operations; irrelative to 11 percent of the same business size in the developed world (Sharma, 2016; Bernhard, 2017 &Standing, 2018). The financing gap to SMEs in low income countries is as high as US$700-850 billion (twice as much as in large firms) (Baldwin, 2015; Scott, 2017). High collateral needs due to undue loan defaults; lack of skills within financial intermediaries, and non-liquidity of the finding institution are some of common dares in most of micro-financing industries in Africa, including Tanzania (Karlan, 2011; Mader, 2016; Sharma, 2017 & TANCAD, 2018)

Despite their long term identification as the entrepreneurs financing vehicles, and economic elevators in the developing world (including Tanzania), MFIs have never been perceived to be pro-poor by the majority of economic players due to their inability to reach the most vulnerable and weak sections in the society (Ayyagari, 2012; Gbandi, 2014 & Bernhard, 2017). Moreover, besides the enjoyed financing opportunities available, MFIs suffer acute losses due to a number of loan defaulters. Loans default rates in developing world is as high as 4.5 percent while in the developed world, the said default rate is recorded to be 3 to 4 percent (Korankye, 2014 & Makorere, 2014). Since the evolvement of gramen bank by Prof. Yunus in Bangladesh, group lending model has been the common practice in overcoming loan

defaults (Khan, 2010; Mader, 2016 & TANCAD, 2018). However, the pertinent question is on whether the said model is appropriate in ensuring MFIs loan security; that all financing firms should solely rely or not.

Statement of the problem

Though group lending seem to be the most opted model in the vast of global micro-financing industries, the said framework has never ensured the best of financial security as expected by lenders due to endless loan defaulting facets. Different studies have been done on long-term relation between MFIs and its clients in Tanzania (Makorere, 2014 & Mori, 2015); however, little have been revealed on dares impairing the value of group lending on MFIs loan security. Therefore, the current study seeks to determine challenges of group lending on MFIs loan security; with specific focus to group norms and differed interest within the loan groups in relation to loans default rates in Tanzania.

The study objectives

The general objective of this study was "to determine the challenges of group lending on MFIs loans security in Tanzania. The specific objectives of the study were: to examine the challenges of deferred interests in MFIs loan groups on loans defaults; and, to examine the effect of group norms[1] on MFIs loans defaults. It was the researcher's expectation that, if the objectives are equitably met, MFIs players will be aware of the key defies for MFIs loan security; and hence, generate the profitable strategies for apt recital of industrial loaning systems.

Literature review

The literature presents the key concepts and terms as used in the study, namely: Microfinance institutions[2] (MFIs); loans defaulting[3]; loan security[4]; and, group lending[5]. It too offers some theories governing MFIs operations to include: classic microfinance theory of change and Social-Collateral (group micro-lending theory). The group lending[6] principles are too explained in the section.

Micro financing theories and operating principles

According to classic microfinance theory of change, a poor persons go to a microfinance provider and take a loan to start or expand a microenterprise yielding enough net revenue to repay the loan with large interest and still have sufficient profit to increase personal or household income enough to raise the person's standard of living (Erica, 2012 & Scott, 2017). The theory adhere to three steps, namely**:** taking a loan from a microfinance institution; investing the money in a viable business, and; managing the business to yield more return on investment (Erica, 2012 & Standing, 2017). However, the model gives inapt details on futile trends arising out of borrowers' bleak behavior, interests and business environmental volatility.

On the other hand, according to Social-Collateral (group micro-lending or social capital), "MFIs should lend to groups and not to specific individuals" (Khan, 2010 & TANCAD, 2018). Borrowers should select themselves into clusters of the same risk levels and hold each other accountable (Karlan, 2011 & Sharma, 2017). Intra-group lenders become self-driven to monitor and exclude risky-borrowers who might take them into unbearable risky situations by defaulting (Gbandi, 2014 & Haldar, 2016). The theory is built on the grounds of trust, concern for one's friendships, preparedness to live the norms of one's group and to chastise those who do not (Khan, 2010; Erica, 2012). The question is on whether there befalls ample time for the stated groups' common understanding.

Moreover, the group lending theory is governed by the principle of group solidarity; which holds that, the more solidary the group is, the greater the influence it casts upon its members (Khan, 2010 & Haldar, 2016). The principle measures the capacity of a group to influence member's behavior. With normative school of thought, the group become more cohesive as its members internalize the group norms (Dumo, 2015 & TANCAD, 2018). On the other hand, with structuralism ideas, the group becomes more solidary cohesive not because of internalization, rather, because they share the common interest (Mader, 2016 & TANCAD, 2018). However, the extent to which lack of members' internalization to norms or diverse group interests contributes to higher MFIs default rate is not clearly defined.

Nevertheless, the defaulting experience in MFIs group-lending can be explained by the concepts related to group cohesiveness (Gbandi, 2014 & Mohd, 2018). Some scholars argue that, MFIs provide loans to borrowers without considering the impacts of group cohesiveness driving factors, to include; similarity in members' characteristics, group size; goal congruence; group interests; as well as group entry difficulty (Karlan, 2011; Erica, 2012 & Scott, 2017). When the listed are not well considered, the possibility of borrowers to repay their loans become minimal.

Micro-financing Institutions' Focus and Lending practices

The fundamental intention of MFIs were to finance the poor communities in sustaining lives, build better houses, acquire basic education and fight against poverty (Khan, 2010 Haldar, 2016). Adhering to the said primary mission, the performance of MFIs projects have been continuously measured through their social warfare impacts to the community (Bernhard, 2017 & Mohd, 2018). Since the foundation of MFIs services in Bangladesh, a number of microfinance projects have evolved and grown to traditional commercial banks for which the major loaned clients being SMEs (Ayyagari, 2012). The 1990's MFIs change of focus in Latin America, spread to the rest of the world, about the turn from service for poor to the multitude of business financing has shown that, MFIs can be profitable undertakings whilst keeping on track to its primary focus of service for poor (Toussant, 2017; Sharma, 2017 & Standing, 2018*)*. However, the degree to which MFIs balance between financial and nonfinancial mission has never been explicitly recognized.

[1] Group norms are general acceptable standards of behavior shared by the group members (Mori, 2015)

[2] Microfinance; refers to financial services for poor and low-income clients offered by different types of service providers commonly known as MFIs (Gbandi, 2014 & Baldwin, 2015);

[3] Loan defaulting refers to failure to meet legal obligation of a loans (Mori, 2015).

[4] Loan security are pledges of assets ensuring low chances of loan defaults or deliquescent (Scott, 2017)

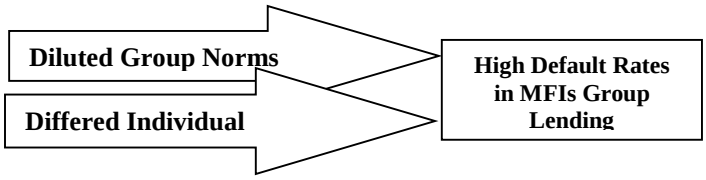
[5] The group lending refers to the practice in which small group borrows collectively and members encourage one another to repay (Haldar, 2016).

Despite an increasing growth of micro-financing industry in Tanzania, social-economic impacts to the targets is still low (Dumo, 2015 & Mori, 2015). Like other developing countries, in Tanzania, small entrepreneurs cannot save enough resources to finance their business (Baldwin, 2015; Gibson, 2016 & Bernhard, 2017). Financial services needs are still high as the greater population is still excluded from credit facilities due to the recorded industrial loan evasion risks of about 4.5 percent; as opposed to 3 percent global accepted rate (Makorere, 2014 & Mori, 2015). Lack of collateral; lack of apt financial record; and inability to prepare the proper business plan among others are named to be major business dares (Erica, 2012 & Mader, 2016).

Literature Gap of knowledge

From *classic microfinance theory of change and Social-Collateral theory*, the literature review provides that, MFIs need to optimize financial discipline, with clear lending models. It too portrays the *principle of group solidarity* as the behavior measure in promoting group cohesiveness. The pertinent research gap rests on inapt fact to whether MFIs group lending is worth enough to eliminate defaulting risks associate to diluted group norms as provided by normative school of thought; and, on borrowers' differed interests as stipulated in structuralism school of thought or not.

Conceptual Framework



Study hypothesis

It is all known that, loan defaulting in MFIs is attributed to a number of factors. But, group norms and individuals' interests in lending groups were considered worth for analysis. And hence, developing two postulates as stated hereunder for the study:-

H1: Tanzanian MFIs experience high loans default rates as they face the competing differed individuals' interests in their lending group.

H2: Tanzanian MFIs experience high loans default rates as they are confronted by diluted group norms in their lending group

Research Methodology

The study was both qualitative and quantitative in approach; with one main objective intended to determine the challenges of group lending on MFIs loans security in Tanzania. A multiple case study design conducted in ten loan groups from four selected MFIs based in Arusha - Tanzania (namely; CRDB; NMB; FINCA and BRAC) was deemed suitable to enhance in-depth and intensive assessment of the dares of group lending on the MFIs loans security. Multiple case is the study examining two or more related cases to gain the detailed understanding of a phenomenon by studying how and why the phenomenon occurs (Kombo, 2006). The target population included MFIs services providers and borrowers groups. Both simple random and purposive sampling techniques were used to select the study participants (Kothari, 2003). A sample of 30 operators, and 60 borrowers groups' members was obtained from four selected MFIs services providers. The research schedules and documentary reviews were used to gather the study data; for which frequencies and percentages were presented in tables. Using non-parametric measures, loan default rate as a dependent variable; as well as individual interests and group norms as independent variables were tested. The Proportion Chi Test, Pearson Correlation Coefficient, Regression Analysis and T-Test Inferential Modals were used to assess variables' relations for better knowing the respondents' views (Kombo, 2006 & Kothari, 2014). Universal research principles and ethical issues were firmly adhered to (Kumar, 2011 & Kothari, 2014).

Results and Discussion

The findings and discussion on "the challenges of group lending on MFIs loans security in Tanzania" was presented by adhering to two pre-determined specific study objectives and the set hypotheses for which high level analyses of data obtained was done by the use of inferential models to testify and generalize the result's validity and reliability.

The General MFIs and Borrowers Information

After satisfactory analysis, the study directs the researcher to generalize that, the greater proportion of MFIs borrowers are individuals aged between 21 to 60 years with cumulative percent of 85.5; and, about 55.5 percent of them are women. The active partakers in MFIs group lending are individual with primary and secondary school education; occupying about 30 and 36.7 percent respectively; whose large proportion (61.1 percent) use non-depository MFIs, relative to 38.9 percent users of depository firms with micro-financing status. About 60 percent of MFIs borrowers comprise of small business, start-up aspirants and varied firm's employees collectively (***see table 01***)

Table 01: General MFIs and Borrowers Information

Parameters	Frequency	Percent
Age group		
01-20	05	05.6
21-40	40	44.4
41-60	37	41.1
61 +	08	08.9
Total	**90**	**100**
Sex of identified respondents		
Male	40	44.4
Female	50	55.6
Total	**90**	**100**
Education level of respondents		
Non-formal educated	**10**	**11.1**
Primary Education	**27**	**30.0**
Secondary Education	**33**	**36.7**
Post-secondary Education	**20**	**22.2**
Total	**90**	**100**
The Well Known and Ideal MFIs Operators		
Depository (NMB, CRDB, BOA, Twiga Corp, etc)	35	38.9
Non-depository (BRACK, FINCA, SEDA, HAKIKA etc)	55	61.1
Total	**90**	**100**
Nature Of Borrowers in MFIs Groups		
Start-up Aspirants	26	28.9
Small Business Owners	28	31.1
Employees from both public and private firms	20	22.2
Others	16	17.8
Total	**90**	**100**
Rated Effectiveness of MFIs lending group on loan security		
(00-25)	14	15.6
(26-50)	38	42.2
(51-75)	30	33.3
(76-100)	08	08.9
Total	**80**	**100**

Source: Survey data, 2019

The large involvement of individuals aged 21 to 60 year could be driven by two main factors. First, individual aged 21 to 40 years are said to be dynamic economic actors as though argued by Scot (2017); and secondly, those with 41 to 60 are family laboring individuals; mixed with business pursuit that compel them to find more funds in meeting their pressing onuses as though also supported by TANCAD (2018). The study results concurs with Mori's view that, women are active partakers in micro-lending than men not because they are active business machinery, but because they are heavily subjected to families bills (Mori, 2015).

The study reveals that, individuals with primary education (30 percent) and secondary educations (36.7 percent) are major users of MFIs. This may be because the said groups are largely absorbed in commercial sectors than in formal employments (Mader, 2016). While most of depository financial institutions are known to fund large and medium business, non-depository MFIs are said to be favored by majority of small business and start-up partakers (Sharma, 2016 & Bernhard, 2017). This scholars' argument is also revealed in this study as the differed non-depository MFIs absorb about 60 percent of all actors.

Moreover, as also explained by (Standing, 2017), the study finds employees included in the group of MFIs borrowers with 22.2 percent as they borrow funds to diversify their inadequate primary incomes, and adding-on their allied non-commercial staffs. Due to their empirical absence in business cycles, their ventures pay less to none. However, the group may render financial delinquency with less to non-defaults as their debts may be covered through their wages (Baldwin, 2015). The start-up aspirants with 28.9 percent in this study is perceived to be the most default riskier group as their experiential absence in business cycles leads their ventures to pay lesser than expected (Scott, 2017). As though it is for the start-up aspirants, small business with 31.1 percent in most cases suffers the effect of economies of scale in their ventures; and about 40 to 68 percent of them are prone to business failure (Gibson, 2016). This is counted as the second most default riskier group. Nerveless, about 91.1 percent of partakers in micro-financing industry view group lending to be less than 75 percent effective. This may be due to a number of dares including; improper selection of group, high interests attached to loans, dynamic business environments, and lack of loan monitoring as pointed out in some literatures (Haldar, 2016 & TANCAD, 2018). However, cohesiveness deterring factors in table 02 are too significant.

Clients Factors Fueling Loans Default Rates in MFIs Loan Groups

From the study, table 02 indicates the key borrowers' factors for loans default rates in percentage to be; diluted MFIs group norms (24.4 percent), differed group goals (22.2 percent), size of MFIs Lending groups (17.8 percent), Differed interests in MFIs loan groups (26.7 percent), and MFIs Group entry (08.9 percent)

Table 02: Members Factors Fueling Loans Default Rates in MFIs Loan Groups

Ranks	Frequency	Percent
Diluted norms in MFIs lending groups	22	24.4
Differed group goals in MFIs Lending Groups	20	22.2
The Large Size of MFIs Lending Groups	16	17.8
Differed Interest in MFIs Lending Groups	24	26.7
Easy of entry into MFIs Lending Groups	08	08.9
Total	**90**	**100.0**

Source: Survey data, 2019

As it may be seen in table 2 above; and supported by some scholars (Karlan, 2011; Erica, 2012 & Scott, 2017), the diluted group norms; differed group goals; large group sizes; differed individual interest in groups; and, easiness to group entry impacts the group cohesiveness by reducing members powers to condemn deviants. When this happens, individuals in groups are likely to default their loans. Many MFIs face high loan defaults beyond the normal acceptable rate (3 percent) as they underrate the said personal and psychological factors while working on the formulaic macro-institutional and industrial challenges (Dumo, 2015 & TANCAD, 2018). Hence, for apt recital of loan security, all loans risky exposing dimensions need to be ably addressed.

The Link between Deferred Individuals Interests and MFIs Loans Defaults

The data in table 03 portrays that, about 60 cumulative percent of differed individual interest influence decisions making in MFIs groups by 41 to 80 percent (i.e. from medium to high level); while their corresponding default rate being about 56 percent cumulatively. In establishing the link between individual's interest and loan defaults, using the field data provided, rearrangement for inferential statistics in table 04 was a compelling affair.

Table 03: Rated Extents of Deferred Interests and Loan Defaults in MFIs Loan Groups

Categorical Ranking of parameters	Level at which individuals' Interests Influence MFIs Group Decisions (x)		MFIs Loan Default Rates (fy)	
	Frequency (fx)	Percentage (Px)	Frequency (fy)	Percentage (Py)
Very Low (01 -20%)	07	08	11	12
Low (21 -40%)	18	20	20	22
Medium (41 -60%)	29	32	27	30
High (61 -80%)	25	28	23	26
Very high (81 -100%)	11	12	09	10
Total	**∑fx = 90**	**∑x = 100**	**∑fy = 90**	**∑y = 100**

Source: Survey data, 2019

Inferential implications on the relationship between Group Interests and MFIs Loans Defaults

The higher analysis of variables was carried by using hypothesis one *(H1)* stating that; "*Tanzanian MFIs experience high loans default rates as they face the competing differed individuals' interests in their lending group".*

The hypothesis was re-stated in both of *Null (Ho)* and *Alternative (Hi)* hypotheses thus:-

H_0: High MFIs loans defaults rates in Tanzania do not relate to differed individuals' interests.

H_I: High MFIs loans defaults rates in Tanzania relate to differed individuals' interests.

That is; Ho: p=0; and, H_I: p≠0

It was hypothized that, having congruent interests among MFIs loans' group members influence greater cohesiveness in taking collective errands for deviant behaviors. MFIs face high default rates as discrete members bear differed interests on loans they acquire from what they advocate during their entry in loan groups; hence giving no apt room to ascertain its security for decision taking. The hypothesis aimed to assess the correlation between the levels at which ones "interest influence decisions making" and "loans default rates" in MFIs loan groups.

Table 04: Correlation between Individuals Interests and MFIs Loans Defaults

Categorical Ranking of parameters	Level at which individuals' Interests Influence MFIs Group Decisions (x)	MFIs Loan Default Rates (y)	x^2	y^2	Xy
Very Low (01 -20%)	08	12	64	144	96
Low (21 -40%)	20	22	400	484	440
Medium (41 -60%)	32	30	1024	900	960
High (61 -80%)	28	26	784	676	728
Very high (81 -100%)	12	10	144	100	120
Total	**∑x = 100**	**∑y = 100**	**∑ x^2 =2416**	**∑ y^2 = 2304**	**∑ xy = 2344**

Source: Survey data, 2019 **Degree of freedom (*df*) = n-2= (5-2) =3**

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}$$

$$r = \frac{5(2344)-(100)(100)}{\sqrt{5(2416)-(100)^2}\sqrt{5(2304)-(100)^2}} r = \frac{1720}{\sqrt{2080}\sqrt{1520}}$$

$$r = \frac{1720}{45.61 \times 38.99} = 0.967$$

$$The\ correlation\ coefficient\ (r) = 0.967$$

The calculated r-value (r=0.967) suggests a strong positive *linear* relationship between MFIs loan defaults and individuals' interest in influencing MFIs group decisions making.

The coefficient of determination (r^2) = $(0.967)^2$ = 0.935 implies that; 93.5 percent of variation in loans defaults can be explained to the relationship between high loan default rates and deferred individuals interests in MFIs loan groups. While the remaining 6.5 percent being due to other varied factors "ϵ". With t-test, as shown below, the calculated *"r"* is statistically significant, as the calculated t-value (7.85) is greater than the stated *p-value* at the probability *p=0*. That is, *H_0: p>0 = (7.85>0)*

$$t = \frac{1}{\sqrt{\frac{1-r^2}{n-1}}} = \frac{1}{\sqrt{\frac{1-(0.967)^2}{5-1}}} = 7.85$$

Considering the 95 percent critical *r-values* at *ά=0.05* and, three (3) degree of freedom *(df)* to be ± 0.878 (Kothari, 2003); whereas, the calculated r-value using n=5 data points to be *0.967*, at *df=3*; and, the calculated *t-value* being *7.85*; the statistical evidence was significant enough to reject the null *(H_0)* hypothesis that; High MFIs loans defaults rates in Tanzania do not relate to differed individuals' interests as the calculated r-value was greater than the critical table *r-values (*beyond critical r-values limits -0.878 to +0.878). Please, see the r-value in appendix 2.

In predicting this strong positive linear relationship, the regression analysis model (y = a + bx+ ϵ) was employed. Whereas, y= dependent variable (MFIs loan defaults as defined in the methodology); x=independent variable (also defined in the methodology); a= an intercept; and, b=slope (variation factor)

But,

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} = \frac{5(2344)-(100)(1000)}{5(2416)-(100)(100)} = \frac{1720}{2080} = 0.827$$

And,

$$a = \frac{\sum y - b\sum x}{n} = \frac{100-0.827(100)}{5} = 3.460$$

From Regression equation "y=a+bx+∈",

$$We\ have,\ y = 3.460 + 0.827x + \in$$

Considering "y" as a dependent variable (MFIs loan default rate), the study result predict that, the change in a unit measure of MFIs loan default rate is influenced by 0.827 changes in units degree of individual's interest. The overall result give the researcher's right to conclude that, "*Tanzanian MFIs experience high loans default rates as they face the competing differed individuals' interests in their lending group".*

The Effect of Diluted Group Norms on MFIs Loans Default Rates

The field result in table 05 indicates that, the average responses for AGREE; DISAGREE; and UNDECIDED were 38.9; 47.4; and 13.7 percent respectively.

Table 05: The Effect of Diluted Group Norms on MFIs Loans Defaults

Parameters	Responses From Respondents						Total	
(Statements)	Agree	Percent	Disagree	Percent	Undecided	Percent	Total Frequency	Percent
There is an adequate conformity of loaned members of MFIs to their group norms in overcoming loan defaulters	34	37.8	46	51.1	10	11.1	90	100
Members in MFIs loans groups are of equal status in the light of their group norms in overcoming loan defaulters.	36	40.0	46	51.1	08	08.9	90	100
Decision made by members in MFIs loans groups are free from groupthink that could influences loan defaulting	35	38.9	42	46.7	13	14.4	90	100

Decision made in MFIs loans groups are fairly free from group shift that could trigger defaulting among members	35	38.9	40	44.4	15	16.7	90	100
MFIs loans groups manage social loafing in ascertaining the security of MFIs lent money by other members	33	36.7	40	44.4	17	18.9	90	100
The defaulting rate is not fueled by production blocking tendency of some persons in MFIs Group	37	41.1	42	46.7	11	12.2	90	100
Total	**21**	**233.4**	**256**	**284.4**	**74**	**82.2**	**540**	**600**
Average score	**35**	**38.9**	**42.7**	**47.4**	**12.3**	**13.7**	**90**	**100**

Source: Survey data, 2019

The study considered measuring the effects of diluted norms in MFIs lending Groups on loans default rates by assessing such norms inducing parameters as; conformity to norms[7], members equality in status[8]; groupthink[9], group shift[10], social loafing[11]; and production blocking[12] aspects. The responses were scaled on **"Agree", "Disagree",** and **"Undecided"** (neutral state). With Agree retorts, it could mean norms inducing variables are in favor of strong group cohesiveness building; leading to less MFIs loan defaults, and the "disagree" response would mean the opposite of "agree". Hence, the greatest scores for "disagree" retorts in this study denotes that high loans default rates in MFIs is the result of diluted norms in their lending groups.

Inferential Implications on the Relationship between Diluted Group Norms and MFIs Loans Defaults

The higher analysis of variables was carried by using hypothesis two *(H2)* stating that;

"*Tanzanian MFIs experience high loans default rates as they are confronted by diluted group norms in their lending group"*

The hypothesis was re-stated in both of *Null (Ho*) and *Alternative (Hi)* hypotheses thus:-

H_0: *High loans default rate in Tanzanian MFIs is not related to dilute group norms*

H_I: *High loans default rate in Tanzanian MFIs is related to diluted group norms.*

Since micro-landing groups are more built on norms than on governing laws, there is a likelihood that the diluted norms triggers loans defaulting among members as a result of weakened cohesiveness in MFIs lending group. Hence, the group norm was considered the important variable for higher level analysis.

Since norms cannot be internalized alike, the magnitude of dilution was assessed by the use of three scale of responses (Agree, Undecided and Disagree) to give individuals' freedom in assessing on whether diluted norms contributes to MFIs loans default rates or not. The *"proportions Chi-squire*" was employed as a test statistic (see Kothari, 2003) *at 95percent degree of confidence, with Z=1.96* and the *significance level* of $\alpha = 0.05$, using scores for variables influencing norms to testify the hypothized likelihood (*See results in Table 06*)

Table 06: Proportion Chi squire test on the likelihood that diluted group norms influence MFIs loans default rates

	The proportional scores for					
Parameters	Agree Answer (X)	Plus (+)	Disagree Answer (Y)	Plus (+)	"Undecided" Answer (X)	Total ($\sum f$)
Observed Value (O)	35	+	42.7	+	12.3	90
Expected Value(E)	30.0	+	30.0	+	30.0	90*1
O – E	5.0	+	12.7	+	-17.7	00*
$(O-E)^2$	25		161.29		313.29	--
$(O-E)^2 / E$	0.83	+	5.38	+	10.44	$16.65 = X^2$

Source: Survey data, 2019. Degree of freedom (df) = *C-1 = (3-1) = 2*

Whereas: X^2 = the test statistic that asymptotically approaches χ^2 distribution; o = an observed value (frequency); E = an expected theoretical value (frequency) asserted by the null hypothesis; *df*= degree of freedom (Number of Columns "C"- One = 3-1 =2)

The critical *Chi* table value (X^2) for *df=2* at $\alpha = 0.05$ is 5.99 (Kothari, 2014). Since the calculated *Chi value* ($X^2 = 16.65$) was greater than *critical Chi table value* ($X^2 = 5.99$) *as read in appendix 1*, the difference between the observed (*O*) and expected (*E*) values was considered significant. Then there is a statistical evidence to reject the null *(Ho)* hypothesis asserting that, *"high loans default rate in Tanzanian MFIs is not related to diluted group norms".*

The rejection of the null *(Ho)* hypothesis is a statistical proof to affirm that "Tanzania MFIs face high loans default rates as they are confronted by diluted group norms in their loan groups"

[7] Conformity to norms: the process of adhering to group norms (Dumo, 2015)

[8] Status: a socially defined position or rank given to groups or group members by others (Mader, 2016)

[9] Groupthink: fall of mental efficacy and moral decree due to in-group pressures (Haldar, 2016)

[10] Group shift: a special case of group think in which conservatives shift to more risk taking (Haldar, 2016)

[11] Social loafing: group members rely on the efforts of others fail while reserving their own (Dumo, 2015)

[12] Production blocking: limiting another person's output by getting in his or her way (Haldar, 2016)

Conclusion

The purpose of this study was to examine the challenges of group lending on MFIs loan security in Tanzania. The study was undertaken in four selected MFIs operating in Arusha region of Tanzania, namely: CRDB; NMB; FINCA and BRAC. Using descriptive and inferential tests, while guided with both research questions and hypothesis, the study discloses that; *the security of MFIs loans is impaired by; diluted group norms and deferred lonee interests in groups, among other factors*. This could imply that, instead of considering group lending as an ideal mechanism for loan security, MFIs should also think of behavioral targeting in abating defaulting chances; as the observed evasion behavior is the result of individual's and group attitudes fueled by differed drives ranging from personal to psychological predispositions. Some of the said drives are beyond the control by the group members themselves. Despite being the ready source of literature for reviews, it was a belief that, the results obtained would be reflective enough to create awareness on the pertinent challenges of group lending to MFIs loans security in Tanzanian micro-financing industry; and, come up with apt strategies to overcome them. It was the researcher's suggestion that similar studies be done to establish the magnitude of impacts associated with named MFIs loans security challenges for better micro-financing industrial modeling in alleviating loan defaulting chances.

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Appendix 1: The Chi Test Table for X^2 Values

Degrees of Freedom	Probability, *p*				
	0.99	**0.95**	**0.05**	**0.01**	**0.001**
1	0.000	0.004	3.84	6.64	10.83
2	0.020	0.103	5.99	9.21	13.82
3	0.115	0.352	7.82	11.35	16.27
4	0.297	0.711	9.49	13.28	18.47
5	0.554	1.145	11.07	15.09	20.52
6	0.872	1.635	12.59	16.81	22.46
7	1.239	2.167	14.07	18.48	24.32
8	1.646	2.733	15.51	20.09	26.13
9	2.088	3.325	16.92	21.67	27.88

Source: Cohen, 1988

Appendix 2: The correlation Coefficient "r" Table Value

Degrees of Freedom	Probability, *p*		
	0.05	**0.01**	**0.001**
1	0.997	1.000	1.000
2	0.950	0.990	0.999
3	0.878	0.959	0.991
4	0.811	0.917	0.974
5	0.755	0.875	0.951
6	0.707	0.834	0.925
7	0.666	0.798	0.898
8	0.632	0.765	0.872
9	0.602	0.735	0.847
10	0.576	0.708	0.823

Source: Cohen, 1988

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Development of Virtue-Based Sharia Economics Textbook as Support for Sharia Economics Lectures in Economic Education Study Program IKIP Budi Utomo

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Abstract- The development of Virtue-Based Sharia Economics textbooks conducted at the Economic Education Study Program is a study that uses research and development techniques. The implementation of this research based on the majority of participants in Islamic economics courses who are non-Muslim, thus experiencing difficulties in using textbooks because there are many verses of the Qur'an. Based on the results of the pretest and posttest, the results of expert validation, as well as small-scale and large-scale tests, obtained the results that Virtue-Based Sharia Economics textbooks included in the criteria of good and feasible to use.

Index Terms- Sharia Economics, Textbooks, Virtue-based.

I. INTRODUCTION

By-Law No. 12 of 2012, tertiary institutions have autonomy in the preparation of the curriculum that applies to their institutions, which in its implementation still follows the rules that apply nationally. One of the goals of higher education contained in Law No. 12 of 2012 is to make humans as creatures who have faith, fear God and have a noble character, healthy, knowledgeable, capable, creative, independent, skilled, competent, and cultured for the benefit of the nation [1]. Because of these ideas, students who are adult people are required to have awareness in developing their potential to become scientists, intellectual practitioners or professionals in their fields, so that the ideals mandated in the Act above can be realized. One way to realize this is through improving the quality of education by developing a curriculum in tertiary education by national standards. National standards for tertiary education curricula are curricula that are in line with the Indonesian National Qualification Framework or KKNI. With the application of the KKNI-based curriculum, graduates from major tertiary institutions from the economic education study program can become graduates who have the quality that is desired by the world of work, and have good cognitive, affective and psychomotor mastery. So graduates can and can juxtapose, equalize and integrate the world of education, training, and work experience separately to meet the demands of employment.

Indonesian National Qualification Framework or KKNI listed in Presidential Regulation Number 8 of 2012 and Law Number 12 of 2012 concerning Higher Education. In the IQF curriculum there are three (3) stages that must be followed by tertiary institutions so that graduates will later become graduates who are in accordance with KKNI standards, the three stages are: 1) the curriculum planning stage, namely curriculum preparation begins with the preparation of CPL or graduate learning outcomes, structuring courses, as well as the formation of courses, 2) the learning planning stage, where the learning process for one semester is designed to be in accordance with CPL in each course, and 3) the program evaluation stage is the evaluation and evaluation stage which is carried out periodically to improve the quality of lectures continuously. The implementation of the IQF-based curriculum must go through seven (7) stages, namely: 1) Establish graduate profile, 2) Formulate learning outcomes, 3) Formulate competence of study material, 4) Mapping the learning outcomes of study material, 5) Course preparation, 6) Compilation of curriculum framework, and 7) Develop lecture plans.

In order for a student to become a prospective graduate by KKNI standards, it must follow the lecture correctly or according to the seventh KKNI stage. The following lectures well must be supported by many factors. In addition to the motivation and enthusiasm of students themselves, a pleasant atmosphere of lectures is also one of the important things. Creating a comfortable, conducive and pleasant classroom atmosphere requires a lot of support, and teaching materials is one of them. Teaching material is one of the most important components of the learning process.

Teaching materials in lectures can be useful for students to help understand the material taught by lecturers, as a guide to learning activities, can also help the implementation of more organized learning. Teaching materials used in teaching and learning activities, if developed according to the teaching needs of lecturers and students and can be used correctly by both parties can be one of the main factors in improving the quality of learning. With the teaching materials developed by lecturers for lectures, the role of lecturers and students who were initially lecturers as primary information givers and student listeners or recipients of information can change roles to become teachers as facilitators in lecturing activities, because learning sources or sources of information can be obtained from the book. The development of teaching materials conducted by lecturers has several benefits, among others [2]: 1) available teaching materials in accordance with the curriculum used at the learning place, 2) students have no difficulty in obtaining textbooks in lectures, 3) the availability of teaching materials that are more varied because they are developed according to needs and obtained from various references and have been assessed or reviewed, 4) become a contribution of knowledge, 5) the establishment of effective communication between lecturers and students, and 6) the fulfillment of professionalism demands of lecturers included in the tri dharma of higher education.

Sharia Economics Course is an elective course presented in semester five (5) or odd semester in the Economic Education Study Program. This course has MK EKO227 code and 2 credits are presented. In the implementation of Islamic economic lectures, several obstacles occur and quite disturbing lecture activities, among others, most of the lecture participants are students from Nusa Tenggara and Kalimantan who are non-Muslim, so that they experience difficulties in understanding and reciting the Qur'an, several terms in Islamic economics. The second obstacle is that the books on the market are very diverse and contain many verses of the Qur'an as well as some hadith quotes that are also obstacles for students. So that researcher as lecturers of Islamic economics courses is obliged to help students solve problems in Islamic economic lecture activities that are expected to be overcome through this Islamic economics textbook.

Some of the material presented or discussed in this book include: an introduction to Islamic economics, classical and contemporary Islamic economic thought, assets and ownership in Islam, usury, gharar, maysir, Islamic banks, Islamic bank products, zakat, dinar and dirham , Islamic insurance, Baitul Maal Wat Tamwil, as well as various types of existing elements in Islamic economics. Sharia economics today is a discussion that is so trendy, this is evidenced by the increasing number of financial institutions that are labeled sharia. Basically, the difference between conventional financial service institutions and Islamic financial service institutions lies in fulfilling aspects of sharia principles. Where the principles of Islamic economics are all things referring to the Qur'an and the Hadith.

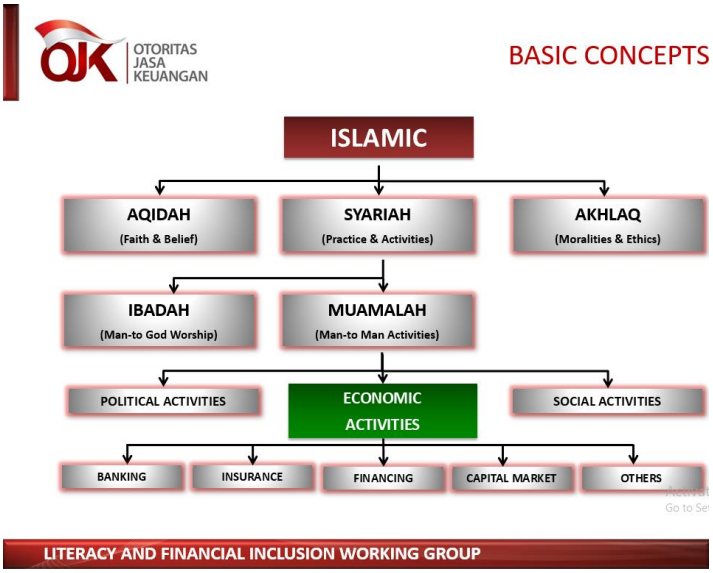

Figure 1. The Basics Concept of Sharia Economic (Sumber: OJK)

Economic life in Islam is regulated in a number of guidelines, in broad terms, namely: 1) no activities are permitted that contain elements of speculation and gambling in economic activities which may be detrimental to many parties; 2) God does not like possessions that are stockpiled or centered on just a few people, so property must move or use for business; 3) work and earn a living is a worship and must be done by everyone; 4) all things in life, including

economic activities, must be done in an honest, fair and transparent manner, based on like and without consent from any party; 5) every transaction, especially non-cash, is required to be recorded in the knowledge of a trusted witness; 6) there is awareness of the obligation to set aside assets that are the rights of others in the form of zakat, infaq or shodaqoh; 7) there is an agreement between scholars, jurisprudents, and Islamic bankers in the World Islamic Bank who argue that bank interest is usury, and usury is haram.

In addition to those described above, there are also some prohibited matters in Islamic financial services, namely:

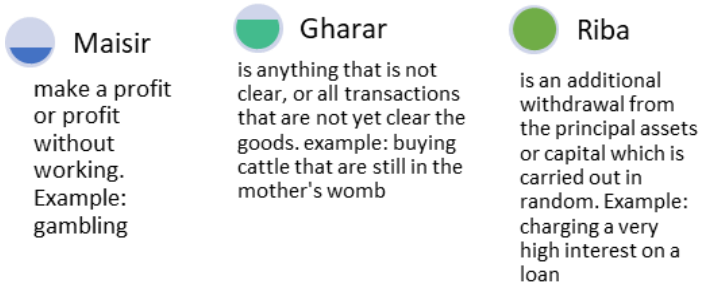

Figure 2. Islamic financial services

In this textbook also explained about the types of contracts that exist in Islamic financial institutions, as in the picture below:

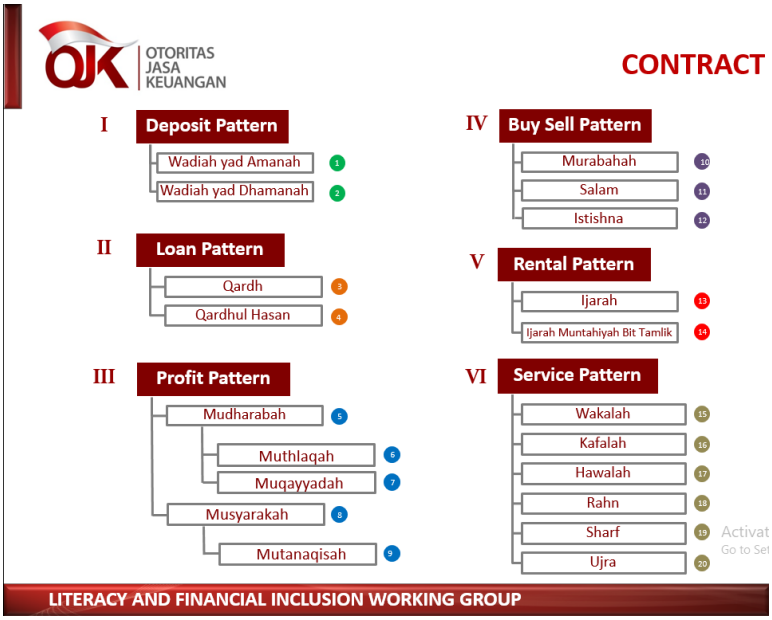

Figure 3. sub-bab of Virtue-based textbooks

In addition to Islamic economics courses, one of the courses at IKIP Budi Utomo and a characteristic of the IBU campus is culture, which consists of five pillars of virtue, namely:

Figure 4. five pillars of virtue-based

Reviewed from the KBBI website (online, 2019). The five pillars of virtue above have meanings, namely: 1) Indonesianness, the word Indonesianness comes from the basic word Indonesia. Indonesianness has a meaning about Indonesia, which has to do with Indonesia or how to develop a culture that is rooted and is in the soul. 2) Expediency is defined as terms of benefits or uses. 3) Concern means that the matter is very caring, attitudes of being concerned (apprehensive), social: attitudes of being heed (apprehensive) of something happening in society. 4) Obedience, that is obedience or obedience, and 5) Propriety, namely (per) the scales, opinions or can also be interpreted as appropriateness, suitability or also suitability, compatibility.

The five pillars of virtue above are not all included in the discussion in the Islamic economics textbook, but only one (1) pillar is incorporated in the discussion, namely the pillar of expediency. In the pillar of expediency, the discussion included in this textbook is the benefit of Islamic economics for the Indonesian economy. There are several benefits felt from the existence of sharia economy for the Indonesian economy, including:

- Islamic banks as financial services performers have contracts and conditions that are different from conventional banks, this tends to benefit the community because the contract or applicable conditions do not burden consumers only.
- Indonesian people who want to open a business are greatly helped by the existence of Islamic banks, one of which is through a loan agreement that is mudharabah, and also the bank does not burden customers with costs that are out of reach
- Islamic banks also provide low-cost loans free of charge
- One of the principles of Islamic banks is to promote justice, prosperity, and economic equality
- If at any time the country experiences a monetary crisis, users of Islamic banks will not be affected because Islamic banks in their operational activities do not use the concept of interest or usury s.

Until now, in Indonesia, there are 13 Sharia Commercial Banks and 21 Sharia business units spread throughout Indonesia.

II. METHODS

Conducting this research at IKIP Budi Utomo Economic Education Study Program using Research and Development (R&D) research methods. R&D can be interpreted as a research method used to produce certain products that have been conducted various tests and assessments. In the book by Sugiyono, it is written that development research according to Borg and Gall is "research and development is a powerful strategy for improving practice [3]. It is a process used to develop and validate educational products, or it can be interpreted that "research development is a powerful strategy for improving practice. It is a process used to develop and assess educational products. " The educational products referred to above must contain four (4) elements, among others:

- Products not only hardware such as modules, textbooks, videos or films, but also software such as curriculum, learning models, learning procedures, etc.
- The product developed is a new product and / or modifies an existing product
- Products that are developed truly have benefits for the world of education
- Products that have been developed can be accounted for both practically and scientifically.

Amile and Renesnes said that development research is "a process of developing educational devices that have been carried out through a series of research and using various methods in a stage". Whereas Seels and Richey stated that research and development is "a systematic study of the design, development, and evaluation of programs, processes and learning products that meet the validity, practical and effective criteria" [4]. In practice, the development of design in research development has several stages, namely:

- Determine the product design to be developed (mortgage design)
- Determine and describe the tasks of various parties involved in research
- Determine the needs for facilities and infrastructure that will be used during the study
- Determine the stages of implementing the field test

The implementation of this study uses the Dick and Carey instructional model [5]. In the Dick and Carey instructional model there are 10 stages, but this study only uses 9 stages, as shown in the figure below: 1) Identity the purpose of general lectures, 2) Recognize the input, characteristics and the characteristics of students participating in Islamic economics courses, 3) conduct material analysis of Sharia economics courses, 4) Formulate specific objectives of Islamic economics courses, 5) Develop references test items in textbooks, 6) Develop instructional strategies, 7) develop and write instructional media tools and tools, 8) Design and carry out formative evaluations, 9) Design and carry out summative evaluations.

The steps in this Dick and Carey model are similar as described by Syaodih regarding the procedure of conducting research and development, which are used, namely: 1) descriptive method, used in preliminary research to collect data on existing conditions, which include the condition of old products or those that already exists as a comparison with new products, conditions of users such as students or lecturers, conditions of supporting factors or other inhibiting factors; 2) evaluation method, useful for testing the development of a new product, which has gone through various trials and evaluating each trial; and 3) experimental methods are used to test the efficacy of the products produced.

The research was located at IKIP Budi Utomo Malang Campus C which is located at Jalan Citandui number 46, Purwantoro Village, Blimbing District, Malang City. The study was conducted on a 2016 batch of 70 students. Data collection using a questionnaire instrument. The questionnaire, besides being used for data collection from students, is also used to obtain data from experts as well as from test results. Experts or validators in this study consist of media experts, linguists, and material experts. The test carried out in the study consisted of small-scale tests and large-scale tests.

III. RESULT AND DISCUSSION

The development of this textbook has nine steps that become the stages in its research, namely 1) Identifying the objectives of general lectures, 2) Recognizing the input, characteristics, and characteristics of students participating in Islamic economics courses, 3) Conducting analysis of Islamic economic subjects, 4) Formulating specific objectives of the course Islamic economics, 5) Develop reference test items in textbooks, 6) Develop instructional strategies, 7) Develop and write instructional textbook tools and media, 8) Design and carry out formative evaluations, 9) Design and carry out summative evaluations. Before testing the students, pretest and posttest are conducted in order to find out the improvement in the results of sharia economic lectures. The results of the pretest were 72.5% and after using the textbook or posttest test the average results obtained were 83.6%. So as a whole it can be concluded that the textbook of Islamic economics based on virtue developed is included in the appropriate category for use.

The results of this research development in the form of textbooks on Islamic economics based on virtue have been tested and validated by three experts namely material experts (economics and virtue), media experts and linguists. There are two material experts in this study, namely Islamic economics material experts and material matter experts. The expert on sharia economics material chosen is a lecturer who masters economics and has the academic rank of Lector and understands about sharia economics, while the subject matter of virtue is a lecturer with the academic

position of associate professor and has mastered material on Principality. From sharia economics material experts, the value of validation was 83.3% and the material expert expertise was 75.2%. The selected media experts are lecturers who have excellent mastery of learning, so they can provide excellent input and advice in validation activities in order to get good textbooks. From media experts, the test results were 78.6%. The third expert is a linguist and is a lecturer who is an expert in the field of language, is a doctor in the field of Indonesian language as well as an academic position of the head lecturer, so that he can assess or validate this textbook in accordance with good Indonesian or in accordance with improved spelling. Linguists gave a test result of 81.7%.

In addition to the three experts, this textbook has also been conducted twice on student tests, namely a small scale test and a large scale test. A small scale test was conducted involving 40 students of the 2016 class, while a large scale test involved 70 students. A small scale test is carried out by applying and testing the material of Chapters 1 and 2, and gets a response from students who are in good qualifications or equivalent to the percentage level of 82.6%. Whereas a large-scale trial conducted on 70 students by examining material Chapters 4 and 5 got good results or equal to the percentage level of 86.3%.

From the results of the pre-test and post-test, validation on several experts and small-scale and large-scale tests, it was found that the Islamic economics textbook based on Islamic economics is included in both criteria and is included in the appropriate category for use in Islamic economic lectures for students in economic education study programs.

As a country with the world's largest Muslim citizens, the government of Indonesia has been integrating Islamic education in its school curriculum from elementary until senior high levels [6]. Since the opening of specialization professors and students have encountered several problems connected with learning, the main of which is insignificant availability of special literature. This is largely a consequence of the underdevelopment of the scientific direction on the fundamentals of Islamic economics in Russia and the lack of textbooks on the federal level [7]. In these circumstances, the University staff has prepared and published a series of educational publications, including textbooks, lectures, guidelines, covering all the main sections of the Islamic economics and the economy of Islamic countries.

Although most Muslim nations have relatively low levels of per capita income and the accompanying features of such underdevelopment, their economies are quite different not only from each other but also from Muslim economies in the past [8]. These actual economic systems are not the subject of this study, for I am more interested in how Muslims define their future than how they view their present or past. In this study related to the existence of virtue-based, this can develop textbooks that explore the Islamic economy.

However, virtue-based approaches, which challenge the notion of the moral obligation itself, have not yet been fully explored within higher education [9]. Onward, including the development of virtue-based or excellences of character, is a life-long task, and the need for narrative unit in human lives is taken seriously within a virtue-based approach, because: “the good life cannot be discussed if the sense of that life is lost in its atomization into a series of unrelated acts” [10].

IV. CONCLUSION

The development of Virtue-Based Sharia Economics textbooks conducted at the Economic Education Study Program is a study that uses research and development techniques. The implementation of this research is based on the majority of participants in Islamic economics courses who are non-Muslim, thus experiencing difficulties in using textbooks because there are many verses of the Qur'an. Based on the results of the pretest and posttest, the results of expert validation as well as small-scale and large-scale tests obtained the results that Virtue-Based Sharia Economics textbooks are included in the criteria of good and feasible to use. These actual economic systems are not the subject of this study, for I am more interested in how Muslims define their future than how they view their present or past. In this study related to the existence of virtue-based, this can develop textbooks that explore the Islamic economy.

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Development of Physical Learning Instrument by Using Newton's Laws with Inquiry Method to Complete Student's Learning Achievement in Senior High School

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Abstract- This research is a type of research development that is about developing learning instrument. Development of learning instruments including the Learning Implementation Plan, Student Activity Sheets, Student Teaching Materials, with Sheets Assessment oriented towards guided inquiry learning. The subject in this study was Newton's Law of Motion. The research was conducted at SMA Negeri 20 Surabaya, for trial I held for 12 students of class X academic year 2011-2012. While testing complete implementation for class implementation X-1 by replication I with class X-2, Replication II with class X-3 academic year 2013/2014. Learning instrument material Newton's Laws with inquiry methods which includes lesson plans, student teaching materials, worksheets, and learning achievement test is a valid instrument so it is suitable for use. The average score of validation results for the RPP obtained 3.51 with either category. The average score of validation results for Student Teaching Materials obtained 3.96 with a good category. The average score of validation results for the worksheet obtained 3.47 with a good category. While the average score of validation results for learning achievement tests obtained 3.87 in the good category. This already meets the valid criteria, that the learning instruments meets the valid criteria if it has been validated the experts get a minimum score of 2.60. Level of readability of student teaching materials developed in research this is categorized as easy, with an average percentage of the level of legibility student teaching materials by 87.16%. Students easily read material written on teaching material so that it can support the learning process. The level of difficulty of student teaching materials and worksheets developed in this study is included in the easy category, which is 19.07% for teaching material students and 17.98% for LKS. So that student teaching materials and worksheets are easy understood by students can be used to support learning. Learning instrument material Newton's Laws with inquiry methods which includes lesson plans, student teaching materials, worksheets, and learning achievement tests already meet the practical criteria, namely: the implementation of learning on each meeting can be categorized as good, student activities during the process learning is by learning that uses the method inquiry and the obstacles that occur can be overcome. Learning instrument material Newton's Laws with inquiry methods already meets the effective criteria, namely: student's responses in general expressed pleasure and interest to take part in further learning with the same method. Student learning achievement have reached KKM increase N-gain minimum 0.7 with high criteria. Research on developing of physical learning instrument by using newton's laws with inquiry method to complete student's learning achievement in senior high school that has been tested on students of class X on Newton's Laws of motion material produce instruments learning which includes RPP, LKS, student teaching materials, and THB. based on the findings of the study, it concludes that physic learning instrument Newton's Law material which developed with the inquiry method meeting valid criteria, legibility teaching material is categorized as easy, the level of difficulty of teaching material and LKS has easy category, good practicality, and good effectiveness, so it's worth using by the teacher for learning Physics.

Index Terms- Physical Learning Instruments, Newton's Laws, Inquiry Method, Student's Learning Achivement

I. INTRODUCTION

Physics is an experimental science. Physicists must learn to apply the right question, design an experiment to try to answer the questions and draw the right conclusions from the results [1]. Physics is the natural phenomena that learning about science through a series of processes known as scientific process and supported with a scientific attitude and the results are tangible scientific products that can be in the form of concepts, principles, theories, and are applicable universal. The general objectives of learning physics include understanding and using scientific methods, mastering physical knowledge, using attitudes scientific, meeting personal and community needs, awareness of future careers front [2], so in physics teaching and learning students activities are conditioned in an active state by involving students directly on the process and the object being studied. With these conditions, the teaching learning process can support cognitive development as well as giving students opportunities to be creative so that they form more conceptions complete. Based on the experience of researchers

as instructors, most students responded that physics was difficult, and memorized many formulas. This means that students see physics as a product that is only memorized. This things shows that student learning experiences are not built alone, but rather limited to the facts conveyed by the teacher. "If you understand correctly the nature of Physics as a product and scientific process is certainly more should have put the experimental method in place rather than the lecture method. If indeed it is only natural that Physics is considered a difficult subject, many formulas, not contextual and seem boring" [3].

Learning should be more than just remembering. For students, to truly understand and be able to apply science, students must work hard on solving a problem at hand, find something useful for themselves which in turn can apply it in the community [4]. This means students must building knowledge in their minds. In this case, students must be active in processing information or ingredients, digesting, thinking, analyzing, and finally summarizing what he learned as a whole understanding. The teacher can help this process, by teaching ways that make information to be very meaningful and very suitable for students. In line with the statement above, in Chapter IV Article 19 Government Regulation No. 19 of 2005, it was stated that the process learning in educational units is held interactively, inspiration, fun, challenging, motivating students to participate actively, and provide sufficient space for the initiative, creativity, and then by the talents, interests and physical and psychological development of students.

Effective learning requires an understanding of how making knowledge accessible to students so they can link that knowledge with other knowledge and apply it outside the classroom. The teacher can help students learn knowledge in such a way so that making knowledge besides useful is also meaningful for them. Physics learning is carried out in scientific inquiry to foster the ability to think, work and be scientific as well communicating as one important aspect of life skills. These learning students are involved to actively think and find meaning he wants to know [5].

The inquiry can be interpreted as a process taken by humans to get information or to solve something the problem [6]. Meanwhile, the inquiry is a process took to solve problems, plan experiments, conducting experiments, collecting and analyzing data, and interesting conclusion [7]. The inquiry is a process of obtaining and obtaining information by doing observation and/or experiment to find answers or solve problems to the question or formulation of the problem by using the ability think critically and logically. Thus, in this paper what is meant by inquiry is a process is taken by humans to obtain information or to solve a problem by making observations and/or experiments using critical and logical thinking skills [8]. Learning by inquiry methods prioritizes the process of discovery to gain knowledge, the teacher must always design activities that allow students to do discovery activities in teaching subject matter taught. In inquiry learning, the teacher involves the ability of students to analyze and solve problems in a manner systematic. With inquiry, the contents and process of the investigation learned together at the same time, through a process of inquiry finally students arrive at the content of knowledge itself.

Learning with inquiry methods is based on learning theory constructivist developed by Piaget. According to Piaget, since childhood, each individual tries and can develop their knowledge through the scheme that exists in its cognitive structure. This scheme continues continuously updated through the process of assimilation and accommodation. Knowledge obtained by students in learning can be applied, both in school and outside of school. According one indication of the transfer of learning is the ability to use information and problem-solving skills [9]. Application is the ability to apply, and abstract concepts, ideas, formulas, laws in a new situation. For example, solving problems with certain formulas, apply a concept in an issue. Mastery physics concepts of students who learn through inquiry learning models better then students who learn through conventional learning models. Thing similar also stated by Census Silalahi, that contextual learning the type of inquiry succeeds in increasing student motivation and learning achievement [10]. Meanwhile, according to Orhan Akinoglu in his research stated: "... the most objective benefits are obtained by students from the project works is their increasing interest in science and technology class. The most significant change seen by students regarding project preparation is their increasing grades in exams during and following the project works" [11]. One level of inquiry is guided inquiry, which is an inquiry with teacher involvement in the process of covering determining topics, formulating problems, tools/materials and procedures [12].

Guided inquiry is an inquiry that many teachers interfere with, through briefing through a complete procedure. The inquiry that the researcher uses is the guided inquiry method accompanied by an application (application) concept, with the following steps: formulate the problem, set a temporary answer (hypothesis), collect data, analyze data, draw conclusions, and apply the conclusion. At the stage of applying student conclusions given a contextual problem, which is accompanied by an image that is in everyday life. According to researchers, the material Newton's Laws is one material that has a high level of difficulty. Besides studying, the relationship between force and state of the object (moving or still) also associates with kinematics and vector quantities. By studying Newton's laws allows understanding of known types of motion, these laws are the basis of classical mechanics. In studying the Newton's Laws material, many students have difficulty understanding and applying it. For four the last year before the study was conducted, the average daily test scores the material is still below the minimum completeness criteria, which is 59.8.

Therefore, researchers are interested in researching learning with inquiry methods can be used to teach Newton's Laws material. With learning with inquiry methods, students besides getting knowledge in a way directly from the experiment, can also learn to apply concepts and laws to solve problems.

II. EXPERIMENTAL METHOD

2.1 General Background of Research

Following the title, this research is a type of research development that is about developing learning instrument. Development of learning instruments including the Learning Implementation Plan, Student Activity Sheets, Student Teaching Materials, with Sheets Assessment oriented towards guided inquiry learning. The subject in this study was Newton's Law of Motion.

2.2 Sample of Research

The research was conducted at SMA Negeri 20 Surabaya, for trial I held for 12 students of class X in academic year 2011-2012. While

testing complete implementation for class implementation X-1 by replication I with class X-2, Replication II with class X-3 academic year 2013/2014.

2.3 Instrument and Procedures

This research was conducted in two stages, phase I was development of learning instrument. In this phase I the researcher is compiling learning instruments and validating instruments by several experts (experts at this field), followed by trial I on 12 students. At this stage intended to see the feasibility of learning instruments developed. Phase II is the implementation of learning instruments already deemed appropriate based on the results of trial I. The material used in this study is Newton's Law of motion.

The instruments referred to in this study are (1) instrument validation learning, (2) Sheet of learning instrument implementation (3) observation sheet of student activities, (4) student questionnaire sheets, (5) learning instrument test. Further explanation is as follows.

1. The learning device validation sheet includes the RPP validation sheet, validation sheet student teaching materials, validation sheet lks, and validation sheet learning instrument test.
2. Readability test sheet for students' teaching material, in the form of paragraphs 50 words were removed. This instrument was arranged based on the instrument close procedure developed by Taylor in 1953 [13].
3. The difficulty level of teaching material and worksheets, in the form of a questionnaire given to students. Students are asked to underline sentences which are not understood, then the number of sentences that are not understood are filled in a questionnaire.
4. Instruments of effectiveness in the application of learning tools which include:
   a. Learning Implementation Observation Sheet.
   Observation sheet on the learning process is used to find out the suitability of the learning process with RPP. The reliability of this instrument is tested using percentage agreement.
   $$percentage\ agreement = \left[1 - \frac{A-B}{A+B}\right] x100\%$$
   Note:
   A = Frequency of aspects of behavior observed by observers that provide high frequencies
   B = Frequency of behavioral aspects observed by observers that provide low frequencies
   b. Observation Sheet Student Activities in KBM.
   The aspects observed on this observation sheet are activities students during the learning process. The instrument reliability of observing student activities was tested by technique interobsever agreement, i.e. 2 (two) observers observe aspects the same during the learning activities take place. The formula used to calculate reliability is as follows:
   $$percentage\ agreement = \left[1 - \frac{A-B}{A+B}\right] x100\%$$
   Note:
   A = Frequency of aspects of behavior observed by observers that provide high frequencies
   B = Frequency of behavioral aspects observed by observers that provide low frequencies
   The instrument is said to be good (reliable) if it has a reliability coefficient > 75 (75%) [14].
   c. Student response questionnaire sheet to the inquiry method
   This instrument is used to describe student responses, given to be filled out by students after participating in the learning method of inquiry accompanied by the application.
   d. Learning Instrument Test.
   Learning instrument test are used to measure student mastery levels with regard to material dynamics. The sensitivity of the items is calculated by statistics:
   $$S = \frac{R_A - R_B}{T}$$
   Information :
   S = Item sensitivity
   RA = Number of students who can answer correctly after ongoing learning process
   RB = Number of students who can answer correctly before ongoing learning process
   T = Total (number) of students
   The maximum price sensitivity index of a problem is 1.00; is on the minimum index is equal to 0 (zero). This means that an item can be considered sensitive (sensitive to learning effects) if results the sensitivity calculation is positive [15]. Sensitivity about the description:
   $$S = \frac{\Sigma ses - \Sigma \text{seb}}{N(skor_{maks} - skor_{min})}$$
   Information:
   S = sensitivity index
   N = number of objects
   Σses = Number of subject scores after the process learning
   Σseb = Number of subject scores before the process learning
   Score_{max} = Maximum score that can be achieved by the subject
   Score_{min} = Minimum score that can be achieved by the subject
   The increase in learning achievement is calculated by the n-gain formula which is developed by Hake, namely by using the two

difference test the mean, pre-test and post-test, found differences in improvement in learning achievement before and after learning Physics with inquiry methods.

$$(g) = \frac{(s_{post}) - (s_{pre})}{100\% - (s_{pre})}$$

Information:
g (gain) = Increased learning achievement
S_{pre} = Pre-test average (%)
S_{post} = Average post test (%)

Table 1. Criteria for Gain Level

No	Range	Criteria
1	g ≥ 0,7	High
2	0,3 ≤ g < 0,7	Medium
3	g < 3	Low

e. Observation Sheet constraints
Observation sheets for these constraints are used for know the constraints or obstacles faced by the teacher, which is not in accordance with the planning in the RPP. This observation sheet filled in by observers for each meeting.

2.4 Data Analysis

Analysis of the results of the learning instrument validation and the results of the application learning instrument as follows:

a. Analysis of the learning instrument validation
Analysis validation of the learning instrument is done descriptively descriptive, which is done by means of the data score of each component averaged, then to determine eligibility, the average score is converted to sentences that are qualitative, Very Good (76% - 100%), Good (56% - 75%), Not Good (40% - 55%), Bad (less than 40%) [16]. For validation of learning tools by experts, they have a maximum score 4.00 so:
3,51-4,00 = Very Good / Very appropriate: Can be used without revisions
2.60-3.50 = Good / decent: Can be used with minor revisions
1.70-2.59 = Not good / not appropriate: Can be used with major revisions
0.00-1.69 Not good / improper: Not yet usable

b. Analysis of Readability of Student Teaching Materials
The value of the level of readability is the level of the reading level of students against teaching material developed by researchers, analyzed by percentage as the following:

$$\text{Readability} = \frac{\text{The number of keywords read}}{\text{Number of keywords left blank}} x100\%$$

Table 2. . Readability Level

Percentage	Description
p > 50%	Easy, the reader understands the contents of the reading
35% ≤ p < 50%	Somewhat difficult, the reader needs help to understand the reading
p < 35%	Very difficult, material too difficult

c. Analysis of the Difficulty Level of Teaching Material for Students and Student Worksheets
Difficulty level data were analyzed using a percentage following:

$$P = \frac{X}{X_i} x100\%$$

Information :
P = percentage of difficulty
X = number of sentences that cannot be understood
X_i = total number of sentences
Data grading percentage percentage difficulty:
0% < P ≤ 10%: very easy
10% < P ≤ 20%: easy
20% < P ≤ 30%: easy enough
30% < P ≤ 40%: moderate
40% < P ≤ 50%: quite difficult
50% < P ≤ 70%: difficult
70% < P ≤100%: very difficult

d. Analysis of the Effectiveness of the Application of Learning Instruments
1) Analysis of the implementation of the learning implementation plan
To analyze the results of the assessment given by two people observers of observations of the implementation of learning use a format with a rating scale [17] as following:
1.00 - 1.99 = not good

2.00 - 2.99 = not good enough
3.00 - 3.49 = good enough
3,50-4,00 = good

2) Analysis of student activities in teaching and learning activities
To analyze the observed student activity data a technique is used percentage (%), i.e. the number of activity frequencies that appear divided overall activity multiplied by 100%.
3) Analysis of student's responses
Student responses are obtained and questionnaire with the aim that students answer honestly and correctly. The response is intended to know the opinion students towards the learning process that has been implemented, carried out descriptively qualitatively namely by testing the positive response and student negativity.
4) Analysis of learning achievement test
On the product learning outcomes, the pretest value is tested for homogeneity. Test homogeneity using Levene's test. The testing process uses the help of SPSS software. After homogeneity test, test data are results Student learning is analyzed using descriptive statistics, namely by using the level of completeness of individuals and classicals.
   a) Individual completeness
   Individually, a student completes if a student has a grade equal to or greater than the minimum completeness criteria (KKM) has been established. Minimum completeness criterion value (KKM) in SMA Negeri 20 for Physics is 75.
   b) Learning objectives completeness
   Learning objectives are said to be complete if the percentage of students is achieving learning objectives equal to or greater 70.

e. Analysis of the constraints of implementing learning
The constraints of implementing learning are analyzed descriptively by gathering, discussing and evaluating suggestions given by observers to the learning activities done.

III. RESULT AND DISCUSSION

After conducting a complete test the following research results are obtained:

a. Learning instrument material Newton's Laws with inquiry methods which includes lesson plans, student teaching materials, worksheets, and learning achievement test is a valid instruments so it is suitable for use. The average score of validation results for the RPP obtained 3.51 with either category. The average score of validation results for Student Teaching Materials obtained 3.96 with a good category. The average score of validation results for the worksheet obtained 3.47 with a good category. While the average score of validation results for learning achievement tests obtained 3.87 in the good category. This already meets the valid criteria, that the learning inatrument meets the valid criteria if it has been validated the experts get a minimum score of 2.60.
b. Level of readability of student teaching materials developed in research this is categorized as easy, with an average percentage of the level of legibility student teaching materials by 87.16%. Students easily read material written on teaching material so that it can support the learning process.
c. The level of difficulty of student teaching materials and worksheets developed in this study is included in the easy category, which is 19.07% for teaching material students and 17.98% for LKS. So that student teaching materials and worksheets are easy understood by students can be used to support learning.
d. Learning instrument material Newton's Laws with inquiry methods which includes lesson plans, student teaching materials, worksheets, and learning achievement tests already meet the practical criteria, namely: the implementation of learning on each meeting can be categorized as good, student activities during the process learning is by learning that uses the inquiry method and the obstacles that occur can be overcome.
e. Learning instrument material Newton's Laws with inquiry methods already meets the effective criteria, namely: student's responses in general expressed pleasure and interest to take part in further learning with the same method. Student learning instruments have reached KKM increase N-gain minimum 0.7 with high criteria.

IV. CONCLUSION

Research on developing of physical learning instrument by using newton's laws with inquiry method to complete student's learning achievement in senior high school that has been tested on students of class X on Newton's Laws of motion material produce instruments learning which includes rpp, lks, student teaching materials, and THB. based on the findings of the study, it concludes that physic learning instrument Newton's Law material which developed with the inquiry method meeting valid criteria, legibility teaching material is categorized as easy, the level of difficulty of teaching material and LKS has easy category, good practicality, and good effectiveness, so it's worth using by the teacher for learning Physics.

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Development of Physical Learning Instrument with Process Skills Approach to Train Student's Critical Thinking Skills On the Concept of Dynamic Electricity

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Abstract- This research includes research and development (Research and Development). Research and development are research methods used to produce certain products and test the effectiveness of the product. To be able to produce certain products used research nature of needs analysis and to test the effectiveness of the product so can function in the wider community, research is needed to test the product. As the name implies, Research & Development is understood as a research activity that starts with research and continues with development. Research activities carried out to obtain information about user needs (needs assessment), while activities development is carried out to produce learning instrument. Research activities are not only carried out at the needs assessment stage but also in the product development process, which requires activities data collection and data analysis, that is at the expert validation process stage and the stage of empirical validation or testing. Whereas development refers to products produced in research projects. This research develops learning instrument with a process skill approach to train student's critical thinking skills. The device developed is a Lesson Learning Plan (RPP), Student Textbooks (BAS), Student's Activity Sheets (LKS), Assessment Sheet (LP). This research was conducted in odd semester, academic year 2018-2019 academic year in Al Hikmah High School Surabaya. As for who is the subject of research is learning instrument with a process skill approach to train student's critical thinking skills. And the object of research in this study is class of XII Al Hikmah Surabaya High School with 28 students. In this study, to obtain research data used some data collection techniques, namely as follows: test, observation, and provision of questionnaires. Based on the analysis of the results of research and discussion, obtained the conclusion as follows: The validity of the learning instruments includes lesson plans, student's book, LKS, LP are valid categories, readability of Student's Book and LKS shows that the contents and appearance are attractive and easy understood so that it can be applied in learning. The implementation of the lesson plan shows that the lesson plan can well-implemented and instrument of implementing RPP which used reliably, the most dominant activity is deep make observations, plan experiments, and do experiment or work with science process skills for practice critical thinking skills, student responses after application learning instrument are relevant to the results, the completeness of the results learning products, processes, psychomotor individually and classically has been achieved, the results of the sensitivity analysis of the items are sensitive. Based on the conclusions above, it is obtained a conclusion general that learning instrument with science process skills approach to practice critical thinking skills is worth using in learning.

Index Terms- Physical Learning Instruments, Process Skills Approach, Student's Critical Thinking Skills, Dynamic Electricity

I. INTRODUCTION

The development of science and technology in the current era requires human ability to compete in the process of globalization. The community must have the characteristics of creative, critical, innovative, flexible, agile, competitive to become quality [1]. Apart from that to be superior must also have mastery of information, be sensitive to problems, able to work with teams and cross fields. Humans must able to adjust to existing changes. Advances in science and technology marked the start of the era of globalization. Better mastery of science marks science and technology can be mastered. Physics is a part of science. If physics can be mastered well it will give a meaningful influence to master technology. Physics learning should be to pay attention to the empowerment aspects of thinking in learning. Learning Traditional deductive stresses that the teacher is the center of learning while learning that uses the process approach emphasizes that the role of students is very large in learning or usually referred to as the student-centered paradigm. Natural Sciences has several parts, one of which is physics. In physics, many skills can be performed such as: have a scientific attitude, able to communicate, work that can grown through the ability to think through physics learning scientific inquiry to support life skills. Based on these, high school students must have been trained to think at a high level according to his age level. Students can be trained to be skilled think at a high level by practicing topics that are inviting students think at the level of analysis, evaluation, and design or produce creation.

Critical thinking is constitutes a desire to get information, a tendency to looking for evidence, wanting to know both sides of the whole problem, the attitude of open-mindedness, the tendency not to expel opinion (expressing judgment), respecting the opinions of others, tolerant against ambiguity [2]. Learning that can empower critical thinking skills is the desired learning paradigm in the 21st century. Schools develop critical thinking activities are very important, schools expect teachers to realize learning that activates and develops

student's critical thinking skills. This was conveyed by Thompson and Melancon [3]. The teacher must plan science learning to develop critical thinking skills [4]. Citical thinking skills should be developed early on [5].

Based on observations at Al-Hikmah High School Surabaya, researchers found that learning physics in the classroom is still more advanced mathematical or calculation and have not practiced critical thinking skills to students. Learning emphasizes more on solving physics problems related to theory rather than linking the concepts of physics to analysis and solving real problems in everyday life. The teacher teaches physics is more dominant using the lecture and discussion method than demonstrations method and experiments to practice student's critical thinking skills. The teacher teaches critical thinking skills and still problem-solving as necessary at the time of the experiment because the measurement of this aspect is rarely implemented by the teacher. Consequently, the skills of students completing tests are oriented critical thinking skills namely the ability to analyze, evaluate and creativity students always get low scores. Based on student learning achievement data reached an average level of 69% quoted from archive vice principal of curriculum in the even semester of the academic year 2017/2018. The level of mastery learning individually set at 75% school and level 85% grade completeness.

By the Al-Hikmah Surabaya High School Curriculum, competency standards graduates who want to be achieved in physics include: developing experience to formulate problems, propose and test hypotheses through experiments, designing and assembling experimental instruments, collecting, process and interpret data and communicate experimental results oral and written. Achievement of SKL expected in physics learning should use more experimental methods to train science process skills in students, not just emphasizing understanding concept only. Based on the identification of the above problems, it is necessary learning that involves students actively in the learning process as well guide students discover their products and process skills itself, which in the end is expected to train the ability to think student's critical and student learning outcomes can be improved. Science process skills provide experience to students with learning through the process carried out in developing knowledge inductive. Learning approach oriented to the science process called the Science Process Skills Approach (KPS). In the approach, there are two KPS namely basic science process skills and integrated science process skill. Basic science process skills consist of making observations, classifying, communicating, measuring, doing predictions, provide conclusions and interpret. Integrated science process skills consists of identifying variables, determining variables operational, explain the relationship between variables, construct hypotheses, design procedures, carry out experiments for data collection and analyze data, present experimental results in the form of tables and graphs, conclude and communicate in writing or verbally. Through learning physics with the approach of science process skills then can be a means for students to practice their thinking skills and understanding of the concept to improve his critical thinking skills.

Science process skills on the concept of plant structure can empower critical thinking skills [6]. The science process skill approach will improve the ability to think critically, achievement and attitude to learning it [7]. Process skills can empower critical thinking skills. Through learning physics with an approach to science process skills is expected to be a vehicle for students to practice their critical thinking skills and understanding of the concept, because through this physics learning students trained to think critically, reason logically, and solve problems creatively [8]. One obstacle faced is the use of instruments tests that cannot measure students' critical thinking skills precisely. The recommendations of the National Science Foundation (NSF) to compile and implement evaluations with questions open, because such an assessment can improve student's thinking skills [9].

Based on the above view, it is necessary to design learning instrument that demand active student involvement in learning process as well as guiding students to find their products with the process skills themselves are ultimately expected to be able practice critical thinking skills and student concept learning achievement. For support this purpose, contextual learning instrument are designed physics concepts with a process skills approach. Based on the description above, it can be concluded the need for a study about the development of physics learning instrument with approaches science process skills to practice understanding concepts and skills critical thinking of student in Al Hikmah High School Surabaya.

II. EXPERIMENTAL METHOD

2.1 General Background of Research

This research includes research and development (Research and Development). Research and development are research methods used to produce certain products and test the effectiveness of the product. To be able to produce certain products used research nature of needs analysis and to test the effectiveness of the product so can function in the wider community, research is needed to test the product. As the name implies, Research & Development is understood as a research activity that starts with research and continues with development. Research activities carried out to obtain information about user needs (needs assessment), while activities development is carried out to produce learning instrument. Research activities are not only carried out at the needs assessment stage but also in the product development process, which requires activities data collection and data analysis, that is at the expert validation process stage and the stage of empirical validation or testing. Whereas development refers to products produced in research projects. This research develops learning instrument with a process skill approach to train student's critical thinking skills. The device developed is a Lesson Learning Plan (RPP), Student Textbooks (BAS), Student's Activity Sheets (LKS), Assessment Sheet (LP).

2.2 Sample of Research

This research was conducted in odd semester, academic year 2018-2019 academic year in Al Hikmah High School Surabaya. As for who is the subject of research is learning instrument with a process skill approach to train student's critical thinking skills. And the object of research in this study is class of XII Al Hikmah Surabaya High School with 28 students.

2.3 Instrument and Procedures

In this study, to obtain research data used some data collection techniques, namely as follows:

a. Test

The test is used to determine the completeness of learning instruments, mastery of physics concepts and student's critical thinking skills.

b. Observation

The observation technique aims to collect research data by using observation sheets that have been developed by researchers. Observation uses several research instruments to obtain research data on student activities and the implementation of the lesson plan by the teacher.

c. Provision of questionnaires

The questionnaire giving technique is used to collect data about student responses to the learning process. Granting the questionnaire given to students after learning activities are finished.

2.4 Data Analysis

a. Instrument Validation Analysis

RPP tools, worksheets, and student books developed further conducted by experts to provide an assessment. Validity learning instrument in a qualitative descriptive analysis viz by calculating the results of the assessment given by the validator based on component average scores [10]. Average score (X) described as follows:

$x > 4.65$: Very Valid
$3.45 < x \leq 4.64$: Valid
$1.15 < x \leq 3.45$: Invalid enough
a.35 $x \leq 1.15$: Invalid
$x \leq 0.35$: Very Invalid

b. Analysis of Readability of Student Worksheets and Student Books

The readability of student worksheets and student books was analyzed by descriptive statistics by asking students to provide corrections regarding readability of student worksheets and student books.

c. Learning Implementation Analysis

In the assessment, there are 3 parts, namely introduction, core activities, closing, processing time and class atmosphere. Percentage RPP implementation is calculated using the following formula:

$$P = \frac{\Sigma K}{\Sigma \mathrm{N}} x100$$

Information:
P = Percentage of RPP implementation
∑K = Number of aspects implemented
∑N = Total number of aspects observed

The implementation of the lesson plan at each phase is determined by compare the average rating scale given a second observers with the following evaluation criteria:

1.00 - 1.49: Bad
1.50 - 2.49: Not good
2.50 - 3.49: Enough
3,50 - 4,49: Good
4,50 - 5,00: Very good

To determine the reliability of the instrument of observation of performance RPP, used an interobserver technique using percentage of agreement (R) [11] as follows:

$$R = \left(1 - \frac{A - B}{A + B}\right) x100\%$$

Information:
R = reliability coefficient
A = frequency of behavioral aspects observed by the observer provide high frequency
B = frequency of behavioral aspects observed by the observer provide low frequency

The instrument of observing student activity is said to be reliability if it is of value reliability obtained ≥ 0.75.

d. Data Analysis of Student Activity Observation During Learning

During teaching and learning activities student activities are counted the percentage, then the calculation results are analyzed statistically descriptive. Student activities during teaching and learning activities were assessed by observer.

e. Analysis of Student Responses

To process student response data the percentage (%) is used. The percentage of student responses obtained by using the formula as follows:

$$P = \frac{fa}{fb} x100\%$$

Information:
P = percentage of student activities
fa = student response frequency
fb = overall frequency of response

Student response data were analyzed using descriptive statistics.

f. Analysis of Learning Achievement Tests

1) Individual student completeness

The learning instrument test was analyzed qualitative descriptive. Individually, a student can be said to be complete if the percentage (P) achieved indicators of ≥ 75% (minimum completeness curriculum criteria in Al-Hikmah High School Surabaya).

2) Mastery of student indicators

One indicator is complete when the percentage (P) of students is the accomplishment is ≥ 75%. Student learning instrument data, then processed using gain score (increase score). The percentage formula (P) is:

$$P = \left(\frac{the\ number\ of\ students\ who\ reach\ the\ indicator}{the\ total\ number\ of\ students}\right) x100$$

Student learning outcomes, then processed using a gain score (increase score). The amount of increase or gain is analyzed by the Hake formula [12].

Information:

g (gain) = Increased learning achievement

S_{pre} = Pre-test average (%)

S_{post} = Average post-test (%)

3) Sensitivity

The sensitivity of the multiple-choice form questions is used as a formula following:

$$S = \frac{B_{ss} - B_{sb}}{T}$$

Information:

S = Item sensitivity

B_{ss} = Number of students who answered right after the learning process teach

B_{sb} = Number of students who answered correctly before the learning process teach

T = Total (number of students)

For the calculation of the sensitivity index of item about form description, used the formula [13] according to as follows:

$$S = \frac{\Sigma U_{21} - \Sigma_{U12}}{N(skor\ max - skor\ min)}$$

Information:

S = sensitivity index

$\sum U_{12}$ = number of pre-test scores

$\sum U_{21}$ = number of post-test scores

Maximum score = maximum score achieved for each test item

Minimum score = minimum score achieved for each test item

N = number of students taking the test

According to Arikunto, the items were able to measure the effect learning is a matter that has a sensitivity ≥ 0.30.

g. Analysis of Mastery of Concepts and Critical Thinking Skills

Increased mastery of student's physics concepts and thinking skills critical in learning with the science process skills approach is calculated based on a normalized gain score. Increase which occur before and after learning is calculated by the gain score developed with the formula:

$$< g >= \frac{(S_{post} - S_{pre})}{100\% - S_{pre}}$$

Information:

g (gain) = Increased learning outcomes

S_{post} = Average post-test (%)

S_{pre} = Pre-test average (%)

Hake classifies the gain as follows:

g - high = g > 0.7

g - medium = 0.7 > (g) > 0.3

g - low = (g) < 0

III. RESULT AND DISCUSSION

Based on the analysis of the results of the assessment of the instruments and the results of implementation in class, then a discussion is carried out to describe the feasibility of the device learning, research instruments, and answering research problems based on the results of the implementation of the physics learning device compiled with a process skill approach to practice student's critical thinking skills. In connection with the results of the analysis, it will be described regarding the discussion of research results as follows:

1. The Validity of Learning Instrument

Learning instrument are the teacher's main instruments to carry out learning. The validity of the learning instruments developed determined based on the assessment of RPP, BS, LKS, and LP.

a. RPP

The RPP was developed as a scenario for achieving one KD and as guide teachers in managing PBM by using an process skills approach with inquiry models. KD achieved formulating simple closed-circuit electrical quantities (one loop) described into 8 product indicators, 5 process indicators, 1 psychomotor indicator and 8 indicator of critical thinking skills. The RPP consists of 4 meetings with details 3 times for learning and 1 time for assessment. The RPP was developed with the inquiry learning model with the process skills approach. This inquiry activity is very important because it can optimize the involvement of student's direct experience in the process of learning. Through the inquiry model with a process, skills approach the researcher intends to apply this learning to practice the concepts and student's critical thinking skills. The results of the assessment of lesson plans by experts include learning objectives, methods learning, learning phase, time, learning tools and evaluation get an average value of 4 with a category suitable for use and good use as a teacher's guide to managing learning to train student's critical thinking skills.

b. LKS

The development of worksheets is adjusted to the learning material and models used is the inquiry model with a process skills approach. The process skills approach emphasizes how students learn, how to manage their acquisition, so it's easy to understand. In the learning process strived for students to gain experience and knowledge themselves, carry out scientific investigations, train his intellectual abilities, and stimulates curiosity and can motivate its ability to increase the knowledge he has just gained. LKS Expert assessment results get an average value of 4 with a decent category. This shows that the developed worksheet is appropriate as a teacher's guide to managing learning to practice student's critical thinking skills.

c. Student Book (BS)

The student book developed is a BS for the subject matter of dynamic electricity consisting of introduction, content, material characteristics and translation concepts that are supplemented with indicators of critical thinking skills. Results BS assessments by experts obtained an average value of 3.9 which included the category worthy.

d. Readability of Student Books and Student Worksheet

The results of the readability assessment on the student book as much as 89% stated interesting contents and appearance, as many as 86% of students said there were only a few explanations that are difficult to understand, as many as 86% of students have no difficulty in understanding sentences and 89% easily understand images. Rating result readability in LKS as much as 100% states the contents and appearance are interesting, 89% of students said that there were only a few difficult explanations understood, and as many as 86% of students have no difficulty in an understanding sentences. The assessment results developed are good for students to use to train student's critical thinking skills.

e. The assessment sheet

The Assessment Sheet is used to measure the achievement of one BC, i.e. formulate the electrical quantities of a simple closed circuit (one loop). KD achievement is determined based on the completeness of each indicator. An indicator of learning is said to be complete when a student obtains a percentage (P) of the indicator achieved ≥ 75% (criteria completeness minimum curriculum Al Hikmah High School Surabaya). Results The validity of the contents obtained a value of 3.8 which is a good category and language validity obtained a value of 3.9 which is a good category. Whereas for LP critical thinking skills scored 3.9 which is good category and language validity get a value of 3.9 which is a category this shows that the LPs used are good and proper to use to measure the achievement of KD. The results of the sensitivity of the questions to measure the effectiveness of the learning process done by giving a pretest and posttest. From the results of the analysis obtained product sensitivity and critical thinking skills are categorized as sensitive. This matter shows that the items made can provide that information measurement results are the result of learning.

2. Results of Implementation of Learning Instrument

a. Implementation of RPP

Implementation of lesson plans in implementation with an average value of 3.83 with the good category. This shows that the CSP can be implemented with good and the RPP Implementation Instruments used can be said to be reliable. Also, observations of the preliminary, core, closing, and atmosphere activities the average class get good grades. The implementation of learning activities with the approach of the process skills obtained data students work in a way independent in small groups with teacher guidance. Basic skills include observing, classifying, communicating, take measurements, predict, infer, and interpret. Integrated skills include the ability to identify variables, determine operational variables, explain the relationships between variables, formulate hypotheses, design procedures and carry out experiments for data collection, analyzing data, presenting experimental results in a form tables and graphs, discuss, conclude and communicate in a manner written or oral. It can be used to practice student's critical thinking skills. Thus expected in the implementation of guided inquiry learning by a science process skill approach capable of producing interactions between ideas that students believed before the experiment would be proven to reach the truth after going through experimentation and exploration and evaluation.

b. Student Activities

The results of student activity by two observers on average were good. Which activity the most dominant in every meeting is in making observations, plan experiments, and conduct experiments. Student activities decreased in listening to the teacher's explanation, and behavior did not relevant. Instead, activities in analyzing data and presenting trial results have improved. The activity shows that learning initially centered on the teacher becomes centered on the student. The Student Activity Observation Instrument used is reliable. Student activities in critical thinking that are published with the inquiry learning various student activities are involved in observation, ask questions, test hypotheses and prove with experiments, using tools, analyzing and interpreting data, propose answers and predict and present the results.

c. Student Response

Student responses to teaching materials, student books, worksheets, learning atmosphere and the way to teach teachers is 93% feel

attracted 93% feel new to that component. Student responses to the ease of understanding the deep language student books, worksheets, and ways to teach teachers 88% feel interested in learning with the approach of science process skills to train critical thinking skills. Student responses to the teacher's explanation at the time PBM took place and teacher guidance in critical thinking through the process skills approach is 93% and for the ease of answering critical thinking questions by 89% easy and for the concept 93% easy. This shows that learning with the approach of science process skills can help students in practice high-level thinking skills or critical thinking skills.

d. Complete Learning Achievement

To describe the extent to which students can reach the indicator or learning objectives measuring learning instrument include measurement of the completeness of product learning achievement and critical thinking skills. Measurement of mastery learning achievement and student's critical thinking skills are carried out before learning (pretest) and after learning (posttest). Learning achievement consist of 20 Learning Achievement Test products multiple-choice questions and the Critical Thinking Test process as many as 8 question descriptions. Product Learning Achievement Test are used to measure the completeness of student learning achievement towards understanding the concept of Dynamic Electric material, while the Critical Thinking Testl is used to measure student's critical thinking skills. Measurement of learning achievement refers to the Reference Assessment Benchmark (PAP), so that the completeness of Student Learning Achievement is determined based on the Minimum Criteria for Completeness (KKM) that has been determined. The KKM for physics class XII Science in Al Hikmah High School Surabaya Academic Year 2018-2019 is ≥75. Next, it will be described as consecutive results, student learning achievement, and critical thinking skills. To measure the learning achievement of products and processes, item questions are used has a sensitivity level greater than 0.30 meaning the item able to measure the effects of learning. The results of the sensitivity analysis of items were Researchers have done showed that of the 20 concept questions, there were 18 sensitive questions and 2 non-sensitive questions. While the product and 8 items questions that have been tested all have higher levels of sensitivity greater than 0.30, meaning that the item can measure the effects of learning [14].

e. Constraints During PBM

Barriers that exist during learning with the process skills approach to practice intermediate student's critical thinking skills others: 1) students are not accustomed to using science process skills in solving critical thinking skills problems, 2) students are not yet skilled put forward problems so that some students are still passive, 3) some students are not yet skilled in communicating opinions in front of the class, the constraints faced above can be used as input for research the next is to further optimize the process skills approach for practice critical thinking skills.

IV. CONCLUSION

Based on the analysis of the results of research and discussion, obtained the conclusion as follows:

1. Feasibility Learning Instruments

   The validity of the learning instruments includes lesson plans, student's book, LKS, LP are valid categories, readability of Student's Book and LKS shows that the contents and appearance are attractive and easy understood so that it can be applied in learning.

2. Learning Instrument Test Results

   The implementation of the lesson plan shows that the lesson plan can well-implemented and instrument of implementing RPP which used reliably, the most dominant activity is deep make observations, plan experiments, and do experiment or work with science process skills for practice critical thinking skills, student responses after application learning instrument are relevant to the results, the completeness of the results learning products, processes, psychomotor individually and classically has been achieved, the results of the sensitivity analysis of the items are sensitive.

Based on the conclusions above, it is obtained a conclusion general that learning instrument with science process skills approach to practice critical thinking skills is worth using in learning.

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Transformative Leadership for the 21st Century: Africa at Glance

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Abstract

21st century Africa is embroiled in problems that have stalled the developmental gains postulated in yesteryears. Conflict, poverty, ill-health and illiteracy continue in prevalence, jeopardizing the reversal of gains already made. Solutions to this stalemate are varied, but leadership is according to the most practical step in the direction to finding solutions. Leadership provides the path and bridge to finding solutions that fit the 21st century Africa. Leadership is supposed to be within the context of good governance, transparency, rule of law, private sector development, and respect for property rights, prudent macro-economic management and cognisance of the international community of states. This paper seeks to understand the meaning of leadership and examine the circumstances under which leadership has failed in Africa. It seeks to provide avenues within which transformative leadership can be realized in order to fill the gap in development.

Key Words: *Leadership/Development/Solutions*

1.0. Introduction

The definition of leadership varies in context and understanding (Montuori. 2010: 1). McCloskey (2009:3) defines leadership as the art and science of taking individuals and communities to a new and better place. Transformative leadership can be defined as the process of changing the existent way of livelihoods to new and better ways, as and of when the need arises. Rylander (2010: 1) describes transformational leadership as enhancing the motivation, morale, and job performance of followers through a variety of mechanisms that include connecting the follower's sense of identity and self to the project and the collective identity of the organization; being a role model for followers that inspires them and makes them interested; challenging followers to take greater ownership for their work, and understanding the strengths and weaknesses of followers, so the leader can align followers with tasks that enhance their performance.

Transformational leadership as a concept was introduced by leadership expert James McGregor Burns. He described it as when "leaders and followers making each other advance to a higher level of morality and motivation," and that they are idealized in the sense that they are a moral exemplar of working towards the benefit of the team, organization and/or community (Rylander 2010: 1).

Bernard M. Bass, Sahgal & Pathak (2007: 264) explains further expanded upon Burns' original ideas to develop what is today referred to as Bass' *Transformational Leadership Theory*. They explain further that according to Bass, transformational leadership can be defined based on the impact that it has on followers and that transformational leaders garner trust, respect, and admiration from their followers

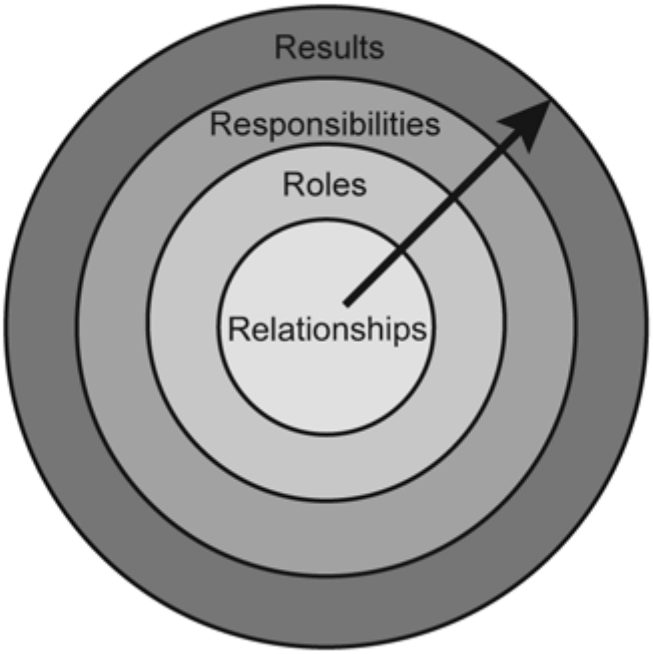
Yukl (1994) draws some tips for transformational leadership as;

1. Developing a challenging and attractive vision, together with the employees.
2. Tying the vision to a strategy for its achievement.
3. Developing the vision, specifying and translating it to actions.
4. Expressing confidence, decisiveness and optimism about the vision and its implementation.
5. Realizing the vision through small planned steps and small successes in the path for its full implementation.

2.0. Model of Transformational Leadership

McCloskey by basing on biblical theology and transformational theory introduces the 4-R Model and identifies four critical leadership variables. The 4-R Model pictures transformational leadership as beginning with our **Relationships**, overflowing into community leadership **Roles**, calling upon the leader to exercise specific leadership **Responsibilities** and eventually producing contextually defined **Results**. The 4-R Model assumes that if we want to understand how the process of leadership works, we must begin with the person doing the leading. This assumption is derived from biblical theology as well as transformational theory (McCloskey, 2009:2)

Figure 1: The 4-R Model



Source: (McCloskey, 2009: 2)

3.0. Methodological Conceptualization

The authors in trying to access relevant and current literature employed analytical qualitative design. The literatures were critically analyzed and conclusions made based on the relevancy of the source to the topic.

4.0. Leadership and development in Africa

Today Africa is averagely 50 years old. It is the least developed continent in the world yet it boasts of having the largest deposits of natural resources that if tapped can turn the tide of poverty in Africa. Leadership as noted is the pathway to attaining this desired goal. In this almost 50 years, there have been exemplary leaders including Kwame Nkrumah, Patrice Lumumba and Abdel Nasser in the political landscape and thousands more in other sectors across Africa. However, a larger number of bad leaders have been in existence including dictators like Idi Amin and Mobuto Sesseseko. What is the difference between this set of leaders? How was their leadership style and what environment made it either progressive or retrogressive?

4.1. Philosophy of Leadership; "Cultural" Perception of Leadership

The philosophy behind doing this a certain way is imperative in the understanding of leadership styles in Africa. It describes the circumstances behind the establishment of authoritarian or democratic regimes. Leadership in Africa has for a long time been built on cultural stand points that date to the early stages of the establishment of administrative systems in Africa (Nwadike, 2011: 1). These cultural beliefs elevate certain principles that streamline leadership in the context of quality, individuality, perception, power distribution and effect on other related agenda such as economics and human development. It is important to note that traditional Africa was based on clan-based administration under the broader chiefdom/kingdom system structure (Warioba, 2006: 1, 4, 6). It determined who ruled, how and in what circumstance. Today's Africa is different, thanks to the entry of colonialism and the establishment of western state administrative systems. This new structure has been difficult to adopt to since change in first naturally difficult and secondly the circumstantial relationships between Africa and the west are from time to time strained owing to the rejection of the latter's imperialistic control.

In a similar context, the role of women and the youth in leadership is dictated by this philosophy (Montuori, 2010; 6: Nebe, 2012: 77, 82). Traditionally, these two were not part of the leadership equation due to the division of roles and duties starting all the way from the family to the society. This has been succeeded into today's African leadership philosophy to a point where even the introduction of laws is not much helpful as is the case in Kenya after the adoption of the new constitution of 2010.

4.2. Regime Analysis

As Rylands points out on what a leader should do, particular on maintaining good governance and transparency, preserving rule of law, encouraging private sector development and having respect for property rights, employing prudent macro-economic management and cognisance of the international community of states (Rylander, 2010: ii), it dawns on everyone who scrutinizes African leaders that most these are broken. While a leader as an individual may try the best they can, the system in place may not give them the opportunity they need. Most regimes in Africa are weak (Juma and Oluoch, 2013: 11). The existence of weak states makes leadership a nightmare. From conflict that are protracted to prevalence of deadly diseases, porous borders to existence of armed militia, rebels or terrorists, under-infrastructure to the wide gap between the rich and the poor, negative ethnicity to illiteracy, un-professional military and mega corruption; the list goes on, all exist in almost all African countries. The cycle of weakness that exists in a country spreads to the entire region in way or another as is the case in the Horn of Africa in the context of insecurity emanating from Somalia. In such a case, leaders in these countries have to do more than double to remedy the situation include cooperating with other international partners of development to bring transformation.

These problems according to Juma and Oluoch (2013:13) emanate from the cold war and the repercussions are being felt today, after the leaders of the time made wrong decisions, based on protecting their interests, single party system and monopoly over their distracters in exchange of patronage so as to remain in power. Constitutions were amended to legitimize their decisions and so much damage done that in various countries like Rwanda, Burundi, Democratic Republic of Congo (DRC), Central African Republic, Mali, Somalia and Angola the impact is still being felt today. It has taken African leaders of today so much effort to transform some of these countries such as Rwanda under President Paul Kagame (Khadiagala, 2009:433).

4.3. Web of Political Confusion

The ideal political system that the majority of countries strive for is democracy. Democracy is praised as the best political system and foreign policies augmented around it so as to influence non-democratic countries to join the bandwagon. African countries are naturally trying to adopt democracy owing to the fact that it is a new form of political management. In this struggle, Africa has made numerous mistakes, making the assertion that maybe after all, democracy has no place in the continent. Today, the manner with which democracy is practised has brought more confusion than the previous authoritarian regimes did (Warioba, 2006:6). From political parties to trade unions, cooperative societies to civil societies, confusion is the order of the day. There is a lack of leadership under this system and to a large extent, it is expensive to implement. Some factors that lead to this confusion include corruption, ethnicity, political religion, elite and military involvement. This has a spill over effect on leadership in that the leader who comes out of this is already tainted by the mess, and the decisions to be made there-of are not as admirable or any better. Compared to the single party era in Africa, leaders at least were perceived under individual and party basis and decisions

were predicted, whether the decisions were correct or not, the expectations were low. Today, an all-inclusive political system such as democracy is supposed to provide good leadership but this still remains an illusion. In the case of Kenya, the leadership elected are selfish and mind the commoner in minimal proportions (Nebe, 2012, 59, 69). They seem worse than the single party era since their number has increased. Democracy remains an ideal political system in Africa, but it has been exploited by leaders to suit certain interests.

5.0. Recommendations

The role leaders should play in transforming Africa is based on various factors that include; Constitutionalism, checking ethnicity, justice and reconciliation, bridging the gap between the elite and working classes, fair resource distribution, checking corruption, prudent public management and employing more African oriented solutions for sustainable development.

Constitutionalism insures all under fair law and brings unity to the people, and as such leaders should defend constitutions in countries without proper constitutions should amend theirs. The rampant influence on leadership by negative ethnicity has led to underdevelopment and conflict as was the case in Rwanda, Burundi and Kenya. Leaders should embrace positive ethnicity so as to reduce and eventually end negative ethnicity through provision of justice and reconciliation and properly distribution natural resources so that all may feel included in nation building. Leaders should put effort in bridging the gap by creating wealth for the state through job creating, expanding markets, availing technology, improving the education and health sectors and infrastructural development expansion in rural areas. Corruption is noted to be a contributor to poverty. Transformative leaders should avoid corruption and put in place legal measures that check it especially in the public sector while prudent public management involves the decentralization of power and decision making, financial control and supervision in public finance and all-inclusive approach to development. Finally, the adoption of African solutions to African problems is to be adopted by leaders in the sense that it leads to sustained growth that does not depend on the other regions (Kutesa, 2009: 2), his is to be done through embracing regionalism in trade and financial assistance, industrial expansion and agricultural specialization and re-evaluation of current administrative system with view to incorporate traditional African societal management approaches.

6.0. Conclusion

Transformative leadership is what Africa needs in the 21st century. Leadership emerges through a process of interactions, with unpredictable, holistic, systemic properties and qualities (Montuori. 2010: 9). The attainment of this phenomenon must be an incremental process owing to the post-colonial history of Africa. It involves the prudent use of available resources, avoiding the blame on the west and re-dedication to the African resolution to development made during independence.

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Effects of Economic Cooperation to Democracy and Governance in Africa

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Abstract

Economics and Politics are bedfellows. An increment in either leads to the increment of the other. The cooperation of more than one economy to achieve common development has a definite impact on politics. How this is impacted is based on the manner with which economic cooperation is undertaken, and secondly by the factor of power politics. Democracy and governance in Africa are embroiled in several circumstantial factors, integration of African economies being one of them (Mwencha, 2008:26). These factors do influence each other, either positively or negatively. As democracy grows in Africa, it is to be noted that economic integration is taking foot and being acclaimed as the key to Africa's development (Ninalowo, 2003). This paper seeks to explain the correlation between these two and the extent they have on contemporary Africa.

Key words: *Economics/Politics/Democracy/Governance/Cooperation*

1.0. Introduction

Due to the efforts and continent-wide economic reforms, Africa has experienced strong growth rates, declining inflation, increased exports, higher levels of foreign direct investment (FDI), and an improving balance of payments. However, Africa is still engulfed in a number of vulnerabilities that include overly dependence on a limited number of export commodities (with nearly half of the continent's 53 countries relying on a single good for more than 50 percent of their exports; rendering them highly susceptible to exogenous economic shocks and natural disasters), underdeveloped infrastructure and resultant high transportation costs, which undermine trade competitiveness and cause labour supply shortages, lack of investment and inefficiencies in infrastructure development. This is further exacerbated by competition for resources in the context of colonial extraction policies that continue to fuel many of the ongoing inter-state and intra-state conflicts in Africa (Juma and Oluoch, 2013). The inception of economic cooperation through regional frameworks has accorded Africa a new lease of life. Key among these frameworks is the African Continental Free Trade agreement (AfCFTA) that was adopted in March 2018. Others are regional

economic communities (RECs), the new partnership for African Development (NEPAD) and ultimately the African Union (AU).

1.1. Background and Rationale

Economic cooperation in contemporary international relations is understood in the context of more than one country engaging in joint economic ventures that in the end benefit them and helps them score better economic performances that are good for development agenda (Ninalowo, 2003; Avellaneda, 2006:2). In Africa, economic cooperation has been present since pre-colonial era, and has since grown to the current pan African context where African states cooperate through regional economic communities (RECs) and other global forums.

Economic cooperation has the potential to increase inter-state relationships among countries in broad contexts. These include: Cross-border trade and commerce. Africa has a total of 55 countries and slightly above 1 billion people. As more and more countries turn to local markets to sustain their development demands, the realization of the potential of cross-border trade to the pan African developmental agenda is growing. This is in terms of addressing continental problems such as security, disease and illiteracy.

Secondly, inter-state development of infrastructure such as road, rail, airports, ports and information, communication and technology (ICT) amongst others. Economic integration is difficult to sustain if infrastructure is not developed. In the long run, when infrastructure is done, development is reachable and Africa is made self-reliant.

Thirdly, the question of security is also critical. Because of economic cooperation, security issues have continually in the last decade been addressed. As more and more countries integrate their markets and provision of services, issues relating to securing have been re-evaluated for the better.

Fourthly, exchanges in information, communication, technology (ICT) and specialties. Economic cooperation has the potential to expand the capacity of ICT and other specialties if markets to these products and services can be found from amongst member states. For example, mobile money has been ranked as highest in terms of usability in Africa. Related to this is the access of internet over mobile handset that has up surged provision of basic services including government services and goods at the convenience of citizens.

1.2. Why does Economic Cooperation Exist?

Why do countries agree to form economic agreements and commitments? The answer to this question lies in the value systems that countries do have and share. Value systems that are shared leads to greater understanding that spreads to cooperation in economic, security, socio-political and environmental

development agenda. This notion of value system has two components; shared values and shared world views that are ingredients for regional cooperation.

Shared values: This ingredient bases on the commonality of values by countries from the same region. Some of these values include; trade, order, stability and unity, peace, liberal democracy, and ethnic identity. Countries in Africa do share a lot of these factors. For example, the Sahel Saharan countries do share common values that include the same ethnic identity, religion, security and geographic locality that makes their need for cooperation high. The same could be said for the East African Community (EAC) and South African Development Community (SADC) states among others.

Shared world views: Orientations within the international system and the resulting world view always do determine the shape of regional integration among countries from a particular region. It does influence the identity and potential for regional cooperation. These world views include colonial subjugation and orientations towards the hegemonic spheres of the world. At the international system, countries like China and India view themselves as rising powers, civilizations as well as states and hence see the world or see themselves as an emerging multi-polarity in the international system (Tellis and Mirski, 2013). For example, several countries in Africa are today turning to the East for economic ties, turning their back on the west (Pilling, 2018). This shows a common shared world view on the politics of aid associated with the West.

Democracy is defined as the rule by majority (Inter-Parliamentary Union, 1998: V). It is viewed and contextualized as the most appropriate form of leadership and governance (Ekenedirichukwu, 2016:1). However, several scholars of comparative politics have pointed to gaps to this notion and have sought to establish the varied view in many countries or regions (Ekenedirichukwu, 2016:3). While democracy has been relatively successful in the west, the East including Russia and China have faced difficulty in localizing it. The same is said of Africa with only few countries like Botswana and Mauritius claiming the trophy (Armah, 2015; Samarasinghe, 1994:15). This paper argues that democracy suits a society in certain ideals that are known to them and not a blanket orientation that is new to culture. Besides this, the growth of democracy does depend on several factors, economic cooperation being one of them.

Governance is the set code of management that is used to administer over a legal entity, in this case, a country. While leadership scholars have differing notions of how governance is understood and practised, it nonetheless determines the performance of the country in several factors including the economy (Kaufmann and Kraay, 2003; Knack, 2003). If the governance structure is sound, then the country is set to attain most of its goals and in due regard, it earns positive features such as power over its subjects and peers in the international system.

1.3. Theoretical considerations

This study uses the "Lipset Thesis" of 1959 that contends a causal relationship between economic development and democracy. This was proposed by Seymour Martin Lipset in 1959 (Lipset, 1959). The main argument of this school is that democracy and economic development are bedfellows with one being as a result of the other. This hypothesis is premised on four main variables; political culture, class structure, state-society relations and civil society (Thiebault, 2013). Arguably, economic development leads to a democratic political culture, revised class structure where the poor or working class get empowered and an improved relationship between the state and civil society within a free and democratic environment.

The Lipset thesis is equally boosted by the *compatibility school* that argues that democracy promoted economic development owing to the entrenchment of fundamental civil liberties. In effect, this school espouses that political rights generate the social conditions necessary for economic development (Baum & Lake, 2003)

The challenges of the Lipset thesis are based on exceptional countries that have achieved economic growth without developing democracy including Singapore and China (Thiebault, 2013). Many comparative politics scholars regard the development of such Asian countries without the necessary democratic principles as being necessitated by bureaucratic authoritarianism or that democratic levels in the 1950s were not as developed as the new millennium (Thiebault, 2013).

2.0. Materials and Methods

This study sought to illustrate the effect of economic cooperation to democracy and governance in Africa. It reviews the various aspects of reforms that have been experienced in Africa in the contexts of democratization and improved levels of governance. An attempt is made to link these positive changes to economic cooperation and an integral change catalyst and framework. The authors relied on qualitative analytical design to review literature so as to arrive at conclusions for discussion.

3.0. Discussion of Findings

Economic cooperation as a process and framework has an impact on democracy and governance.

3.1. Impact of Economic Cooperation on Democracy

A critical aspect is the fact that a state cedes some of its influence or control over its economy owing to commitments to regional economic agreements. Economies thereby left to the forces of demand and supply. This leads to emergence of new agents of power from the economic sphere of influence and may include business elites and market segments' representatives. An example is the emergent middle class in Africa that has continued to impact on governance issues (Akinkugbe & Wohlmuth, 2016). These emergent groups

pile pressure on the state and equally have influence on other public spheres hence increasing the democratic space of the country.

The factor of cooperation between two or more sovereigns takes a regional scope. It assumes an institutional framework within which the influence of the state and its structures such as the party system and bureaucracy change. Countries find themselves taking a back step so as to observe what is trending in the region, then slowly internalize that structure. Since democracy is a trend in contemporary international relations, it automatically becomes the mode of operation, regardless of the existence (if there is) of an authoritarian state. In as much as Yilmaz (2010) points to the factor of a hegemon in cooperative agenda of countries, the fact that a new system is being created, and the authoritarian tendencies of the hegemon tend to waiver when subjected to the forces of economics and markets.

For democracy to get a foothold, it must have support from the society in form of ideological, political-cultural and economic base. The circumstances under which these features grow is dependent on the regional structure that a state is in together with shared values discussed above. The introduction of economic cooperation fuses both the socio-economic and political features that member countries have, borrowing from each other to create a set ideology and political culture. In line therefore with the ideals of liberalism, democracy grows and gains trust through ideological interpretations that best suit this economic endeavour.

3.1.1. Exchange of and influence of democratic ideals by cooperating economies

The question of economic development and sustainability in reference to democratic development are in tandem with economic cooperation. Economic integration leads not only to sustainability in a country, but to the region as well. Sustainability is regarded as a prerequisite of democratic ideals' development (Samarasinghe, 1994:14-15). This is because when integration does happen, much of the control on the state is ceded to other sectors, as explained above, leading to the formation of a system that checks itself. This self-checking system kicks off a process that creates an enabling environment for democracy to develop.

In the same context, if a country or group of countries with an integrated set up does embrace sustainable economic policies, integration included; then it receives the power that goes with wealth accrued with economic gains. It therefore leads the rest in embracing democratic ideals.

3.1.2 Political and institutional paradigms

Economic integration at the political level is based on the underlying rationale of "liberal peace hypothesis". This theory of peace and absence of military confrontation breeds a good environment for democracy to grow. Economic integration at the institutional level for the "ideal" state in which member countries should be in a matter concerning governance and democracy.

The notion in Africa that the cause of economic and social crisis has always been external has been a great source of scapegoat by various governments. While this is debatable, the international community has played a role in creating this crisis in Africa through historical, colonial and post-colonial economic subjugation (Adejumobi, 2000). Kwemo (2017) points out that the inception of economic cooperation attempts to correct this. While critics to this argument point to internal factors such as mismanagement and lack of democratic space, some scholars point to the advantages of economic integration as being important to the development of structures based on African political-cultural curriculum and understanding (Samarasinghe, 1994:22,23).

Economic cooperation gives one the platform to make decisions and errors in a cyclical manner until such a point that one gets it right. This is in the sense that if two or more countries with the same problems do cooperate, they in the end get accrued benefits that will be channelled back to each of the member states, and of course the ideals that are in tandem. This would be difficult if African countries for example have economic ties with the West as this engagement pits Africa as the weaker side that should learn from the West. While benefits will be realized, they will not include ideals as western ideals will carry the day, and African ideals that are still growing will be dropped.

3.1.3. The politics of aid for democracy

The contemporary international political economic realm and theory dictates that developing countries depend on the developed world, through set economic structures and financial institutions such as the World Bank and international monetary fund (Samarasinghe, 1994:17,18). In the same breadth, powerful countries do have their own parallel aid and donor programmes; nonetheless, they do conform to set transnational monetary policies. Third world countries have in several instances decried of these institutions and their sponsor countries. Countries such as China, Russia, South Africa, India and Brazil have even gone a step further to establish the BRICs institution to counter the influence of the western world (Laïdi, 2014). The ideology behind the notion of aid for democracy can be analysed in two ways; the first being its impetus for regionalism and the second being the impetus for democracy.

Regionalism does develop in two aspects. The first being the effort put in place a counter-effective strategy on impact of aid-providing countries and their institutions and the second being the resultant effect of the aid that is invested. In view of the latter, Africa has benefited in many developmental projects that are majorly funded by international partners including and especially the European Union (EU) (Ottosen,2010:7;10). However, the development of regional economic cooperative engagements in Africa today are mostly in rebellion to the hegemonic control of international economic system (Gray and Gills, 2016). The hope is that if the African continent is united economically, then it will have the much-needed

financing to develop based on its own political ideals including interpretations of systems such as democracy and governance models that suit the African political culture.

3.1.4. Political Democracy

In regard to political democracy, scholars of democracy point out that there are two key elements of political democracy; system of government and the political and civil liberties. As economic cooperation takes foot, so are the rules of its engagement. Some regional economic communities (RECs) do put in place laws that stipulate the establishment of basic principles in their member countries; democratic ideals included leading to establishment of political democracies. Such formal institutions of government that lead to good governance include the judiciary, legislature, devolution and constitutionalism. A regional organization like the East African Community (EAC) for example has passed rules that require a member state to have a certain threshold in regards to the above political ideals, democracy being one of them. In fact, the inclusion of new members into the group is based on their qualifications of such set ideals, which in the case of the EAC, denied the entry of Sudan, after two members, Uganda and Tanzania vetoed against its request to join by explaining that Sudan does not meet the threshold set by the EAC on basic political rights (Sudan Tribune, 2011).

Scholars have fronted the hypotheses that socio-economic development (modernization) brings about democracy (Samarasinghe, 1994). That democracy is a "higher order" need that follows "basic needs" of humanity. These are in line with the "Lipset thesis" that economic development not only leads to democracy but is essential for democracy to come into being (Thiebault, 2013). While African scholars have refuted the modernization theory as being Eurocentric, the underlying concept of economic development resulting to democracy remains real. Nonetheless, there are other factors that lead to democratization. Such include historical factors in the economic, political and social environments. These factors include religion (such as the role of the Catholic Church in the Philippines), ethnicity, monarchies, and military etc. While these are internal factors, they at times take regional shapes. Economic integration becomes the butter and catalyst. External factors to such include the introduction of a hegemon, post-colonial relationships and other international institutions such as multi-national corporations

The demand for democracy and good governance is spiralled up to the government under a broader economic cooperation structure (Inter-Parliamentary Union, 1998: VII). This is because; a) efficient system to allocate resources for production, b) an independent civil society that a market economy produces that is indispensable for democracy do set the stage for an open system that leads to democratic ideals. The process within which a state does struggle to fulfil both its requirements in an economic cooperation structure and its local goals on the other side involve the setting up of systems for distribution of resources and maintenance of independent market structures and economy. This procedure plants the seed of democracy

due to the importance and regard given to every political unit, either an individual or institution, in making independent decisions that are in line with resources and demand and supply in the market economy.

3.2. Impact of Economic Cooperation on Governance

A major impact of economic cooperation is that increased returns from economic ties leads to availability of funds to improve governance (Kaufmann and Kray, 2003: Ekenedirichukwu, 2016:4). The provision of public services in a state demands huge input of resources. It is difficult to most governments in Africa. Such important processes as democratization and public participation require resources. Democracy is thus dependent on resource availability. This perhaps explains why western countries have been supporting democratization activities such as elections (Weber, 2018). This also extends to the quality of service delivery. As pointed out earlier, the needs of the people if met, provides them with an opportunity to engage in constructive state development, and if not met will encourage them to resort to social cleavages that they deem as providing what the state has failed to. Ethnic support thrives in Africa because of this (Okuku, 2002). Good governance in this scenario becomes difficult to achieve, and so is democracy. Their approach leans towards particular cleavages that further disrupt the nation-state.

Resolutions passed by economic entities help in promoting governance and effective public management. Regional economic communities and other pan African organizations exist within an established legal framework that bind member states. These legal frameworks are resultantly enacted in municipal law. Since these are independent sovereigns, the legal framework arrived at is of international standing and promotes good governing policies that aim at ensuring success of their economic goals. In effect, no member country can sign up to a legal framework that they cannot tolerate in the first place municipally.

Equally, apart from the visible legal frameworks, there exist the accompanying “good practices” effect that member countries acquire. Exchange of and influence of good governance ideals by the cooperating economies is attained in this way. When regional states come together, they resolve to do everything together in a “good” manner. This explains why the principle of “Good Neighbourliness exists in regional organizations. Such acts are carried back to member’s governance principles. These are expressed in the desire to implement agreements and commit to all agreed agenda.

Economic cooperation increases the pool of resources that becomes the back-stop or cushion for governments. As more and more countries engage in economic ties, their cumulative wealth does grow. This wealth not only give them the needed power politically, but equally provides the avenue within which governments fund their developmental agenda. Good governance is easily attained if the government has more resources. The differences that do exist within a country such as ethnic and religious identities are better addressed if these cleavages have access to resources, or opportunities to have them, such as a strong

economy. Tentatively, managing them becomes easy, in effect therefore establishing a good governance structure.

Economic cooperation also provides an avenue for communal support to governments to each other. Cooperating countries in their effort to establish positive governance structures, do share a lot of experiences and in so doing help in sharing the burden of governance. This is done through exchanges of not only governance ideals but in provision of services in the security, health, education and other governmental services. For example, the conflict in South Sudan has prompted the assistance offered to this country by her neighbours, not only due to the pan African union policy of collective development but also due to the economic ties that countries in the Horn of Africa do share (Mugo, 2016: 28).

4.0. Conclusions

Democracy envisages the inclusiveness of decision making in not only political but on social and economic matters of the country by the citizenry (Baum & Lake, 2003). It is thus developed if economic integration structures are put in place as the normal people in simple endeavours such as businesses are given the chance to make decisions. Economic cooperation increases the importance and focus placed on economic sectors of a country, and in retrospect therefore, giving more room for the development of democracy.

Economic cooperation gives countries the opportunity to explore in new ventures that would ordinarily be difficult. Such ventures as pipeline and railway infrastructures only give returns if a given region come together and implement them together. The shared commitment in such economic endeavours spills over to other significant political relationships including democracy. Equally, shared projects and infrastructure dictate the delicate act of management, which hitherto, results in a good culture of good governance in contributing member states.

5.0. Recommendations

The situational analysis of democracy and governance in Africa has made tremendous changes in the half decade most member states have been independent. It is from this backdrop that this study recommends the re-evaluation of the state of democracy in Africa in view of economic development. Pertinent questions should be raised as to why a number of African countries seem to be doing well economically yet their level of democratization has remained low.

Good governance as is practised in regional bodies and trade blocs does not seem to trickle down to member states. This is accessioned by failure to implement resolutions and the little impact these institutions are making in the general developmental agenda of Africa. More needs to be done, this study recommends, to urge good governance in countries and especially in public institutions.

As new segments including the middle class and new breed of leaders in Africa continue to emerge, radical changes in governance styles and democratization are being felt. However, the economic effect of these changes is not commensurate to these changes. This study recommends a further review of these emergent aspects in the African developmental quest.

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Determine the extent to which there is trust between the reintegrated members and community members in Mount Elgon region, Kenya

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Abstract- After being demobilized, former combatants constitute a weak and marginalized group in need of economic, psychological and social assistance in order to survive. Making sure that such assistance is given poses a major challenge to local communities and international donors. There is need to address the issue of reintegration of former combatants in Mt. Elgon in Bungoma County, but the process has been undermined by persistent instability in the region. The problem of follow up, re-recruitment of former combatants by different armed groups and the lack of long-term funding are some of the obstacles to successful reintegration in Kenya. The purpose of the study was to determine the extent to which there is trust between the reintegrated members and community members in Mount Elgon region, Kenya. The desistance theory was used in the study**.** The study used the cross sectional descriptive survey design. The population of the study comprised former combatants, Sub County Commissioners, peace committee members, religious leaders and NGOs. The respondents comprised former combatants, sub county commissioners and peace committee members, religious leaders and NGOs. The stratified and purposive random sampling technique was used to select a sample of 150 former combatants, Three Sub County commissioners and 16 peace committee members, Five religious leaders and Four NGO members. Data was collected by use of questionnaires, interviews and Focus Group discussion. In order to ascertain validity, the questionnaires and interview schedules were given to experts who matched all the items with the research questions to ascertain whether the instruments would measure all that it is supposed to measure. The reliability of the instruments was determined through test retest of the instruments. Data was analyzed by use of descriptive statistics of frequencies and percentages. Data from in-depth interviews was audio taped and transcribed. The transcripts were then organized into themes and categories as they emerged from the field. The findings of the study were presented descriptively. The findings of the study showed that: in the context of social reintegration the three dimensions of family and community; sustainable employment; and civic responsibilities should be given proper attention: to achieve the goal of reintegration there should be a major shift in the contemporary DDR approach by moving from the insertion approach towards a social reintegration one; community support is essential for the successful reintegration of former combatants and the sustainable social and economic reintegration of former combatants should be the ultimate objective of disarmament and demobilization and reintegration (DDR). Consequently, the study recommends that the government should budget for and give priority to the reintegration programmes so that they are fully completed instead of leaving them at the reinsertion stage; the communities take the lead in proposing community- based solutions for the issues identified.

Index Terms- Combatant, Demobilization, Disarmament, Reconciliation Rehabilitation Reintegration Reinsertion and Social Cohesion.

I. Background to the Study

Former combatants, however**,** not only pose a challenge because of their tendency to engage in violence but their return to civilian life may also create serious rifts in society. During hostilities, former combatants often commit atrocities against the civilian population. These may range from pillaging to physical abuse, rape, mutilation, kidnappings and murder. With the arrival of peace, society must deal with these issues, both at national and local levels. Failure to address the need for reconciliation may result in a lack of societal peace creating continuous tensions in society. However it is not possible to reconcile combatants with their communities. Most of them lack formal education and yet their fighting skills are seldom in demand on the job market (Lundin, 1998).

It is a common phenomena that former combatants rearm themselves in order to further their political demands. For example in the Republic of Congo a Ninja splinter group recruited many ex – Ninjas and attacked Brazzaville in 2002 (IRIN, 2004). A second risk is that former combatants recreate disbanded guerilla groups or military units and challenge the post war order with arms, which at worst can lead to open rebellion. A related problem is when former combatants sell their military services to armed actors involved in wars in foreign countries. Demobilized soldiers in South African Defense Force (SADF) have fought as Mercenaries in both Angola and Sierra Leone (Kingma, 1999).

Another threat comes from former combatants joining or founding organized, criminal groups (Alden, 2002). The main reason why former combatants so end up in organized crime is the ease with which clandestine military structures are transformed into self-sustaining, criminal organizations(Call and Stanley, 2003). A related threat is one of former combatants becoming involved in criminality in a wider sense, such as petty crime. This type of criminality comprises individuals carrying out small - scale theft and banditry with no organized structure (Kingma, 1999).

After being demobilized, former combatants constitute a weak and marginalized group in need of economic, psychological

and social assistance in order to survive. Making sure that such assistance is given poses a major challenge to local communities and international donors (Kingma, 2000).

II. Statement of the Problem

Several actions have been taken in the past to end recruitment and use of combatants in Kenya. As a result, combatants are released from the ranks of armed forces and groups and recruitment levels have progressively reduced. However, for thousands of former combatants who remain or risk re-recruitment, the situation remains substantially unchanged. The ongoing conflict in Kenya undermines the reintegration of former combatants as many of them are re-recruited by different armed groups.

After combatants have been demobilized, their effective and sustainable reintegration into civilian life is necessary to prevent a new escalation of the conflict. In the short term, ex-combatants who do not find peaceful ways of making a living are likely to return to conflict. In the longer term, disaffected veterans can play an important role in destabilizing the social order and polarizing the political debate, becoming easy targets of populist, reactionary and extremist movements.

The former combatants need to be given an opportunity to be integrated into the community in order to build a cohesive society. This study, therefore, sought to determine the extent to which there is trust between the reintegrated members and community members in Mt. Elgon, Bungoma County.

III. Objective of the Study

The objective of the study was based on one of the dimensions of social cohesion. The study therefore sought to determine the extent to which there is trust between the reintegrated members and community members in Mount Elgon region;

IV. Research Question

The research question was:
To what extent is there trust between the reintegrated members and community members in Mount Elgon region?

V. Significance of the Study

The study is significant in various ways: It provides greater insight on best to handle former combatants. Furthermore, the study is useful in making reintegration efforts more effective by taking the existing theoretical knowledge into consideration and learning from practical experiences. The study further contributes towards providing a deeper understanding of strategies required in carrying out reintegration.

This study is very valuable to the community and to the government of Kenya since it provides information on the role of reintegration of ex- combatants on social cohesion. This in turn, can assist the government to determine suitable ways in dealing with reintegration of the affected members in the society in order to promote social cohesion.

VI. Scope and Delimitations of the Study

The study will be conducted in Kopsiro, Kapsokwony, Cheptais and Kaptama of Mt. Elgon region where the former combatants underwent the reintegration programme. Mount Elgon is an administrative unit in Bungoma County. The study focused on the reintegration of former combatants in Mt. Elgon region. The respondents will included the sampled 150 former combatants, Four Sub- County Commissioners and 16 peace committee members from the the four locations, 5 Church elders and 5 Non Governmental Organization leaders.

The study made reference to the year 2005 when the Sabaot Land Defense Force came into being up to 2017. This enabled the researcher to look at the current levels of reintegration and their contribution towards social cohesion.

The theoretical framework for the study was desistance theory which is pertinent in terms of conceptualizing the offender rehabilitation. It outlines assistance models of ex-offenders recovery into society and addresses the question of social reintegration.

VII. Theoretical Framework

Theoretical framework can be likened to lens through which the researcher views the world (study). Existing knowledge, or theory, serves as the foundation of this research (Khan 1999:3-4). A preliminary theoretical framework contributes to problematizing the issue under investigation and identifies the different variables that will be measured in the work. Furthermore, it helps to clarify the researcher's objectives and values

The theoretical framework for the study was the reintegration needs of former combatants. The desistance theory according to Maruna (2009) a social and political psychologist is a criminological phenomenon which describes how criminal offenders stop their offending behavior. It is particularly pertinent in terms of conceptualizing offender rehabilitation and the career of a criminal, as well as having practical applications for probation workers working with convicted criminals in the community.

Desistance theory strives to explain the process by which offenders come to live life free from criminality. A number of factors are implicated in the natural (changes over time) and manufactured (changes due to rehabilitation programs or community strategies) processes of desistance. Some aspects of desistance include ageing. Some researchers claim that offenders, particular juveniles, essentially "grow out" of criminality.

The second aspect is life stability whereby engaging in regular employment helps offenders to focus their attention on something more meaningful than criminality. Similar to how a particularly aggressive individual may turn to sport, maintaining a routine of working and earning money can act as a kind of carthasis, meaning that motivation to engage in crime because of a lack of other activities or financial stress is replaced by the regularity of the work. Job satisfaction is suggested as a far better indicator as to whether or not an offender will desist. A second

stability related factor is marriage. Satisfaction here again is an important factor in guaranteeing change of behavior patterns

The third desistance aspect is social identity which will almost exclusively be adopted in conjunction with a condemnation narrative script, meaning that the offender living in the community feels little hope of resisting from criminality in the long term. This lack of hope is widely cited as a risk factor for recidivism. Contrastingly offenders with redemption script tend to actively seek out positive social identities, such as 'good father', 'volunteer', or 'hard worker'. These individuals are likely to be met with increased support and acceptance from their wider community, which increases the likelihood of long term desistance.

Maruna (2001) states that desistance is the long term abstinence from crime among individuals who previously engaged in persistent patterns of criminal offending. This highlights the need to look at a long term perspective and it also hints at the need to be realistic about circumstances of life. If people have previously engaged in persistent patterns of criminal offending it is likely that there are some entrenched problems that will take time to resolve.

From a theoretical standpoint, desistance theory offers an opportunity to test specific variables connected with the cessation of criminal behavior. Practically, desistance theory helps in identifying potential ways of reducing reoffending in the community.

Offenders are often seen as a threat to society until they are able to 'prove' their reformation. For this reason desistance is viewed as a long term relapse prevention measure. Related to this, there are some cases where attempted reintegration is met with outrage by the public.

The desistance theory outlines assistance models of ex-offenders recovery into society and addresses the question of social reintegration can be perceived and structured effectively DDR operational landscape. The proposed approach is presented through a matrix of relationships between the elements of 'emphasis on the combatant' and 'emphasis on the community' in terms of 'low' and 'high' levels, resulting in the four main models for community reentry: 'self – demobilization', 'reinsertion', 'community' – located reintegration and 'social reintegration'.

VIII. Relevance of Desistance Theory

From the theoretical standpoint, the desistance theory offers researchers the opportunity to test specific variables connected with the cessation of criminal behavior. It enables historical criminological approaches to be considered in relation to modern day society, which allows for validation or refutation of classical ways of thinking. This leads to a more accurate picture of criminal behavior to be painted, and enables criminology, and its related fields of psychology, politics and social policy, to collaborate strategically in order to reduce reoffending rates.

The desistance theory is most suited for this study since it addresses the three dimensions of social cohesion under economic, political and socio cultural aspects.

IX. Review of Related Theories

Existing knowledge, or theory, serves as the foundation of this research (Khan 1999:3-4). A preliminary theoretical framework contributes to problematising the issue under investigation and identifies the different variables that will be measured in the work. Furthermore, it helps to clarify the researcher's objectives and values. Embedded within the interdisciplinary field of social science, this research draws on already discussed theories and concepts situated within the field of former combatants. It utilized also concepts from contemporary conflict studies.

Most prominent here is the theory of conflict transformation. The philosophy of conflict transformation may differ between actors and contexts, and this study makes use of important concepts from the founder of modern peace studies Galtung (1996) which were later visited by Laderach (1997), Miall (2004) and Ramsbotham et al. (2008). Conflict transformation conflicts such as ethnic conflict, are transformed into peaceful outcomes. It is therefore a process of engaging with and transforming the relationships, interests, discourses and if necessary the very constitution of society that supports the continuation of violent conflict.

Through the lens of Maslow's hierarchy of needs theory which is a key theoretical perspective that helps conceptualize the ex combatants unique needs following their return from fighting is Maslow's hierarchy of needs theory; a theory which posits that individuals cannot achieve their full potential unless their lower needs are met partially if not fully (Maslow, 1951; 1971). Maslow's hierarchy of needs theory is an appropriate theory which researchers and social workers can use to categorize, prioritize and evaluate ex combatants needs in the years following the war. This is because the ex combatants lack the resources to meet their basic needs, it is extremely difficult and almost impossible to reach full human potential (Ramsbotham et al. 2008). The purpose of this theoretical framework is to describe the factors that contribute to the ex- combatants experiences during reintegration. An important part of this study is to explore the former combatants reintegration experiences as they transition to civilian living.

Erikson's psychosocial stages of development theory is used in this study. According to the former combatant's development: Erikson proposes eight stages of psychosocial development and assumes that in each stage, minors face psychosocial crisis that he views as an opportunity and challenge. The fifth stage identity versus role confusion is significant to adolescents or young ex- combatants. In this stage the developmental duty is to discover and establish a clear sense of identity. However, when this developmental task is not successfully completed Erikson (1993; 1968) argues that adolescents lack a sense of identity, have difficulty establishing meaningful bonds with others and may also experience role confusion.

From this theory soldiers experience abnormal stress since they are not given the opportunity to experiment with various social roles (Erikson, 1968). For this reason they are going to grow up into adults who lack the necessary sense of competence and self – efficacy

According to the Bronfrenbrenner's Ecological Systems Theory, the ex-combatant's environments have significant influence on their overall development and subsequent

reintegration experiences. Thus the effects of being former combatants can be explained through an ecological systems theory that examines the relationships between individuals and their environment. An ecological systems theory is the concept of role that denotes the usual behaviors of individuals occupying particular social positions. It is evident that abducted young soldiers experience significant stress and trauma as a result of role transitions they face. The ecological systems theory emphasizes the roe of social contexts in human development and comprises five environmental systems, ranging from direct interaction with social agents to the overall general influence of culture (Bronfrenbrenner, 1998).

This theory outlines assistance models of ex combatants' reentry into society and addresses the question of how social integration can be perceived and structured effectively in the overall DDR landscape. The proposed approach is presented through a matrix of relationships between the elements of 'emphasis on the combatant' and 'emphasis on the community' in terms of 'low' and 'high' levels, resulting in the four main models of community reentry: 'self-demobilization', 'reinsertion', 'community located reintegration', and 'social reintegration". The social reintegration approach is structured over the dimensions of 'family and community'.

The purpose of this review of theories is to describe the factors that contribute to the former combatants' experiences during reintegration. An important part of this study is to explore the ex combatants reintegration experiences as they transition to civilian living. Erikson's theory explains child soldier's development during adolescence and how military experience affects their identities. Bronfrenbrenner's theory suggests the effects of five systems on reintegration experience.

X. Research Design

The cross sectional design of the descriptive survey method was used. Descriptive research methods are pretty much as they sound since they describe situations. Surveys are good because they don't take as long as observational studies. The cross sectional design includes the study of individuals at one point in time (Jackson, 2009). This design was employed in this study in an attempt to gather large scale data in order to make generalizations on the role of the reintegration of former combatants on social cohesion.

According to Mugenda and Mugenda (2003) the design was appropriate because it measures the characteristics of a large population and yields a great deal of information which is not manipulated. This design was adopted because it allows the collection of large amounts of data from the target population. In addition this study fits within the provisions of this design because the data was collected and reported the way things are without manipulating any variable. The design is therefore considered an appropriate tool for collecting information where research calls for both qualitative and quantitative data.

XI. The Study Area

The study was conducted in Mt. Elgon Sub County. This is an administrative unit in Bungoma County. It is located in the South Eastern slopes of Mt. Elgon covering an area of 940 square kilometers with a population of about 160,000 living in the Southern part which is more fertile and inhabitable that the northern part which is higher in altitude and almost entirely covered by forests. Mt Elgon is predominantly occupied by the Sabaot, Iteso and Bukusu communities. The Sabaot community is further divided into several clans comprising the Kony, Bok, Sebei and Bongom sub clans (Rombora, 2008). This region has 4 administrative units namely Cheptais Sub County with its head quarters at Cheptais, Mt. Elgon Sub County with its headquarters at Kapsokwony and a recent one Kopsiro with its head quarters at Kopsiro and Kaptama.

XII. Target Population

The study targeted all the former Sabaot Land Defense Force members. These former combatants who were reintegrated are a total of 1200 from the Mt. Elgon region**.** Four Deputy county commissioners, 16 peace committee members, Six church leaders and Five NGO coordinators**.**

Description of Sampling Procedure and Sample Size

Target population informed the sampling procedure and sample size.

Sampling Procedure

The stratified random and purposive sampling technique was used in order to help the researcher to achieve the desired representation of various respondents in the population. The stratified random sampling technique involves dividing the population into homogeneous subgroups and then taking a simple random sample in each group. The sample was selected in such a way to ensure that certain subgroups are represented in the sample in proportion to the population for them to have equal chance to be included in the study. A purposive sample is non probability sample that is selected based on the characteristics of a population and the objectives of the study. This type of sampling can be very useful in situations where the researcher needs to reach a targeted sample quickly and where sampling for proportionality is not the main concern.

Sample Size

In this case the 1200 reintegrated former combatants were targeted. A sample of 150 reintegrated former combatants was taken, Four Deputy county commissioners, Six members of Cheptais, Kopsiro and Kapsokwony and Kaptama peace committees, Five church pastors and Five NGO leaders as shown in Table 1.1.

Table 1.1 Sample Size

Category	Population	Sample
Reintegrated combatants	1200	150
Deputy County Commissioner	4	4
NGOs	6	6
Pastors	5	5

Peace Committee Members	64	16
Total	**1279**	**181**

XIII. DISCUSION

Civic Responsibilities

Those former combatants who served jail terms underwent certain forms of rehabilitation while in prison. They were advised on how to come back home and fit in the community. Some of them benefitted from vocational skills acquired while in prison. In a broad sense, education, both traditional and alternative, supports the reintegration of former combatants in a number of ways, For instance, Marchel (1996) emphasizes the important link between literacy/skills learning and economic security for returning soldiers, factors that often determine the successful social reintegration and prevention of re-recruitment.

Indeed in Northern Uganda, because of schooling loss as well as serious injuries suffered during the war, former abductees were on average, less than half as likely to be engaged in skilled work. These constraints furthermore reduced by about one-third the average age earned by the adolescents' post reintegration (Annan and Blattman, 2006). Research on former combatants from El Salvado has also emphasized the important livelihood benefit of education (Varhey, 2001)1`1

Various organizations helped the returnee members of the community to settle back at home in their communities. These included: Action Aid Kenya who organized a peace meetings with the community therefore enabling some of them to change their attitude and behavior.

FPFK helped by organizing Open dialogue among the former combatants and the community members. This was a necessary step since there was need for the two groups to understand one another in order to live in harmony.

Peace and Rights Programme Action Aid worked together and as a result they helped in bringing about reconciliation

Rural Women Peace Link (RWPL) helped Women to have a network of peace among themselves regardless of which community they came from.

Trust between the reintegrated members and community members in Mount Elgon?

It is important that there should be trust between the reintegrated members and the community members in order for them to live harmoniously in the community.

The respondents felt that to be able to restore trust among the people of Mt. Elgon fire arms needed to be surrendered. They complained that the fire arms operation force never went to Ndorobo land to collect fire arms the way they did to the Soi people. This makes the Soi people to fear the former combatants making it difficult to trust one another.

It was noted during the Focus Group discussions that a good number of the former combatants had greatly reformed. It was estimated at 75% of the former combatants had reformed. The former combatants who were rehabilitated fully are successful for example some of them went back to school to complete their studies. Three of them were reported to have gone up to the university and were undertaking their studies. However there are some in the reintegration programme who revert back feeling that the program makes them poor. While those who have never been rehabilitated are hardly found at home making it difficult to be reached by those involved for assistance.

Various organizations have been involved in trying to ensure that there is peaceful coexistence among the people. For example the Women Peace Kenya teaches women on promoting peace in the community. Action Aid organization helps by paying school fees for students in secondary schools and colleges. Besides it helps in provision of food to the displaced people plus the rest of the community members. It also educates the community members on the essence of eradicating cultural practices such as Female Genital Mutilation.

Act Kenya contributes by ensuring that there is provision of water to the community members. It also participates in the rehabilitation process of the former combatants. There is also the Kewapngetuny Women group that focuses on helping women to do savings and organizing boundaries of the community members**.** There is also the Amani Community Based Organisation that Targets the youth in the community. Medicines San Frontiers came in during the conflict to treat those who were wounded. It continued giving medical care to the community members. Various Churches for example the Reformed Church, Baptist church, helped in provision of food. Human Rights occasionally comes in to assist when the community member's rights are infringed upon. The youth after being trained on how to form a groups some youth groups have set up a tree nurseries which helps them to receive the needed income for their upkeep while contributing toward a forestation and environmental conservation.

UNDP's Peace Building and Conflict Prevention Programmes

The UN initiated the United Nations Volunteer Peace Monitor Programme. This programme was meant to help in easing the tensions in the volatile area. Working with the district peace committee the volunteers traversed the expansive region, being involved in peace initiative reconciling not only the Sabaot clans but also the Teso, Bukusu and Sabaot communities, as well as intervening in cross border conflict between Kenyans and Ugandans. Most of the conflicts experienced in this region stem from deep seated issues that have sometimes lasted generations and the efforts were to try and end these conflicts to ensure peaceful coexistence.

The Peace Initiatives in Mt. Elgon

Following the violent conflicts in Mt. Elgon region of Western Kenya in which hundreds of people were killed, displaced and their social life severely affected, different peace efforts were initiated to try and bring calm to the area. As a way of dealing with dysfunctional effects of the conflict, various NGO, government institutions and private initiatives were started to intervene and to support active non violent youth groups movements with focus on the area youth who had been found most involved in violence and killings in the region as a result of land dispute in order to help achieve reconciliation and peaceful coexistence in the region. The overall goal of the peace process was to contribute to the consolidation of the democratic process in Mt. Elgon through a more informed and responsible engagement of the youth (Peace Tree Network).

NGOs such as the Peace Tree Network (PTN) through its youth network organized trainings for the other youth who were involved in conflict and even those who were in prison at the time the project was on-going, and they did this through the support provided by the PTN. The area youth happened to understand that conflict instigated by political instigation only benefited the politicians and violence never leads to a lasting solution. The rehabilitated youth trained by the PTN continued to reach out with the mission to their peers reintegrating with the community after being in jail or in the bush fighting with the militia. These efforts were geared to realizing reconciliation benefits.

The youths were able to organize football matches in the region between the conflicting clans or groups to foster reconciliation and peaceful coexistence in the region (Rombora, 2008). Soon after the outbreak of the hostilities, NGOs embarked on the project of sending to the field peace workers to engage with fighting clans. They focused on advocacy work with specific objectives of strengthening the capabilities of the youth of Mt. Elgon to participate in decision making and monitor the local democracy.

Efforts by Global Network of Women Peace Builders

When the warring parties were on the verge of fighting women tried to ensure that amicable solution was arrives at. Their relentless irresistible determination tried to ensure that peace was restored among the communities (Kibet, 2012). The women's dreams were to be ambassadors of the voiceless developed in them when they experienced violence unleashed on them.

In advocating for peace, women exposed themselves to risks of being direct victim of the conflicts and also face death or other forms of retribution by the militia. Their undeterred determination to reach and comfort families that had lost loved ones in ethnic clashes was a tremendous achievement. They listened to the horror stories of mothers whose husbands had been taken and killed in the conflict.

When conflict began to build up, any young men who did not join the Sabaot Land Defense force fled leaving their wives to tend their farms. There were reports of rape perpetuated against women by both the SLDF militia by forces deployed by the government.

Women began by registering 600 women who had lost their husbands in the conflict under the umbrella of Rural Women Peace Link a network of grassroots women's organization working for peace in Western Kenya region, They listened to their stories of torture documented all cases of rape. Women network became a bridge to take information back and forth from the communities to the camps.

These organizations helped restore trust and helped bring about peaceful coexistence among the people including the former combatants and community members.

Summary of Findings

The findings of the study are based on the objectives and research questions raised to generate data in its analysis. The study therefore sought to:

Determine the extent to which there is trust between the reintegrated members and community members in Mount Elgon region;

The objective investigated the level of trust between the reintegrated members and community members in Mount Elgon The UN initiated the Unite Nations Volunteer Peace Monitor Programme. This programme was meant to help in easing the tensions in the volatile area. Working with the district peace committee the volunteers traversed the expansive region, being involved in peace initiative reconciling not only the Sabaot clans but also the Teso, Bukusu and Sabaot communities, as well as intervening in cross border conflict between Kenyans and Ugandans. Most of the conflicts experienced in this region stem from deep seated issues that have sometimes lasted generations and the efforts were to try and end these conflicts to ensure peaceful coexistence.

Besides the United Nations Volunteer Peace Monitor Programme, there were various peace initiatives that included the Global Network of Women Peace Builders, Act Kenya, Amani Community Based Organization, Kewapngetuny Women Group, Action Aid Organization, Medicines San Frontiers, and Churches such as the Reformed church and the Baptist church.

XIV. Conclusion

Based on the findings of this study, the following conclusions were made:

The findings show that in order to unpack the context of social reintegration the three dimensions of family and community; sustainable employment; and civic responsibilities should be given proper attention.

More so, social reintegration is the ultimate goal of former combatant's reintegration into the society and all other undertakings in terms of economic and political reintegration would need to be part and parcel of social reintegration.

To achieve the goal of reintegration there should be a major shift in the contemporary DDR approach by moving from the insertion approach towards a social reintegration one. More than 90% of the reintegration work done was carried out by the NGOs. Community support is essential for the successful reintegration of former combatants, but their experience may make worse the real or perceived vulnerability of local populations, which have neither the capacity nor the desire to assist a 'lost generation' of ex- fighters with little education, employment or training; war trauma; and a highly militarized view of the world. Unsupported former combatants can be a major threat to the community's capacity to recover because of their lack of skills or assets, their tendency to rely on violence to get what they want and their ignorance of or disrespect for local cultures, leaders and social habits.

In addition, there should be a strategy of making receiving communities beneficiaries of reintegration programmes. However, it is only through social reintegration that there can be bridging between former combatants and their receiving communities.

The sustainable social and economic reintegration of former combatants should be the ultimate objective of disarmament and demobilization and reintegration (DDR). If reintegration fails, the achievements of disarmament and demobilization phase are undermined; instability increases and sustainable reconstruction and development are put at risk.

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Locus of Control at Work: Does Age Matter?

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Abstract- Locus of control is one of the most relevant and important concepts that affects outcomes in modern organizations. It is psychologically connected to how we cope with stress and our overall well-being. Research has shown that as a construct locus of control, specifically whether a person displays an internal or external orientation, plays a substantial role in a person's attitudes and beliefs in the workplace (Spector, 1988). A person's age is also interrelated to how they perceive life events. A study was done with a total of 871 participants who were recruited through the use of convenience sampling in order to examine whether there was a significant difference in work locus of control between age groups. Participants completed a survey answering a series of demographic questions as well as several Likert scale type questions measuring a group of nine constructs. The main instrument used for this study was the 8-item abbreviated version of Spector's Work Locus of Control Scale (WLCS) (1988). Results indicated no significant difference in work locus of control among the four different age groups. The findings of this study have implications for employee performance and HR practices.

Index Terms- age, locus of control, perceived control, work locus of control.

I. Introduction

An extensive body of research is devoted to control beliefs and their importance. Adler (1930) observed that having control over one's external environment is an intrinsic human need. Psychologists today continue to examine perceived control in a variety of ways and control beliefs are correlated with an assortment of affective, behavioral, cognitive, and biological outcomes (Ng, Sorensen, & Eby, 2006). Work locus of control focuses exclusively on control beliefs and expectancies concerning the workplace and has proven to be significant for outcomes at both individual and organizational levels (Spector, 1988). Research supports the idea that in the domain of work, control beliefs tend to increase with age. Therefore, the intention of this paper is to observe whether differences in work locus of control can be attributed to a person's age.

II. Literature Review

1.1 Locus of Control

Locus of control as a concept was first introduced by Phares (1957) and further expanded by Rotter (1966) as the framework of his social-learning theory of personality (Akkaya & Akyol, 2016). It is the extent to which people believe outcomes are determined by their own behavior versus the extent to which they perceive that outcomes are uncontrollable, due to chance, luck, fate, or influenced by more powerful others (Rotter, 1966). As a psychological construct, locus of control indicates how much control an individual perceives they have over their general life outcomes. Rotter (1966) further established the Internal-External Locus of Control Scale (I-E Scale), which has endured as the most repeatedly used scale for assessing locus of control (Twenge, Zhang, & Im, 2004).

Those who display an internal locus of control (internals) identify outcomes as a direct consequence of their behavior, while those who display an external locus of control (externals) attribute outcomes to factors that are outside of themselves (Rotter, 1966). Research indicates that locus of control is interrelated to several variables of motivation, personality, behavior, and attitudes (Twenge et al., 2004) as well as being linked to psychological and physical well-being throughout life (Dijkstra, Beersma, & Evers, 2001). Personal belief of control over one's exterior environment symbolizes a constructive and essential assessment of self-worth, while the absence of control denotes a negative estimation of self-worth (Ng et al., 2006). Perception of control is by itself psychologically beneficial, even when control does not exist (Miller, 1980). This is why internal locus of control is often associated with better overall welfare.

Lynch, Hurford, and Cole (2002) suggest that internal and external locus of control orientations are shaped throughout a person's childhood, molded by learning experience and parental behavior. Parents foster internal locus of control when they encourage a child's independence, whereas overprotection can lead to forming an external locus of control orientation (Lynch et al. 2002). Rotter (1966) explained that locus of control stems from an individual's universal belief regarding their environment. Those who have their endeavors steadily rewarded develop an internal locus of control, whereas those who have difficulty succeeding notwithstanding their best efforts tend to develop an external locus of control (Rotter, 1966). Thus, people who develop a high internal locus of control learn to notice an association between behavior and rewards (Rotter, 1966).

A common assumption by most psychology and sociology literature is that locus of control is stable across time (Phares, 1957). Nevertheless, while general locus of control is a fixed characteristic, control orientations can habitually shift depending on the present situation (Wilski, Chmielewski, & Tomczak, 2015). This is because whether someone is internal or external is determined by environmental factors. Under this assumption, locus of control has been identified as a multidimensional construct, assuming that people have the ability to change their control orientations throughout different stages of their lives (Wilski et al., 2015). This signifies that people have

the ability to be both internal and external or to change their orientation depending on the environment.

1.2 Work Locus of Control

Spector (1988) established work locus of control as the prospect that outcomes, returns, and reinforcements (e.g. promotions or salary increases) in the work place are decided by either one's own behaviors or external forces. This expectancy impacts the occurrence of frustration and the reactions to experienced frustration in the workplace (Fox & Spector, 1999). In order to focus on specific attitudes and beliefs in the work field, Spector (1988) created the Work Locus of Control Scale (WLCS). Items for this scale were produced through theoretical examination of the locus of control construct and how it is interconnected to behavior in the domain of work (Spector, 1988). The Work Locus of Control Scale was found to have noticeable associations to job satisfaction, turnover intentions, and role stress (Spector, 1988).

Spector (1988) observed that within a work setting, locus of control is associated with overall effort, motivation, perceptions, overall job performance, and compliance with authority. Those who display an internal work locus of control orientation display additional hours worked, intrapreneurship skills, self-efficacy, psychological capital, better attendance, and positive relationships with their supervisors (Karabay, Akyüz, & Elçi, 2016). Moreover, people with an internal orientation are also perceived as more sociable, success-oriented, competent, and independent than those with external orientation, who often engage in inflexible, suspicious and insecure-avoidant behaviors (Basım, Çetin, & Meydan, 2009).

Individuals who hold higher positions in their organizations usually display an internal locus of control (Angelova, 2016). Yukl and Latham (1978) observed that those who exhibit an internal locus of control often set more challenging goals and their need to achieve these goals is stronger. This is reflective of greater intrinsic motivation (Yukl & Latham, 1978). Conversely, people with an external locus of control often display inferior job performance when compared to internals because they are unable to anticipate rewards for their efforts (Tong & Wang, 2006).

Locus of control also has the ability to influence coping styles in the workplace. Perceiving control over one's external environment is a strong sign of effective personal coping resources (Thoits, 1995). Gray-Stanley et al. (2010) detected that internals are more inclined to actively cope with negative circumstances as opposed to externals, who believe they are at the mercy of luck, chance, or fate. Internals often display the ability to overcome adverse task experiences and job attitudes, including job stress, burnout, anxiety, turnover, absenteeism, role overload, role conflict, and role ambiguity (Karabay et al. 2016).

Since externals perceive that outside forces have direct control over their experiences, it is possible they will identify more stressors (Muhonen & Torkelson, 2004) and report lower job satisfaction. Wilski et al. (2015) advised that work locus of control fundamentally depends on degree of autonomy a person experiences in the workplace. Hard-workers who usually exhibit an internal orientation may develop external perceptions if they come up against many difficulties, such as a rigid work system, an authoritarian leader, or high levels of stress (Wilski et al. 2015). Similarly, externals may change their perceptions if working conditions encourage autonomy (Wilski et al. 2015).

1.3 Age as an Indicator of Locus of Control Orientation

Twenge et al., (2004) discuss two models which offer opposing views regarding changes over time in locus of control. The independence model highlights a substantial increase in individualism to suggest that locus of control has become more internal (Helson, Jones, & Kwan, 2002; Twenge & Campbell, 2001). This model reinforces that people are more internal today because they have a higher degree of control over their environments. As individualism rises, the independence model expects internality to rise as well (Twenge et al., 2004). Remarkably, increased individualism can also cause greater externality. This is due to the fact that individualism encourages self-serving bias, which arises when people accredit positive events to themselves and assign negative events to forces outside themselves (Twenge et al., 2004). According to prior research, the presence of self-serving bias is noticeably higher people who report an external locus of control (Campbell & Sedikides, 1999).

The opposing alienation model anticipates that locus of control will become more external over time. This model suggests that more recent generations experience greater cynicism, distrust, and alienation (Twenge et al., 2004). Research has noted that over time, college students are progressively exhibiting a more external locus of control. Eighty percent of students attending universities in in the early 1960s reported considerably less external control beliefs than a typical millennial college student in the 2000s (Twenge & Campbell, 2008). Millennials account for over half of the workforce in the United States today (Pew Research Center, 2018) and a sharp rise of external locus of control in young adults has its own implications for behaviors, attitudes, and beliefs in the workplace (Twenge & Campbell, 2008).

In the workplace, externals are more prone to blame others when something goes wrong and seek to avoid being held accountable for failures as opposed to internals (Twenge & Campbell, 2008). Blau (1987) found that in a workplace setting, internals seek to control their immediate environments, whereas externals tend to fall back, displaying a need to be pushed before attempting to do certain things themselves. In young adults, this may be due to inexperience and the desire to want to present themselves as knowledgeable in front of their more seasoned coworkers. Twenge and Campell (2008) suggest that externals in the workplace are more likely to view themselves as helpless and this leads them to see outcomes as a consequence of external variables such as company policies and procedures. Externals also tend to show a preference for team work due to the fact that team work establishes collective accountability, where employees share responsibilities, but also take part in subsequent rewards and losses (Twenge & Campbell, 2008).

According to Siu, Spector, Cooper and Donald (2001), research supports the idea that in the domain of work, a person's control beliefs increase as they age. Perceptions of control over work have proven to be greater in middle age than in young adulthood (Lachman & James, 1997). Those in middle age have a higher chance of holding more powerful positions with more

responsibilities on the job and in their families, compared to when they are younger or older (Lachman & James, 1997). Older employees also tend to exhibit less stress against problems at work than younger employees (Lachman & James, 1997). Siu et al., (2001) observed that older individuals usually develop additional coping resources over time, consequently seeing their problems as less taxing. This may be why older people usually report fewer aggravations than their younger counterparts, due to their greater range of experience (Siu et al., 2001).

Locus of control can determine an employee's motivation, performance, coping mechanisms, and overall organizational behavior. Prior studies on locus of control have shown that general control beliefs increase with age. It has also been suggested that people have the ability to differ in their control orientations during different stages of their lives and that older people sense a higher level of control over their work domains. However, few studies have exclusively concentrated on how work locus of control changes as people age. Therefore, after reviewing the literature it is hypothesized that there is a significant difference in work locus of control between age groups.

III. Methodology

A. Participants

A sample of 871 participants was drawn using convenience and snowball sampling methods. Most of the sample resided in the United States, Brazil, the United Kingdom and Curacao. The population on interest was adults 18 years of age or older at the time of the study who are currently employed or have held a full time or part time job at some point prior to the study.

B. Procedure

An internet-based survey was created through Google Forms in order to collect data anonymously. Participants were recruited through e-mail, text messaging, and social media (e.g. LinkedIn, Facebook, WhatsApp, and Instagram) and provided a link with a standardized recruitment message and the designed survey. They were asked to forward the survey to any other contacts who were in the population of interest. Preceding the survey, participants were presented with an informed consent form describing the study and giving them the right to withdraw from the study at any time.

Moreover, participants were requested to disclose demographic information including gender, age, level of education, ethnic identity, sexual orientation, number of children, job tenure, marital status, and household annual income. After demographic information was collected, participants were presented with a series of Likert scale type questions measuring the following group of constructs: competence (perceived personal), independence (perceived personal), leadership (perceived personal), self-determination (perceived personal), Desire for Status, Gender Equality, Work Related Locus of Control, Interpersonal Conflict at Work (perceived personal), and the Big Five Personality Traits (openness to experience, conscientiousness, extraversion-introversion, agreeableness and neuroticism). Survey responses were then exported to SPSS and analyzed statistically.

C. Instrumentation

The construct work locus of control was measured using the 8-item abbreviated version of the Work Locus of Control Scale (WLCS) (Spector, 1988). The Work Locus of Control Scale is a 16-item instrument intended to evaluate control beliefs in the domain of work. Responses are rated on a six-point scale with anchors *6 = disagree very much, 5 = disagree moderately, 4 = disagree slightly, 3 = agree slightly, 2 = agree moderately,* and *1 = agree very much.* Half of the items on the WLCS are written in each direction, representing externality and internality. High scores represent externality, therefore internally worded items must be reversed scored before calculating a total score. Total score, which is the sum of all items, is used to interpret results and ranges from 16 to 96. The 8-item abbreviated version consists of items 2, 3, 5, 9, 11, 13, 14, 16 and scores range from 8 to 48. For the purpose of this study, a score of 8-24 was interpreted as an internal orientation, a score of 25-31 was interpreted as both an internal and external orientation, and a score of 32 or higher was interpreted as an external orientation.

IV. Results

A total of 872 responses were acquired, yet, 1 response was omitted because it did not meet inclusion criteria. Descriptive statistics presented a sample of 871 participants between the ages of 18 and 84, with an average age of 37 years old (See Figure 1). 551 (63%) were female and 316 (36%) were male. The average female in this sample was 38 years old while the average male was 36 years old. 285 (32.7%) of the sample was 18-28 years old, 253 (29%) of the sample was 29-39 years old, 222 (25.5%) of the sample was 40-55 years old, and 111 (12.7%) of the sample was 55 and older.

The majority of the respondents were White/Non-Hispanic (47.3%), followed by 37 % Hispanic/Latinos, and 6.9% Black/African-American. 344 (39.5%) of the respondents held a Bachelor's degree at the time of the study, followed by 179 (20.6%) with a Master's degree, 156 (17.9%) with a high school diploma or GED, 119 (13.7%) with an Associate's degree, and 64 (7.3%) with a Doctorates degree. Most of the sample reported their current job as Professional (45.4%), followed by Management (15%), and Service/Sales (14.7%). Therefore, people who took part in the study were primarily professional, college educated, White/Non-Hispanic millennials.

In order to verify if there was a significant difference in work locus of control between age groups, an Analysis of Variance (ANOVA) was chosen as the main source of hypothesis testing. A Pearson correlation test was also performed to establish if there was a linear relationship among perceived work locus of control and age. There was no statistically significant difference between groups as determined by a one-way ANOVA ($F(3,867) = 1.646$, $p = .177$) (Table 1). The result of the correlation denoted a moderately weak ($r = .012$) correlation that was not statically significant ($p=.726$) between variables (Table 2).

V. FINDINGS AND LIMITATIONS

Results of this study failed to support the initial hypothesis, which proposed that there would be a significant difference in work locus of control between age groups. Existing literature may lead one to conclude that younger participants would be more likely to exhibit an external locus of control, while older participants might display a more internal orientation. However, the results indicated that no significant differences existed within the given sample.

These findings directly contradict results of the previous cross temporal meta-analysis conducted by Twenge et al. (2004) which supports the alienation model and determined that college students were becoming increasingly more external over time. The results of that study suggested that as individualism increased, locus of control became more external, specifically in younger people. The findings of the present study however support the independence model, which proposes that locus of control has become more internal. Most responses (84%) were from participants living in the United States, a greatly individualistic country. This coincides with research findings that denote a higher frequency of internal scores in nations that are considered more individualistic (Hsieh, Shybut, & Lotsof, 1969; Hung, 1977; McGinnies, Nordholm, Ward, & Bhanthumnavin, 1974).

While research done by Lachman & James (1997) suggest that perceptions of control over work have proven to be greater in middle age compared with young adulthood, the findings of the present study directly contradict this notion. Work locus of control scores were extremely similar across four different age groups, implying that perception of control is present in young adulthood and in older adulthood as well. Similarly, several other cross-sectional studies have not been able to detect any considerable differences in locus of control scores between young adults and other age groups (Grob, 2000; Mirkowsky, 1995). In some cases, results have even demonstrated a higher degree of externality in older adults (Mirkowsky, 1995; Shaw & Krause, 2001).

Although the initial hypothesis was not supported, results do indicate positive implications for the workforce. Most of the literature strongly sided with the belief that an internal orientation of work locus of control is more advantageous. Internals are found to experience more success at work, while success at work also leads to a higher internal locus of control (Dijkstra et al., 2001). In contrast, negative connotations are often linked to an external work locus of control and work-related well-being.

What the results of this study represent is that each age group perceived more internal attitudes and beliefs about work locus of control. All of the mean scores fell into the internal range. Therefore, it can be determined that age and number of life experiences do not have a bearing on whether someone has an internal or external work locus of control, at least within the given sample. These findings represent an optimistic view of locus of control in the domain of work.

From a HR perspective, the findings demonstrate favorable attitudes and beliefs in the workplace, at least where work locus of control is concerned. The workforce represented by the analyzed sample attributes events in the workplace to their own actions instead external factors, such as management or the organization. This is important and beneficial to employers because it represents increased levels of personal responsibility and accountability in the workforce.

A substantial limitation of this study is presented in the sampling method used to collect data. Convenience and snowball sampling methods are considered non-probability sampling and do not have external validity. Thus, results from this study cannot be generalized to the general populace. In the future, a stratified sampling technique would be most advantageous to this kind of study.

Another limitation stems from the lack of diversity in age. The oldest group (56 and older) only comprised 12% of our sample, while 61% was between the ages of 18 and 39; as such, this sample is not indicative of the typical distribution of age in our society. This could account for the abundant similarity in scores. Perhaps a more diversified sample would have produced a different result. Nevertheless, the results of this study contain valuable information for organizations.

APPENDIX

APPENDIX A

Tables

Table 1: ANOVA test results of work locus of control (WLOC) between age groups

ANOVA
WLOC

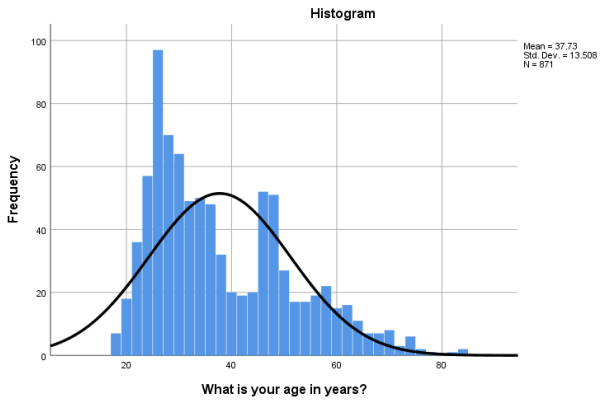
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	180.110	3	60.037	1.646	.177
Within Groups	31626.591	867	36.478		
Total	31806.700	870			

Table 2: Correlation test results between employees' age and work locus of control (WLOC).

		What is your age in years?	WLOC
What is your age in years?	Pearson Correlation	1	.012
	Sig. (2-tailed)		.726
	N	871	871
WLOC	Pearson Correlation	.012	1
	Sig. (2-tailed)	.726	
	N	871	871

APPENDIX B

Figure 1: Distribution of Ages



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Effect of Mass transfer and thermal diffusion on unsteady MHD flow of a dusty gas through permeable boundary

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AbstractIn this paper,We investigate the effect of unsteady MHD flow of a dusty gas through permeable boundary with mass transfer and thermal diffusion. The flow is assumed to be free convective flow and it is induced by the motion of a semi infinite plate. The closed forms of analytical solution are obtained for the saffman's equation of motion of the dusty gas along the x-axis. The effect of various parameters like soret number, permeability parameter, Schmidt number, magnetic parameter on velocity profile, temperature, concentration, wall shear stress and the rate of heat and mass transfer are obtained and their behaviour are discussed through the graphs.
Keywords: MHD, Convective flow, Dusty flow, Mass transfer ,Thermal diffusion.

1.Introduction

Many transport processes exist in nature and industrial application in which the transfer of heat and mass occurs simultaneously as a result of combined buoyancy effects of thermal diffusion and diffusion of chemical species. In the last few decades several efforts have been made to solve the problems on heat and mass transfer in view of their application to astrophysics, geophysics and engineering.Chemical reaction can be codified either heterogeneous or homogeneous processes. Its effect depends on the nature of the reaction whether the reaction is heterogeneous or homogeneous. A reaction is of order n, if the reaction rate is proportional to the nth power of concentration. In particular, a reaction is of first order, if the rate of reaction is directly proportional to concentration itself.
Experimental and theoretical works on MHD flow with thermal diffusion and chemical reaction have been done extensively in various areas i.e. sustain plasma confinement for controlled thermonuclear fusion, liquid metal cooling of nuclear reactions and electromagnetic casting of metals.The study of radiation in thermal engineering is of great interest for industry point of view. Many processes in thermal engineering areas occur at high temperature and radiative heat transfer becomes very important for the design of pertinent equipment. Nuclear power plants, gas turbines and the various propulsion devices for air craft, missiles, satellites and space vehicles are example of such engineering areas.
The study of fluids having uniform distribution of solid spherical particles is of interest in a wide range of areas of technical importance. These areas include fluidization (flow through packed feds), flow in rockets, tubes, where small carbon or metallic fuel particles are present, environmental pollution, the process by which rain drops are formed by the coalescence of small droplets, which might be considered as solid particles for the purpose of examining their movement prior to coal scene, combustion and more recently blood flow in capillaries. The study of heat and mass transfer to chemical reacting MHD free convection flow with radiation effects on a vertical plate has received a growing interest during the last decades. Free convection arises in the fluid when temperature changes cause density variation leading to buoyancy forces acting on the fluid elements. Accurate knowledge of the overall convection heat transfer has vital importance in several fields such as thermal insulation, drying of porous solid materials, electrical conductors and geophysical, astrophysical applications such

as polymer production, packed-bed catalytic reactors, aeronautics, cooling of nuclear reactors, underground energy transport, magnetized plasma flow, high speed plasma wind, geothermal reservoirs geothermal extractions and cosmic jets.
A clear understanding of the nature of interaction between thermal and concentration buoyancies is necessary. Consolidated effects of heat and mass transfer problems are of importance in many chemical formulations and reactive chemicals.
More such engineering applications can be seeing in electrical power generation systems when the electrical energy is extracted directly from a moving conducting fluid.In many transport processes and industrial applications, transfer of heat and mass simultaneously as a result of combined buoyancy effects of thermal diffusion and diffusion of chemical species. Unsteady natural-convection of heat and mass transfer is great importance in designing control systems for modern free convection heat exchangers.

P. G. Saffman (1962) studied on the stability of laminar flow of a dusty gas.J.T.C. Liu (1972) discussed the flow of a dusty gas through a channel arbitrary time varying pressure gradient.W.Gretler and R. Regenfelder (2002) studied about the similarity solution for laser-driven shock waves in a dust-laden gas with internal heat transfer effects.N.K.Varshney and Ram Prakash (2004) discussed about MHD free convective flow of a visco-elastic(Kuvshiniski type) dusty gas through a porous medium induced by the motion of a semi-infinite flat plate moving with velocity decreasing exponentially with time.N. K. Varshney and Ram Prakash (2004) discussed about the MHD free convection flow of a visco elastic dusty gas through a porous medium induced by the motion of a semi- infinite flat plate moving with velocity decreasing exponentially with time. D.Kumar et.al (2006) have discussed on the MHD free convective flow of a visco-elastic (Kuvshiniki type) dusty gas through a porous medium induced by the motion of a semi-infinite flat plate moving with time and heat source. I. U. Mbeledogu and A. Ogulu (2007) discussed on the effect of heat and mass transfer of an unsteady MHD natural convection flow of a rotating fluid past a vertical porous flat plate in the presence of radiative heat transfer. P. M. Patil and P. S. Kulkarni (2008) discussed on the effects of chemical re-action on free convective flow of a polar fluid through a porous medium in the presence of internal heat generation. A. A. Afify (2009) studied on similarity solution in MHD effects of thermal diffusion on free convective heat and mass transfer over a stretching surface considering suction or injection.
P.Singh et.al (2010)studied on the effect of mass transfer in MHD free convective flow of a viscoelastic (Kuvshiniki type) dusty gas through a porous medium with heat source/sink.O. D. Makinde and T. Chinyoka (2010) discussed about the MHD transient flows and heat transfer of dusty fluid in a channel with variable physical properties and Navier slip condition.Om Prakash et .al (2010) studied the effects of thermal diffusion and chemical reaction on MHD Flow of dusty visco-elastic (Walter's Liquid Model-B) fluid. V.K Sharma et.al (2011) studied the effect of Dusty viscous fluid on MHD free convection flow with heat and mass transfer past a vertical porous plate. Rajesh Kumar et.al (2011) studied the thermal diffusion and mass transfer effects on MHD flow of a dusty gas through porous medium.
In this chapter, We have studied the effect of unsteady MHD flow of a dusty gas through permeable boundary with mass transfer and thermal diffusion. The flow is assumed to be free convective flow and it is induced by the motion of a semi – infinte plate. The closed forms of analytical solution are obtained for the saffman's equation of motion of the dusty gas and the dust particles along the x-axis. The effect of various parameters like soret number, permeability parameter, Schmidt number, magnetic parameter on velocity profile, temperature ,concentration, wall shear stress and the rate of heat and mass transfer are obtained and their behaviour are discussed graphically.

2.Mathematical formulation

Consider the unsteady incompressible dusty gas to be confined in the space y >0 and the flow is produced by the motion of the finite flat plate moving with the velocity $\vartheta e^{-\lambda^2 t}$ in x direction. The gas has small electrical conductivity and the electromagnetic force produced is also very small.
According to Saffman (1962) the equation of motion of the dust gas and the dust particles along $x-$axis are given by

$$\frac{\partial u}{\partial t} = \vartheta \frac{\partial^2 u}{\partial y^2} + \frac{K_0 N_0}{\rho}(v-u) \tag{1}$$

$$\frac{\partial v}{\partial t} = \frac{K_0}{m}(u-v) \tag{2}$$

$$\frac{\partial T}{\partial t} = \frac{K_T}{\rho C_p}\frac{\partial^2 T}{\partial y^2} \tag{3}$$

$$\frac{\partial C}{\partial t} = D\frac{\partial^2 C}{\partial y^2} + D_T \frac{\partial^2 T}{\partial y^2} \tag{4}$$

Where u and v denotes the velocity of gas and dust particles respectively. ϑ is the kinematic coefficient of viscosity of the gas, K_0 is the stokes resistance coefficient. N_0 is the number density of the dust particles which is taken to be constant, ρ is the density of the gas, m is the mass of the dust partical, K_τ is the thermal conductivity, D is the molecular diffusivity and D_τ is the thermal diffusivity.C_p is the specific heat at the constant pressure.
Applying the magnetic field, free convection, mass transfer and thermal diffusion along the $x-$ axis the equation of motion (7.1) reduces to

$$\frac{\partial u}{\partial t} = \vartheta \tfrac{\partial^2 u}{\partial y^2} + \tfrac{K_0 N_0}{\rho}(v-u) - \tfrac{\sigma B_0^2 u}{\rho} + g\beta\theta + g\beta'\phi \tag{5}$$

Where $\theta = T - T_1, \phi = C - C_1$
The initial and boundary conditions are given as

$$\left.\begin{array}{l} u = u_p \text{ and } \dfrac{\partial u}{\partial y} = \dfrac{\alpha}{\sqrt{Da}}(u_B - u_p) \;\; ; v = \vartheta e^{-\lambda^2 t}; \theta = \vartheta e^{-\lambda^2 t}; \;\; \phi = \vartheta e^{-\lambda^2 t} \;\; at \;\; y = \sqrt{\vartheta\tau} \\ \dfrac{\partial u}{\partial y} = 0 \;\; ; v = 0; \theta = 0; \;\; \phi = 0 \;\; at \;\; y = 0 \end{array}\right\} \tag{6}$$

Introducing the following non-dimensional quantities

$$\left. y^* = \frac{y}{\sqrt{(\vartheta\tau)}}; u^* = \frac{u}{\vartheta}; v^* = \frac{v}{\vartheta}; t^* = \frac{t}{\tau}; \tau = \frac{m}{k_0}; \theta^* = \frac{\theta}{\vartheta}; \phi^* = \frac{\phi}{\vartheta} \right\} \tag{7}$$

using the above non- dimensional quantities, equations (2) to (5) can be reduced to the following

dimensionless forms (dropping the stars)

$$\frac{\partial u}{\partial t} = \vartheta \frac{\partial^2 u}{\partial y^2} + f(v-u) - Mu + \beta_1 \theta + \beta_2 \phi \tag{8}$$

$$\frac{\partial v}{\partial t} = (u-v) \tag{9}$$

$$\frac{\partial \theta}{\partial t} = \frac{1}{Pr}\frac{\partial^2 \theta}{\partial y^2} \tag{10}$$

$$\frac{\partial \phi}{\partial t} = \frac{1}{Sc}\frac{\partial^2 \phi}{\partial y^2} + \frac{1}{S_1}\frac{\partial^2 \theta}{\partial y^2} \tag{11}$$

where $f = \frac{mN_0}{\rho}$ is the mass of concentration of dust particles, $M = \frac{m\sigma B_0^2}{K_0 \rho}$ is the magnetic parameter,, $\beta_1 = g\beta\tau$ is the volumetric expansion parameter , $\beta_2 = g\beta'\tau$ is the mass expansion parameter,$Sc = \frac{\vartheta}{D}$ is the Schmidt number, $Pr = \frac{\rho \vartheta C_p}{K_\tau}$ is the prandtl number, $S_1 = \frac{\vartheta}{D_\tau}$ is the thermal diffusion parameter as soret number.
Now the boundary conditions becomes

$$\left.\begin{array}{l} u = u_p \text{ and } \dfrac{\partial u}{\partial y} = \dfrac{\alpha}{\sqrt{Da}}(u_B - u_p) \ ; \theta = e^{-\lambda^2 t}; \ \ \phi = e^{-\lambda^2 t} \quad at \ \ y = 1 \\ \dfrac{\partial u}{\partial y} = 0 \ ; \theta = 0; \ \ \phi = 0 \quad at \quad y = 0 \end{array}\right\} \tag{12}$$

3.Solution of the problem

To solve the equations (8) to (11) subject to the boundary conditions (6), we assume solutions of the form

$$u = F(y)e^{-\lambda^2 t} \tag{13}$$

$$v = G(y)e^{-\lambda^2 t} \tag{14}$$

$$\theta = H(y)e^{-\lambda^2 t} \tag{15}$$

$$\phi = I(y)e^{-\lambda^2 t} \tag{16}$$

Substituting the equations (13) to (16) in to the equations (8) to (11), we get

$$\frac{\partial^2 F}{\partial y^2} + fG + F(\lambda^2 - f - M) = -\beta_1 H - \beta_2 I \tag{17}$$

$$G(1-\lambda^2) = F \tag{18}$$

$$\frac{\partial^2 H}{\partial y^2} + \lambda^2 H Pr = 0 \tag{19}$$

$$\frac{\partial^2 I}{\partial y^2} + \frac{\partial^2 H}{\partial y^2} + \lambda^2 I S_1 Sc = 0 \tag{20}$$

Now the boundary conditions becomes

$$\left.\begin{array}{l} \dfrac{\partial F}{\partial y} = \dfrac{\alpha}{\sqrt{Da}}[u_B - u_P]; G = 1; H = 1; I = 1 \quad \text{at } \ y = 1 \\ \dfrac{\partial F}{\partial y} = 0; G = 0; H = 0; I = 0; \quad \text{at } \ y = 0 \end{array}\right\} \tag{21}$$

Using the equation(18), equation (17)becomes

$$\frac{\partial^2 F}{\partial y^2} + {c_3}^2 F = -\beta_1 H - \beta_2 I \tag{22}$$

solving the equation (19) using the boundary conditions (21),The temperature distribution is

$$H = \frac{\sinh(c_1 y)}{\sinh(c_1)} \tag{23}$$

$$\theta = \left[\frac{\sinh(c_1 y)}{\sinh(c_1)}\right] e^{-\lambda^2 t} \tag{24}$$

solving the equation (20) using the boundary condition (21), The concentration distribution is

$$I = A_3 e^{c_2 y} + A_4 e^{-c_2 y} - \frac{c_1^2 \sinh(c_1 y)}{(c_1^2 - c_2^2)\sinh c_1} \tag{25}$$

$$\phi = \left[A_3 e^{c_2 y} + A_4 e^{-c_2 y} - \frac{c_1^2 \sinh(c_1 y)}{(c_1^2 - c_2^2)\sinh c_1}\right] e^{-\lambda^2 t} \tag{26}$$

solving the equation (25) using the boundary condition (21), The velocity of the gas is

$$F = A_5 \cos c_3 y + A_6 \sin c_3 y - \frac{\beta_1}{c_1^2 + c_3^2}\frac{\sinh(c_1 y)}{\sinh c_1} - \frac{\beta_2}{(c_1^2 - c_2^2)} \left(\frac{2c_1^2 - c_2^2}{c_2^2 + c_3^2}\frac{\sinh(c_2 y)}{2\sinh c_2} - \frac{c_1^2}{c_1^2 + c_3^2}\frac{\sinh(c_1 y)}{\sinh c_1}\right) \tag{27}$$

$$u = \left[A_5 \cos c_3 y + A_6 \sin c_3 y - \frac{\beta_1}{c_1^2 + c_3^2}\frac{\sinh(c_1 y)}{\sinh c_1} - \frac{\beta_2}{(c_1^2 - c_2^2)} \left(\frac{2c_1^2 - c_2^2}{c_2^2 + c_3^2}\frac{\sinh(c_2 y)}{2\sinh c_2} - \frac{c_1^2}{c_1^2 + c_3^2}\frac{\sinh(c_1 y)}{\sinh c_1}\right)\right] e^{-\lambda^2 t} \tag{28}$$

solving the equation (18) using the boundary condition (21), The velocity of the dusty particles is

$$G = \frac{1}{(1-\lambda^2)}\left[A_5 \cos c_3 y + A_6 \sin c_3 y - \frac{\beta_1}{c_1^2 + c_3^2}\frac{\sinh(c_1 y)}{\sinh c_1} - \frac{\beta_2}{(c_1^2 - c_2^2)} \left(\frac{2c_1^2 - c_2^2}{c_2^2 + c_3^2}\frac{\sinh(c_2 y)}{2\sinh c_2} - \frac{c_1^2}{c_1^2 + c_3^2}\frac{\sinh(c_1 y)}{\sinh c_1}\right)\right] \tag{29}$$

$$v = \frac{1}{(1-\lambda^2)}\left[A_5 \cos c_3 y + A_6 \sin c_3 y - \frac{\beta_1}{c_1^2 + c_3^2}\frac{\sinh(c_1 y)}{\sinh c_1} - \frac{\beta_2}{(c_1^2 - c_2^2)} \left(\frac{2c_1^2 - c_2^2}{c_2^2 + c_3^2}\frac{\sinh(c_2 y)}{2\sinh c_2} - \frac{c_1^2}{c_1^2 + c_3^2}\frac{\sinh(c_1 y)}{\sinh c_1}\right)\right] e^{-\lambda^2 t} \tag{30}$$

Using the boundary condition equation (21), the values of the co- efficient A1, A2, A3, A4, A5 and A6 are obtained and their values are mentioned in Appendix

Using the equation (28), The skin friction of the gas is

$$\tau = \left[\frac{\partial u}{\partial y}\right]_{y=1} \tag{31}$$

$$\tau = \left[- c_3 A_5 \sin(c_3) + c_3 A_6 \cos(c_3) - \frac{\beta_1}{c_1^2 + c_3^2}\frac{c_1 \cosh(c_1)}{\sinh c_1} - \frac{\beta_2}{(c_1^2 - c_2^2)} \left(\frac{2c_1^2 - c_2^2}{c_2^2 + c_3^2}\frac{c_2 \cosh(c_2)}{2\sinh c_2} - \frac{c_1^2}{c_1^2 + c_3^2}\frac{c_1 \cosh(c_1)}{\sinh c_1}\right)\right] e^{-\lambda^2 t} \tag{32}$$

using the equation (30), The skin friction of the dust particles is

$$\tau_p = \left[\frac{\partial v}{\partial y}\right]_{y=1} \tag{33}$$

$$\tau_p = \left[\frac{1}{(1-\lambda^2)}\left[-c_3A_5\sin(c_3) + c_3A_6\cos(c_3) - \frac{\beta_1}{c_1^2+c_3^2}\frac{c_1\cosh(c_1)}{\sinh c_1} - \frac{\beta_2}{(c_1^2-c_2^2)}\right.\right.$$
$$\left.\left.\left(\frac{2c_1^2-c_2^2}{c_2^2+c_3^2}\frac{c_2\cosh(c_2)}{2\sinh c_2} - \frac{c_1^2}{c_1^2+c_3^2}\frac{c_1\cosh(c_1)}{\sinh c_1}\right)\right]e^{-\lambda^2 t} \tag{34}$$

Using the equation (24) The rate of heat transfer of the dusty gas is

$$Nu = \left[\frac{\partial \theta}{\partial y}\right]_{y=1} \tag{35}$$

$$Nu = \left[\frac{c_1\sinh c_1}{\sinh c_1}\right]e^{-\lambda^2 t} \tag{36}$$

Using the equation (26) The rate of mass transfer of the dusty gas is

$$Sh = \left[\frac{\partial \phi}{\partial y}\right]_{y=1} \tag{37}$$

$$Sh = \left[A_3c_2e^{c_2} - A_4c_2e^{-c_2} - \frac{c_1^2\cosh c_1}{(c_1^2-c_2^2)\sinh c_1}\right]e^{-\lambda^2 t} \tag{38}$$

4.Results and discussion

In this paper, We studied the effect of unsteady MHD flow of a dusty gas through permeable boundary with mass transfer and thermal diffusion. The flow is assumed to be free convective flow. The closed forms of analytical solution are obtained for the saffman's equation of motion of the dusty gas and the dust particles along the x-axis. The effect of various parameters like magnetic parameter(M), thermal diffusion parameter as soret number(S_1), Schmidt number(Sc),Prandtl number(Pr),mass concentration of dust particles(f),volumetric expansion parameter (β_1),mass expansion parameter (β_2),Darcy number(Da) on velocity profile, temperature ,concentration, skin friction and the rate of heat and mass transfer are obtained and their behavior are discussed graphically.

Figures 1 and 2 shows that an increase in Magnetic parameter (M) leads to decrease in both the velocities u and v.This is because there exist a resistive type force called Lorentz force similar to drag force which has tendency to slow down the the motion of the dusty gas.so the velocity decreases while increasing the magnetic parameter. Figures 3 and 4 shows that an increase in mass concentration (f) leads to decrease in both the velocities u and v.Figures 5 and 6 shows that an increase in volumetric expansion parameter (β_1) leads to increases in both the velocities u and v.Figures 7 and 8 shows that an increase in mass expansion parameter (β_2) leads to decrease in both the velocities u and v. Figure 9 shows that an increase in the Schmidt number (Sc) leads to decrease in the velocity u. Figure 10, shows that an increase in the λ decreases the temperature profile(θ) of the dusty gas.Figures 11 and 12, shows that the concentration profile(ϕ) of the dusty gas decreases while increasing the values of Schmidt number(Sc) and the thermal diffusion parameter as soret number(S_1).

Figures 13 and 14, shows that the skin friction of the gas(τ) and the skin friction of the dust particles (τ_p) decreases while increasing the values of the thermal diffusion parameter as soret number(S_1).Figures 15 and 16, shows that the skin friction of the gas(τ) and the skin friction of the dust particles (τ_p)

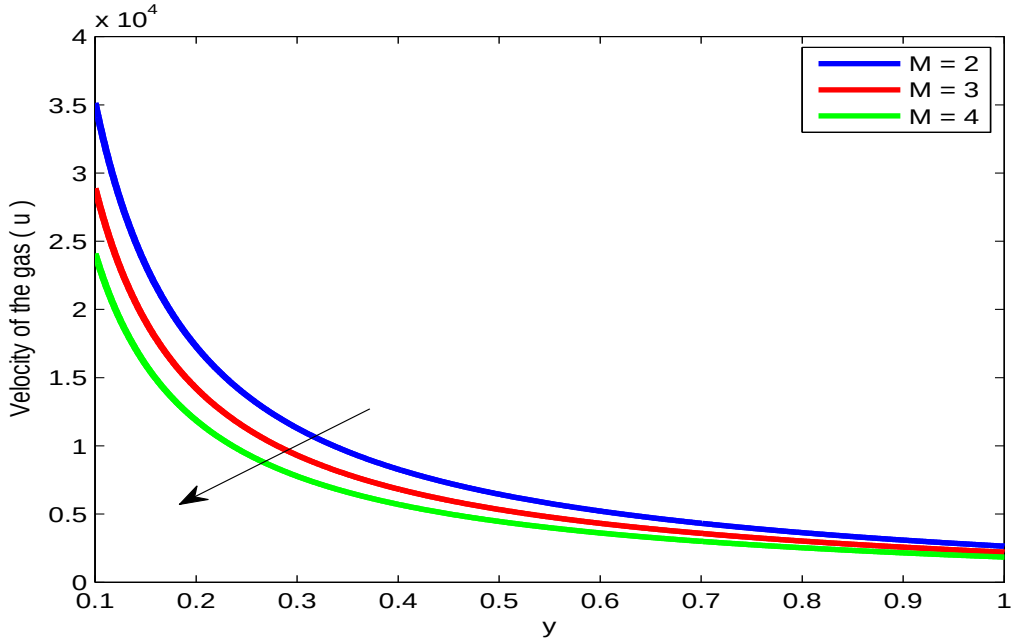

Figure 1: Variation of velocity of the gas (u) for different values of Magnetic parameter (M) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.3, \beta_1 = 0.5, \beta_2 = 2, f = 0.4, Da = 2$.

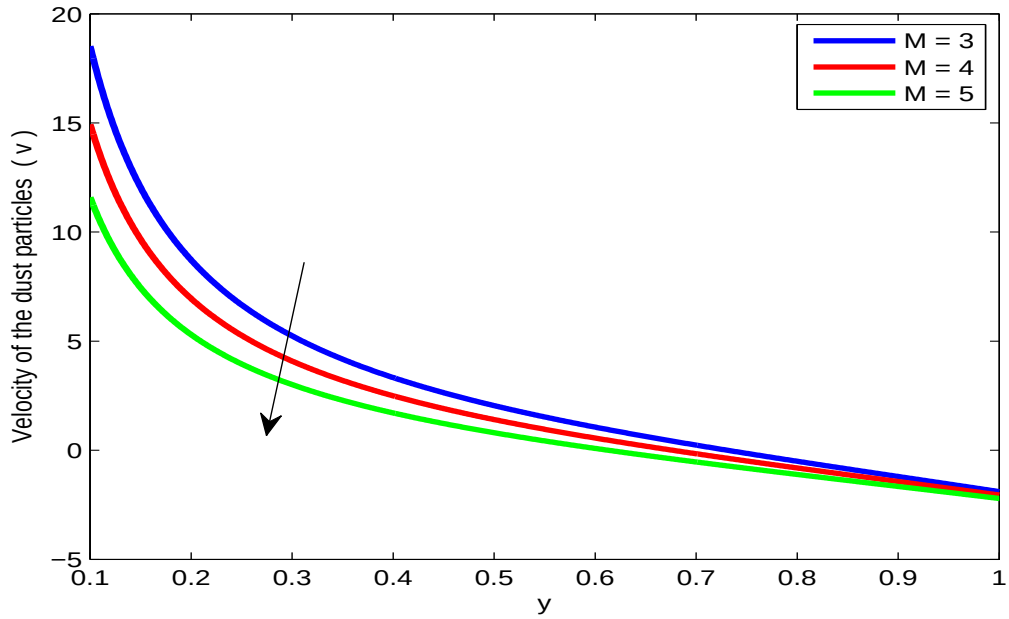

Figure 2: Variation of velocity of the dust particles (v) for different values of Magnetic parameter (M) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, \beta_1 = 0.5, \beta_2 = 2, f = 0.4, Da = 2$.

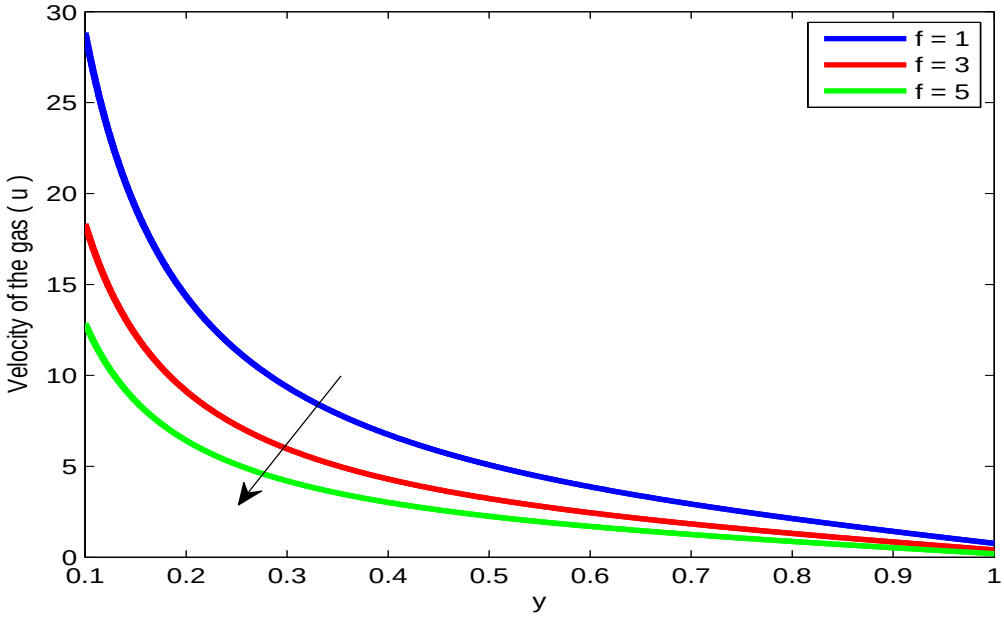

Figure 3: Variation of velocity of the gas (u) for different values of mass concentration (f) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.3, \beta_1 = 0.5, \beta_2 = 2, M = 3, Da = 2$.

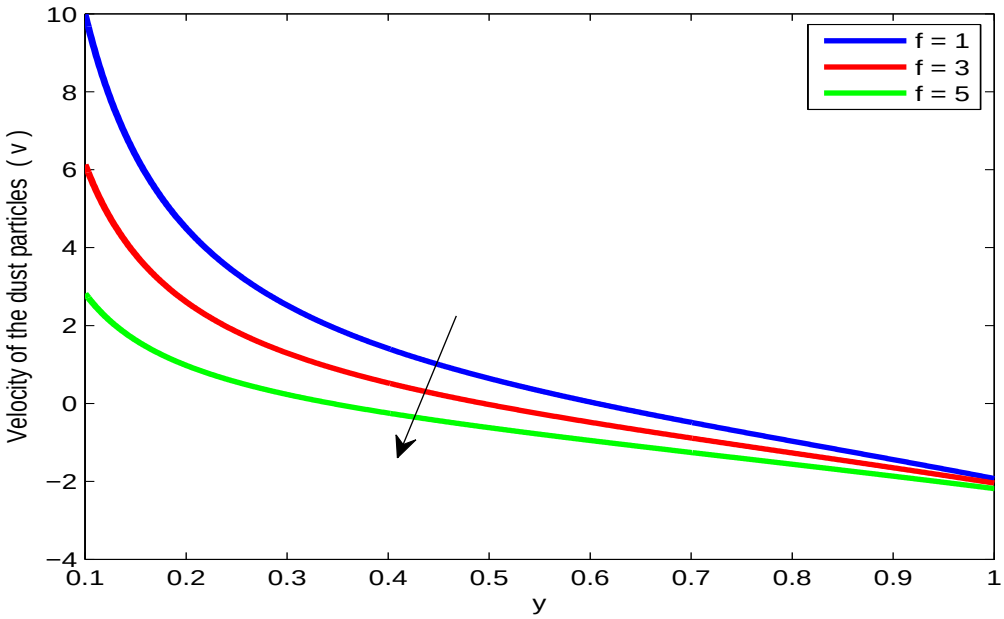

Figure 4: Variation of velocity of the dust particles (v) for different values of mass concentration (f) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, \beta_1 = 0.5, \beta_2 = 2, M = 3, Da = 2$.

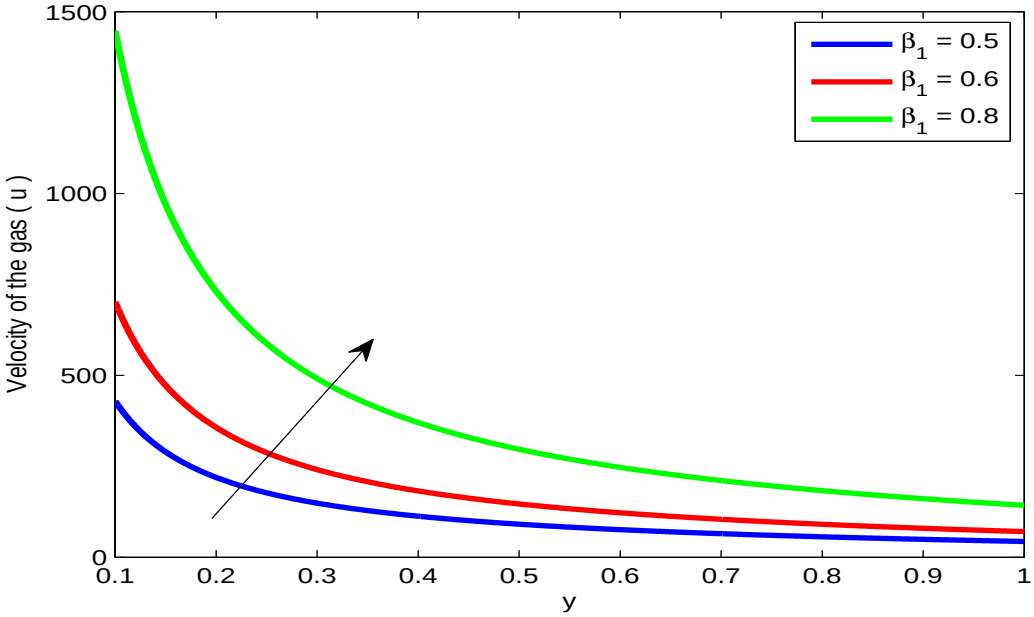

Figure 5: Variation of velocity of the gas (u) for different values of volumetric expansion parameter (β_1) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.3, M = 3, \beta_2 = 2, f = 0.4, Da = 2$.

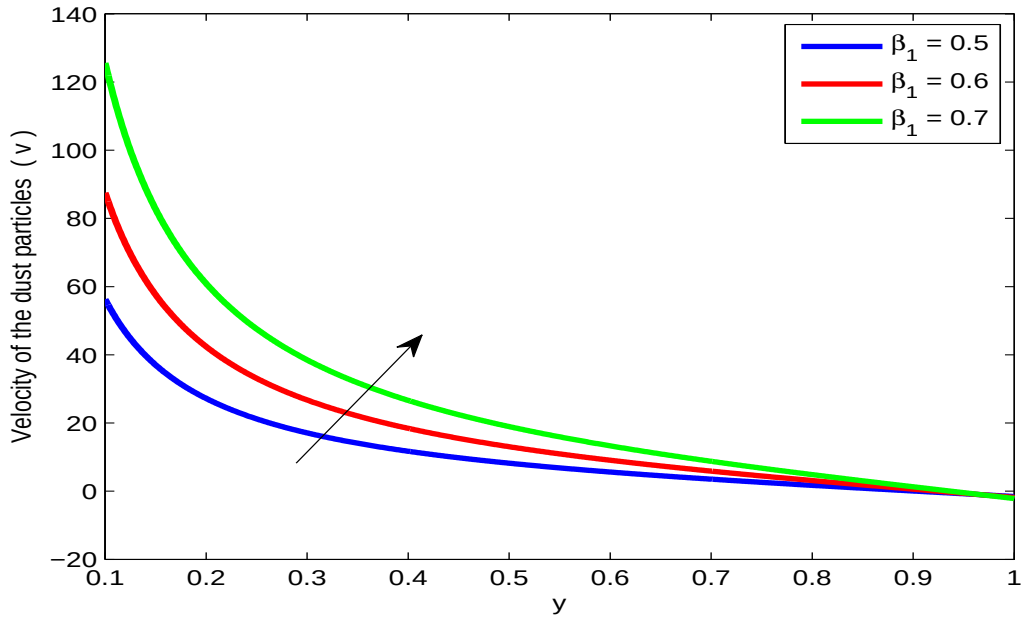

Figure 6: Variation of velocity of the dust particles (v) for different values of volumetric expansion parameter (β_1) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, M = 3, \beta_2 = 2, f = 0.4, Da = 2$.

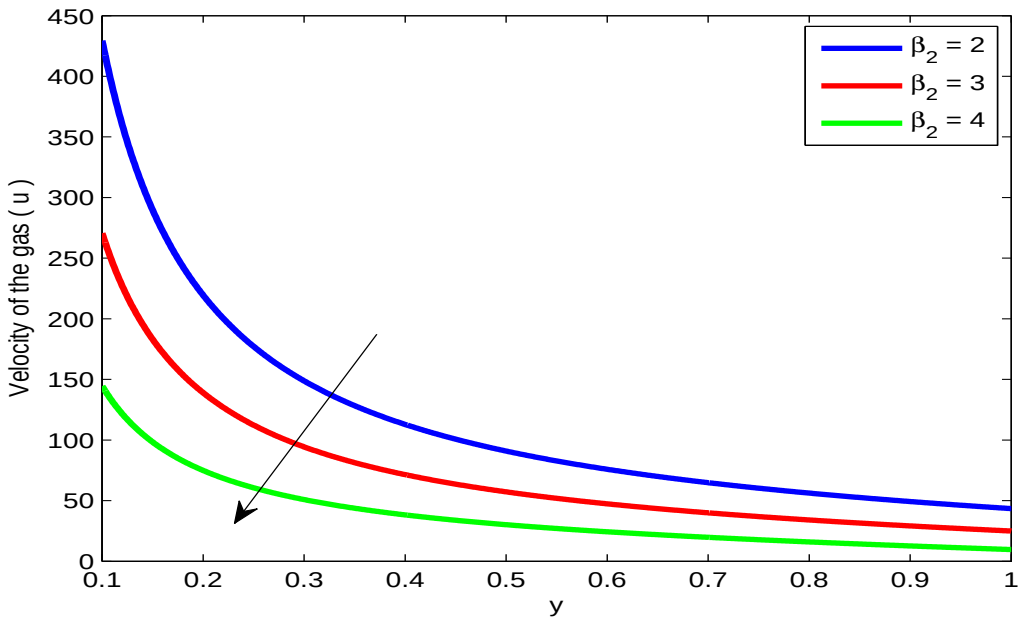

Figure 7: Variation of velocity of the gas (u) for different values of mass expansion parameter (β_2) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.3, M = 3, \beta_1 = 0.5, f = 0.4, Da = 2.$

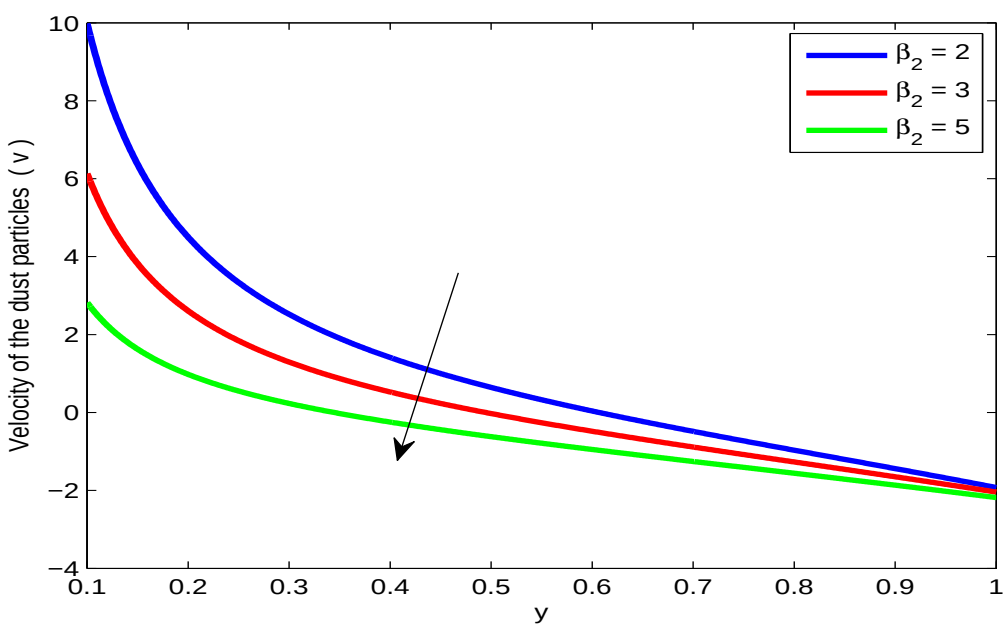

Figure 8: Variation of velocity of the dust particles (v) for different values of mass expansion parameter (β_2) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, M = 3, \beta_1 = 0.5, f = 0.4, Da = 2.$

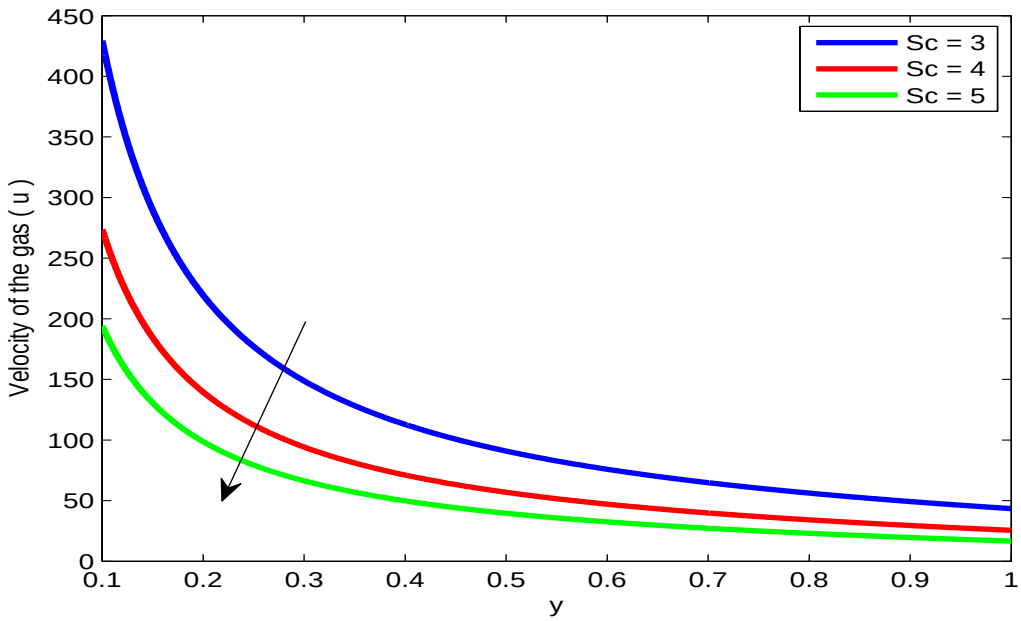

Figure 9: Variation of velocity of the gas (u) for different values of Schmidt number (Sc) for fixed $Da = 2, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, M = 3, \beta_2 = 2, \beta_1 = 0.5, f = 0.4$

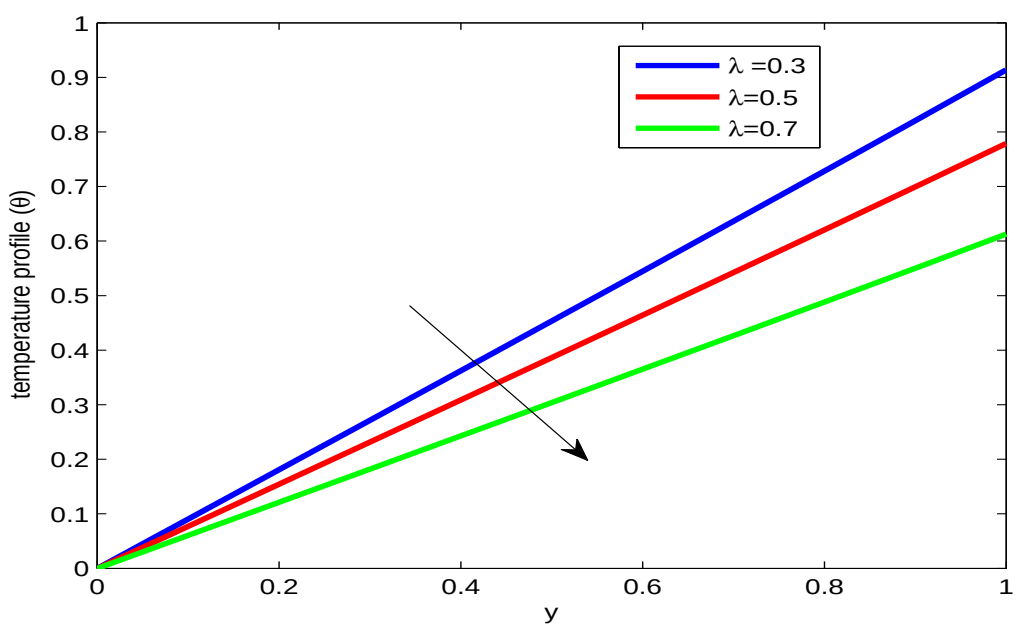

Figure 10: Temperature profile (θ) for different values of λ for fixed $Pr = 0.71, t = 1$.

decreases while increasing the values of the mass expansion parameter (β_2).Figure 17 shows that an increase in the mass concentration (f) leads to decrease in the skin friction of the gas (τ).Figure 18

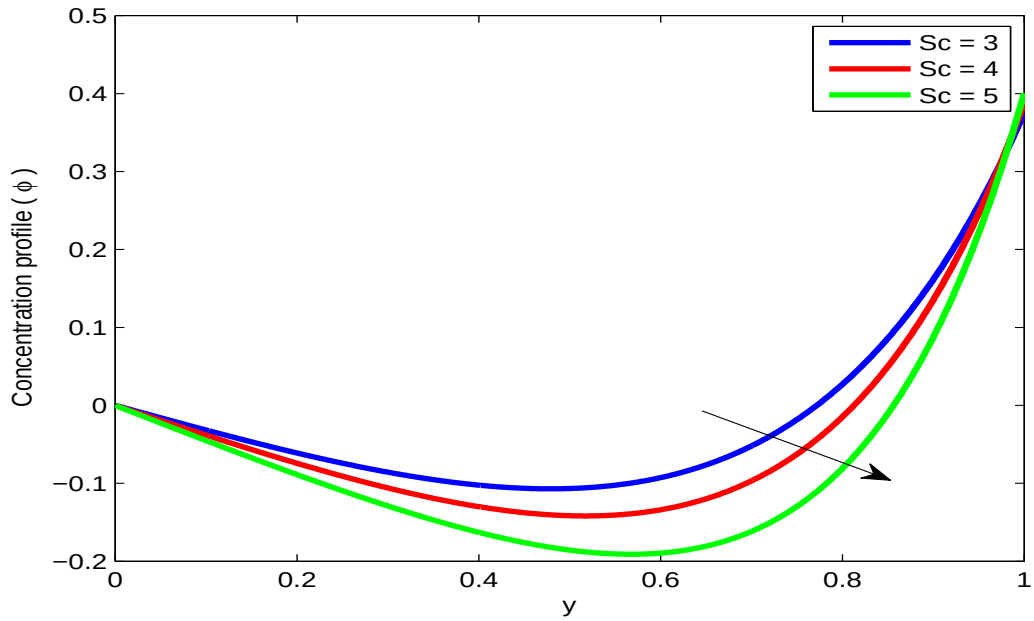

Figure 11: Concentration profile (ϕ) for different values of Schmidt number (Sc) for fixed $\lambda = 3, S_1 = 5, Pr = 0.71, t = 0.3$

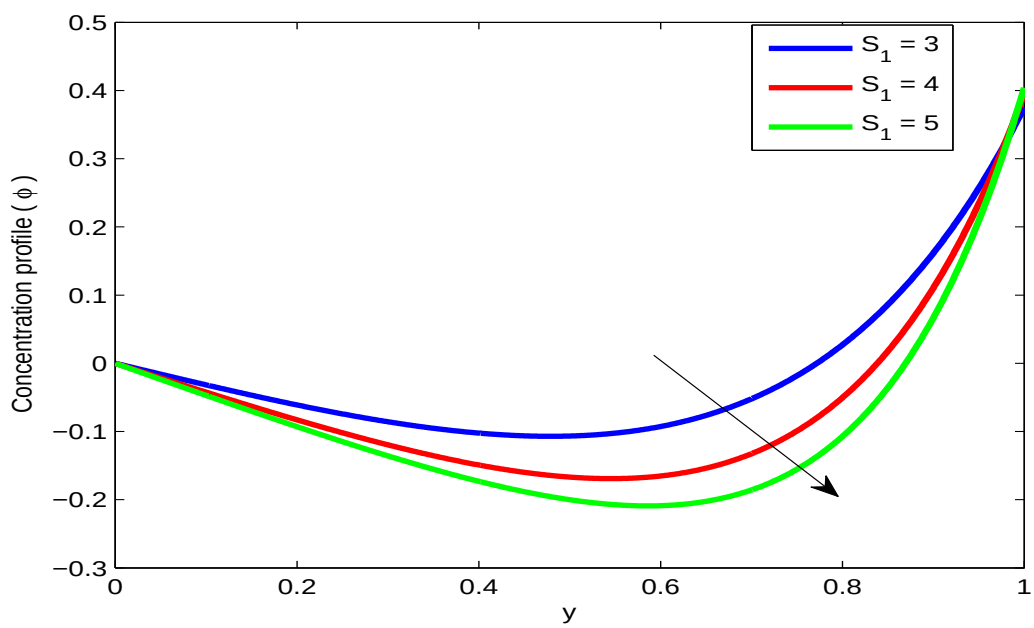

Figure 12: Concentration profile (ϕ) for different values of thermal diffusion parameter (S_1) for fixed $Sc = 3, \lambda = 3, Pr = 0.71, t = 0.3$

shows that an increase in the λ leads to decrease the Nusselt number (Nu).

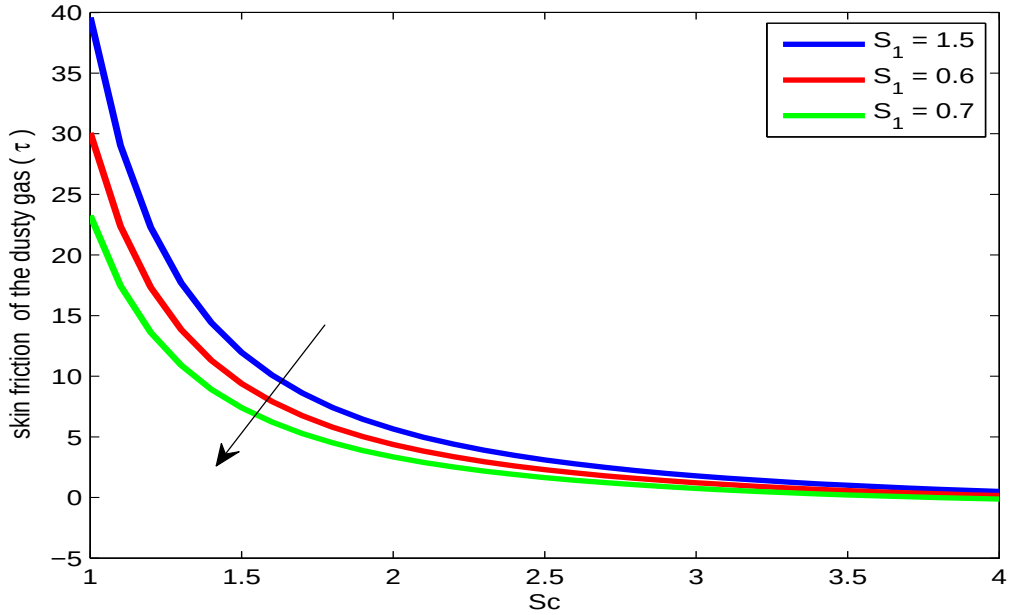

Figure 13: Skin friction of the gas(τ) for different values of thermal diffusion parameter (S_1)for fixed $Sc = 3, \lambda = 0.5, Pr = 0.71, t = 0.5, \beta_1 = 0.5, \beta_2 = 2, f = 0.4, Da = 2$.

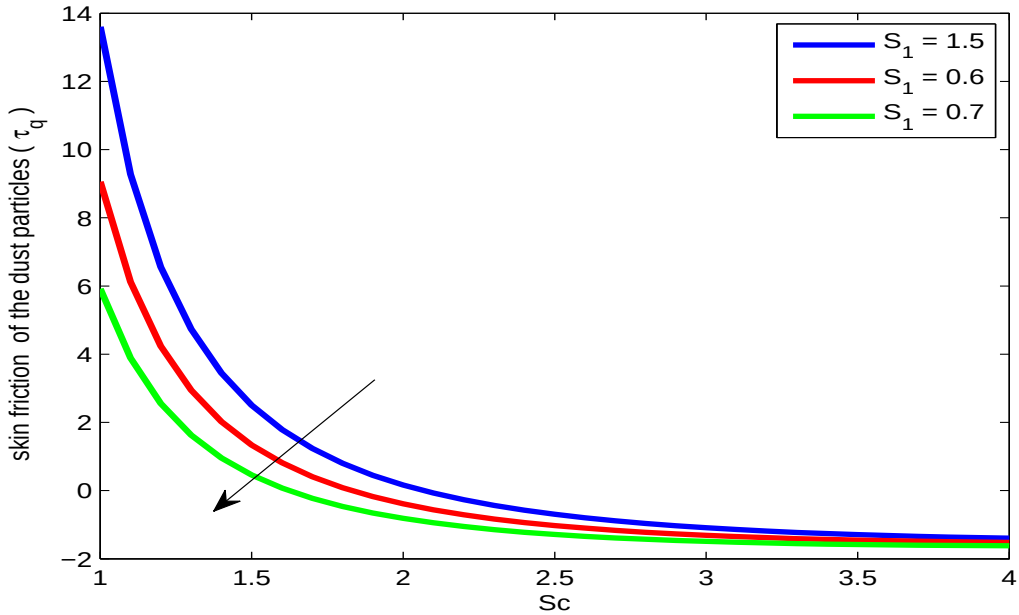

Figure 14: Skin friction of the dust particles (τ_p) for different values of thermal diffusion parameter (S_1)for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, \beta_1 = 0.5, \beta_2 = 2, f = 0.4, Da = 2$.

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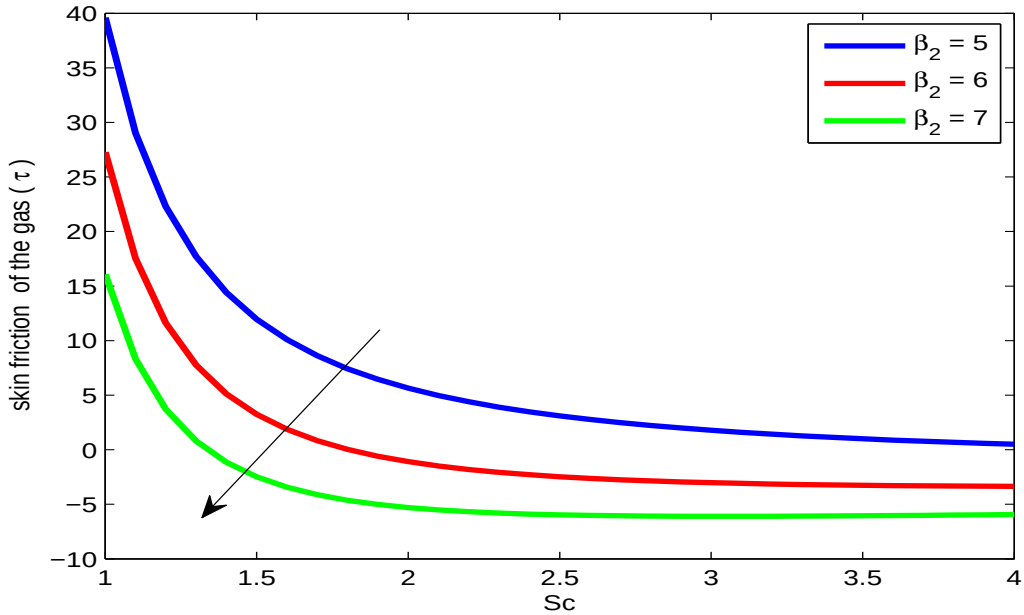

Figure 15: Skin friction of the gas(τ) for different values of mass expansion parameter (β_2) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, M = 3, \beta_1 = 0.5, f = 0.4, Da = 2$.

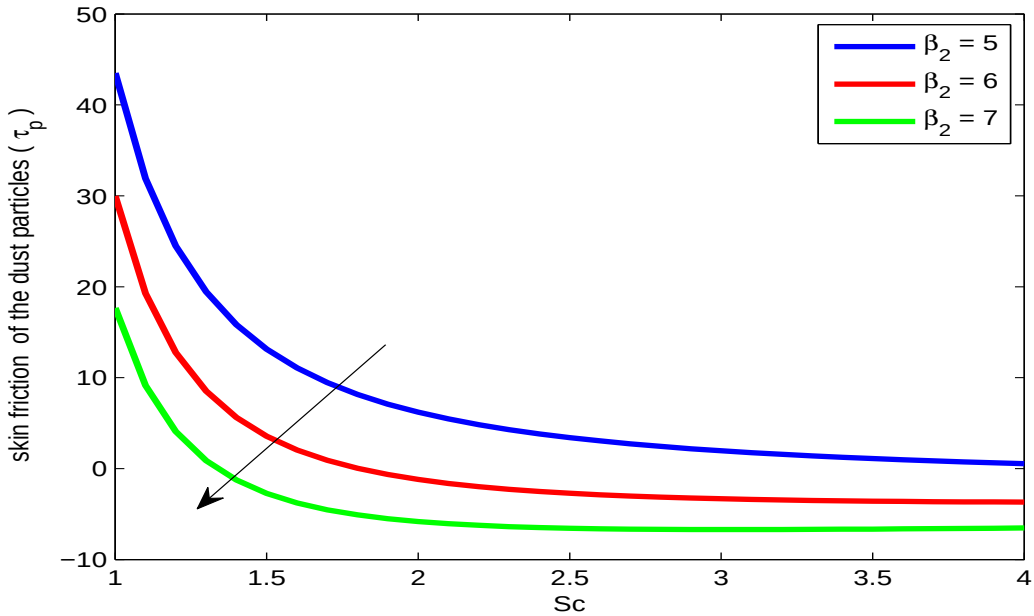

Figure 16: Skin friction of the dust particles (τ_p) for different values of mass expansion parameter (β_2) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, M = 3, \beta_1 = 0.5, f = 0.4, Da = 2$.

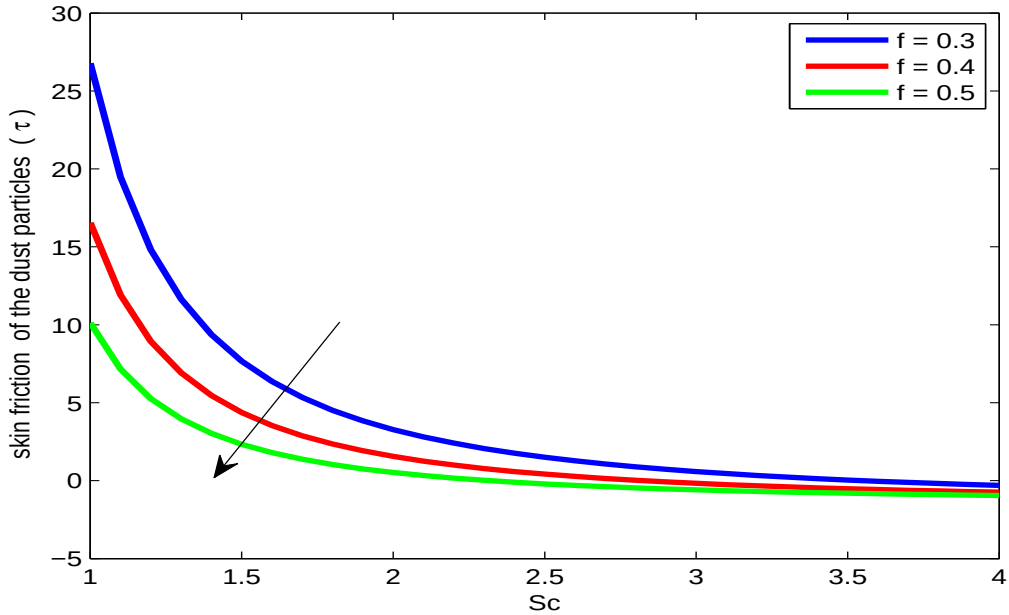

Figure 17: Skin friction of the gas (τ) for different values of mass concentration (f) for fixed $Sc = 3, \lambda = 0.5, S_1 = 0.5, Pr = 0.71, t = 0.5, M = 3, \beta_1 = 0.5, Da = 2$.

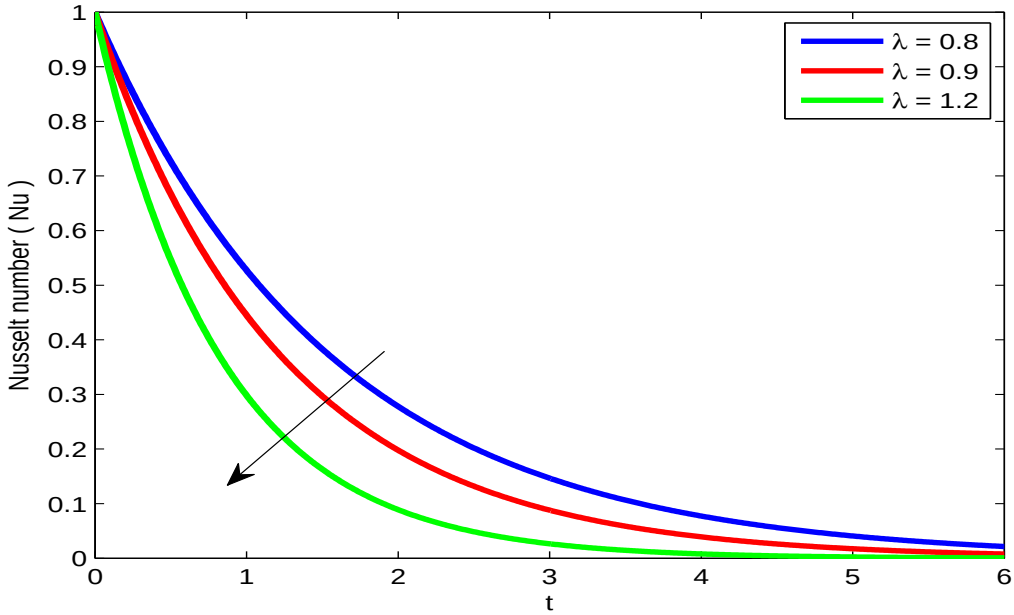

Figure 18: Variation of Nusselt number (Nu) for the different values of λ for fixed $Pr = 0.71, t = 1$

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Appendix

$$A_1 = \frac{1}{2\sinh(c_1)}$$
$$A_2 = -\frac{1}{2\sinh(c_1)}$$
$$A_3 = \frac{1}{2\sinh(c_2)}\frac{2c_1^2 - c_2^2}{c_1^2 - c_2^2}$$
$$A_4 = -\frac{1}{2\sinh(c_2)}\frac{2c_1^2 - c_2^2}{c_1^2 - c_2^2}$$
$$A_5 = -\frac{1}{C_3\sin C_3}\frac{\alpha}{\sqrt{Da}}[u_B - u_P] - \cos C_3[\frac{\beta_1}{C_1^2 + C_3^2}\frac{C_1}{\sinh C_1}$$
$$-\frac{\beta_2}{C_1^2 - C_2^2}\{\frac{2C_1^2 - C_2^2}{C_1^2 + C_3^2}\frac{C_2}{\sinh C_2} - \frac{C_1^3}{C_1^2 + C_3^2}C_2\frac{1}{\sinh C_1}\}] - \frac{\cosh C_1}{\sinh C_1}[\frac{\beta_1}{C_1^2 + C_3^2}$$
$$+\frac{\beta_2}{C_1^2 - C_2^2}\{\frac{2C_1^2 - C_2^2}{C_2^2 + C_3^2}C_2 + \frac{C_1^2}{C_2^2 + C_3^2}\}]$$
$$A_6 = \frac{1}{C_3}[\frac{C_1}{(C_1^2 - C_2^2)\sinh C_1}\{\beta_1 + \frac{\beta_2 C_1^2}{C_1^2 - C_2^2}\} + \{\frac{\beta_2}{C_1^2 - C_2^2}\frac{2C_1^2 - C_2^2}{C_2^2 + C_3^2}C_2 + \frac{C_1^2}{C_2^2 + C_3^2}\}]$$
$$c_1 = \lambda\sqrt{Pr}$$
$$c_2 = \lambda\sqrt{S_1 Sc}$$
$$c_3 = \frac{f}{(1 - \lambda^2)} + \lambda^2 - f - M$$

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UNSTEADY MHD FLOW OF A VISCOELASTIC FLUID THROUGH A POROUS MEDIUM WITH THE EFFECT OF MASS TRANSFER AND HALL CURRENT

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Abstract In this paper, we investigate the effect of unsteady MHD oscillatory flow of a viscoelastic fluid through the porous medium with the effect of mass transfer and hall current. The viscous incompressible and electrically conducting viscoelastic fluid through a porous medium over the finite plate with temperature and mass transfer are considered and the closed form of analytical solution are obtained for the Momentum,Energy and Concentration equation. The influence of assorted flow parameters like the thermal Grashof number, mass Grashof number, Schmidt number, Prandtl number, Hartmann number, Hall parameter, and the Viscoelastic parameter on the velocity,temperature and concentration distributions, the coefficient of Skin friction, Nusselt number and Sherwood number are obtained and their behaviour are discussed graphically.
Keywords: MHD oscillatory flow, Porous medium, Heat transfer, Thermal Radiation, Hall current.

1.INTRODUCTION

Magnetohydrodynamics (MHD) is a field of study which combines elements of electromagnetism and fluid mechanics to describe the flow of electrically conducting fluids. It is generally regarded as a difficult academic discipline, both conceptually as well as mechanically. MHD is the study of electrically conducting fluids, combining both principles of fluid dynamics and electromagnetism. Magnetohydrodynamics is that the study of the magnetic properties of electrically conducting fluids. When a conducting fluid moves through a field of force, an electric field, may be induced and, in turn the current interacts with the magnetic field to produce a body force. The science which deals with this phenomenon is called Magnetohydrodynamics.

The subject of MHD is traditionally studied as a continuum theory, that is to say, attempts at studying discrete particles in the flows are not at a level such that computation in these regards is realistic. To run realistic simulations would require computations of flows with many more particles than current computers are able to handle. Aboeldahab and Elbardy (2001) studied the Hall current effect on Magnetohydrodynamics free convection flow past a semi infinite vertical plate with mass transfer.Magnetohydrodynamics (MHD) is a field of study which combines elements of electromagnetism and fluid mechanics to describe the flow of electrically conducting fluids. It is generally regarded as a difficult academic discipline, both conceptually as well as mechanically. MHD is the study of electrically conducting fluids, combining both principles of fluid dynamics and electromagnetism. Magnetohydrodynamics is the study of the magnetic properties of electrically conducting fluids. When a conducting fluid moves through a magnetic field, an electric field, may be induced and, in turn the current interacts with the magnetic field to produce a body force.

When the strength of the magnetic field is strong one cannot neglect the effects of Hall currents. It is of significant importance and interest to review however the results of the hydrodynamical issues get changed by the consequences of Hall current. In Fluid dynamics, Hall current attains widespread

interest due to its applications in many geophysical and astrophysical situations as well as in engineering problems such as Hall accelerators, Hall effect sensors, constructions of turbines and centrifugal machines. MHD flows with Hall current effect are encountered in power generators, MHD accelerators, refrigeration coils, electrical transformers and in flight magnetohydrodynamics.
Heat and mass transfer from totally different geometries embedded in porous media has several engineering and geology applications like drying of porous solids, thermal insulations, cooling of nuclear reactors, crude oil extraction, underground energy transport, etc. The study of mass transfer of unsteday MHD flows plays a vital role in many engineering fields due to its applications in various areas such as heat exchanger, petroleum reservoirs, chemical catalytic reactors and processes, geothermal and geophysical engineering, aerodynamic engineering and others. Das and Jana (2010) examined Heat and Mass transfer effects on unsteady MHD free convection flow near a moving vertical plate in a porous medium. The effects of chemical reaction, Hall current and Ion – Slip currents on MHD micropolar fluid flow with thermal Diffusivity using Novel Numerical Technique was studied by Motsa and Shateyi (2012). Hall current effect with simultaneous thermal and mass diffusion on unsteady hydromagnetic flow near an accelerated vertical plate was investigated by Acharya et al. (2001). Takhar (2006) studied Unsteady flow free convective flow over an infinite vertical porous plate due to the combined effects of thermal and mass diffusion, magnetic field and Hall current.// Exact resolution of MHD free convection flow and Mass Transfer close to a moving vertical porous plate within the presence of thermal radiation was investigated by Das (2010). Anjali Devi and Ganga (2012) examined effects of viscous and Joules dissipation and MHD flow, heat and mass transfer past a Stretching porous surface embedded in a porous medium. Sonth et al. (2012) studied Heat associate degreed Mass transfer in an exceedingly elastic fluid over an accelerated surface with heat source/sink and viscous dissipation.

The study of magnetohydrodynamic flows, heat and mass transfer with Hall currents has an important bearing in engineering applications. Study of effects of Hall currents on flows have been done by many researchers. A. S. Gupta (1975) discussed the Hydromagnetic flow past a porous flat plate with hall current effects. D. Pal and B. Talukdar (2011) discused the Combined effects of Joule heating and chemical reaction on unsteady magnetohydrodynamic mixed convection of a viscous dissipating fluid over a vertical plate in porous media with thermal radiation.M. A. El-Hakiem (2000) studied the effect of MHD oscillatory flow on free convection radiation through a porous medium with constant suction velocity.P. R. Sharma and K.D.Singh,(2009) have studied the effect of unsteady MHD free convective flow and heat transfer along a vertical porous plate with variable suction and internal heat generation.K.D Singh and R.Pathak (2013) studied the effects of slip conditions and Hall current on an oscillatory convective flow in a rotating vertical porous channel with thermal radiation.Effect of Hall currents and Chemical reaction and Hydromagnetic flow of a stretching surface with internal heat generation / absorption was examined by Salem and El-Aziz (2008).

Shateyi et al.(2010) investigated the consequences of thermal Radiation, Hall currents, Soret and Dufour on MHD flow by mixed convection over surface in porous medium. Rakesh (2011) studied effect of slip conditions and Hall current on unsteady MHD flow of a viscoelastic fluid past an infinite vertical porous plate through porous medium. B.I Olajuwon et al (2014) studied the effect of thermal radiation and Hall current on heat and mass transfer of unsteady MHD flow of a viscoelastic micropolar fluid through a porous medium. E.Omokhuale and G.I.Onwuka (2012) studied the effect of mass transfer and hall current On unsteady MHD flow of a viscoelastic fluid in a porous medium.

The objective of this paper is to study about the unsteady MHD oscillatory flow of a viscoelastic fluid through the porous medium with the effect of mass transfer and hall current. The viscous in-

compressible and electrically conducting viscoelastic fluid through a porous medium over the finite plate with temperature and mass transfer are considered and the closed form of analytical solution are obtained for the Momentum,Energy and Concentration equation. The influence of assorted flow parameters like the thermal Grashof number, mass Grashof number, Schmidt number, Prandtl number, Hartmann number, Hall parameter, and the Viscoelastic parameter on the velocity,temperature and concentration distributions, the coefficient of Skin friction, Nusselt number and Sherwood number are obtained and their behaviour are discussed graphically.

2.MATHEMATICAL FORMULATION

We consider the unsteady oscillatory flow of a viscous incompressible and electrically conducting viscoelastic fluid over an finite porus plate with temperature and mass transfer. The x-axis is assumed to be oriented vertically upwards along the plate and y-axis is taken normal to the plane of the plate. It is assumed that the plate is electrically non-conducting and a uniform magnetic field of straight B_0 is applied normal to the plate. The induced magnetic field is assumed constant. So that $\overrightarrow{B} = (0, B_0, 0)$. The plate is subjected to a constant suction velocity.

$$\left.\begin{array}{l}\text{The equation of conservation of charge } \nabla \times J = 0, \text{gives constant.} \\ \overrightarrow{J} = \omega_e \tau_e (\overrightarrow{J} \times \overrightarrow{E}) = \sigma \left[\overrightarrow{V} \times \overrightarrow{B} + \dfrac{\nabla P_e}{e n_e} \right]\end{array}\right\} \tag{1}$$

Equation (1) reduces to

$$\left.\begin{aligned} J_{x^*} &= \frac{\sigma B_0}{(1+m^2)}(mu^* - \omega^*) \\ J_{y^*} &= \frac{\sigma B_0}{(1+m^2)}(u^* - m\omega^*) \end{aligned}\right\} \tag{2}$$

where $m = \omega_e \tau_e$ is the Hall parameter.
where ω_e is the cyclotron frequency and τ_e is the electron collision time.
The governing equations for the momentum, energy and concentration are as follows;

$$\frac{\partial u^*}{\partial t^*} + v_0 \frac{\partial u^*}{\partial y^*} = \nu \frac{\partial u^{2^*}}{\partial y^{2^*}} - k_1 \frac{\partial^3 u^*}{\partial y^{2^*} \partial t^*} - \sigma B_0^2 \frac{(u^* + mv^*)}{\rho(1+m^2)} + g\beta(T - T_0) + g\beta^*(C - C_0) - \frac{\nu u^*}{k^*} \tag{3}$$

$$\frac{\partial v^*}{\partial t^*} + v_0 \frac{\partial v^*}{\partial y^*} = \nu \frac{\partial^2 v^*}{\partial y^{2^*}} - k_1 \frac{\partial^3 v^*}{\partial y^{2^*} \partial t^*} - \sigma B_0^2 \frac{(v^* - mu^*)}{\rho(1+m^2)} - \frac{u^* v^*}{k^*} \tag{4}$$

$$\frac{\partial T}{\partial t^*} + v_0 \frac{\partial T}{\partial y^*} = \frac{K_T}{\rho Cp} \frac{\partial^2 T}{\partial y^{2^*}} \tag{5}$$

$$\frac{\partial C}{\partial t^*} + v_0 \frac{\partial C}{\partial y^*} = D \frac{\partial^2 C}{\partial y^{2^*}} \tag{6}$$

The boundary conditions are

$$\left.\begin{aligned}
&\frac{\partial u^*}{\partial y^*} = 0 \; at \; y^* = 0; \; u^* = \lambda \frac{\partial u^*}{\partial y^*} \; at y^* = 1 \\
&\frac{\partial v^*}{\partial y^*} = 0 \; at \; y^* = 0; \; v^* = \lambda \frac{\partial v^*}{\partial y^*} \; at y^* = 1 \\
&\frac{\partial \theta}{\partial y^*} = 0 \; at \; y^* = 0; \; \theta = 1 \; at \; y^* = 1 \\
&\frac{\partial C}{\partial y^*} = 0 \; at \; y^* = 0; \; C = 1 \; at \; y^* = 1
\end{aligned}\right\} \tag{7}$$

Where u and v are the components of velocity in the x and y direction respectively, g is the acceleration due to gravity, β and β^* are the coefficient of volume expansion, K is the kinematic viscoelasticity, ρ is the density, μ is the viscosity, ν is the kinematic viscosity, K_T is the thermal conductivity, Cp is the specific heat in the fluid at constant pressure, σ is the electrical conductivity of the fluid, μ_e is the magnetic permeability, D is the molecular diffusivity, T_ω is the temperature of the plane and T_0 is the temperature of the fluid far away from plane. C_ω is the concentration of the plane and C_0 is the concentration of the fluid far away from the plane.
And $v = -v_0$, the negative sign indicate that the suction is towards the plane.
Introducing the following non-dimensionless parameters

$$\left.\begin{aligned}
&\eta = \frac{v_0 y^*}{\nu}, t = \frac{v_0^2 t^*}{4\nu}, u = \frac{u^*}{v_0}, v = \frac{v^*}{v_0}, \theta = \frac{T - T_0}{T_\omega - T_0}, C = \frac{C - C_0}{C_\omega - C_0} \\
&Gr = \frac{g\beta v(T_\omega - T_\infty)}{v_0^2}, Gc = \frac{g\beta c v(C_\omega - C_\infty)}{v_0^2}, M = \frac{\sigma B_0^2 v}{\rho v_0^2}, Pr = \frac{\mu Cp}{K_T} \\
&Sc = \frac{\nu}{D}, K = \frac{k_1 v_0^2}{4\nu^2}, k = \frac{k^* v_0^2}{\nu^2}
\end{aligned}\right\} \tag{8}$$

Substituting the dimensionless variables (8) into Equation (3) to Equation (6), we get

$$\frac{1}{4}\frac{\partial u}{\partial t} - \frac{\partial u}{\partial \eta} = \frac{\partial^2 u}{\partial \eta^2} - \frac{K\partial^3 u}{4\partial \eta^2 \partial t} - \frac{M(u + mv)}{(1 + m^2)} - \frac{u}{k} + Gr\theta + GcC \tag{9}$$

$$\frac{1}{4}\frac{\partial v}{\partial t} - \frac{\partial v}{\partial \eta} = \frac{\partial^2 v}{\partial \eta^2} - \frac{K\partial^3 v}{4\partial \eta^2 \partial t} - \frac{M(v - mu)}{(1 + m^2)} - \frac{u}{k} \tag{10}$$

$$\frac{1}{4}\frac{\partial \theta}{\partial t} - \frac{\partial \theta}{\partial \eta} = \frac{1}{Pr}\frac{\partial^2 \theta}{\partial \eta^2} \tag{11}$$

$$\frac{1}{4}\frac{\partial C}{\partial t} - \frac{\partial C}{\partial \eta} = \frac{1}{Sc}\frac{\partial^2 C}{\partial \eta^2} \tag{12}$$

The corresponding boundary conditions are

$$\left.\begin{aligned}
&\frac{\partial u}{\partial \eta} = 0 \; at \; \eta = 0; \; u = \lambda \frac{\partial u}{\partial \eta} \; at \; \eta = 1 \\
&\frac{\partial v}{\partial \eta} = 0 \; at \; \eta = 0; \; v = \lambda \frac{\partial v}{\partial \eta} \; at \; \eta = 1 \\
&\frac{\partial \theta}{\partial \eta} = 0 \; at \; \eta = 0; \; \theta = 1 \; at \; \eta = 1 \\
&\frac{\partial C}{\partial \eta} = 0 \; at \; \eta = 0; \; C = 1 \; at \; \eta = 1
\end{aligned}\right\} \tag{13}$$

Now combining the equation (9) and equation (10) into single equation by introducing the complex velocity.

$$U = u(\eta, t) + iv(\eta, t) \text{ where } i = \sqrt{-1} \tag{14}$$

Thus,

$$\frac{1}{4}\frac{\partial U}{\partial t} - \frac{\partial U}{\partial \eta} = \frac{\partial^2 U}{\partial \eta^2} - \frac{K\partial^3 U}{4\partial \eta^2 \partial t} - \frac{M(1-im)U}{(1+m^2)} - \frac{U}{k} + Gr\theta + GcC \tag{15}$$

Now the boundary conditions are

$$\left.\begin{aligned} \frac{\partial U}{\partial \eta} &= 0 \; at \; \eta = 0; \; U = \lambda \frac{\partial U}{\partial \eta} \; at \; \eta = 1 \\ \frac{\partial \theta}{\partial \eta} &= 0 \; at \; \eta = 0; \; \theta = 1 \; at \; \eta = 1 \\ \frac{\partial C}{\partial \eta} &= 0 \; at \; \eta = 0; \; C = 1 \; at \; \eta = 1 \end{aligned}\right\} \tag{16}$$

where Gr is the thermal Grashof number, Gc is the mass Grashof number, Sc is the schmidt number, Pr is the prandtl number, K is a viscoelastic number, M is the Hartmann number and k is the permeability.

3.SOLUTION OF THE PROBLEM

To solve Equations(11), (12) and (15) subjected to the boundary conditions (16), we assume the solutions of the form

$$U(\eta, t) = U_1(\eta)e^{i\omega t} \tag{17}$$

$$\theta(\eta, t) = \theta_1(\eta)e^{i\omega t} \tag{18}$$

$$C(\eta, t) = C_1(\eta)e^{i\omega t} \tag{19}$$

where $U(\eta, t)$, $\theta(\eta, t)$ and $C(\eta, t)$ are to be determined.
Substituting the equations (17) to (19) into equations (11), (1) and (15), comparing harmonic and non harmonic terms, we obtain

$$\begin{aligned} \frac{1}{4}U_1(\eta)e^{i\omega t}i\omega - U_1^{'}(\eta)e^{i\omega t} =& U_1^{''}(\eta)e^{i\omega t} - \frac{K}{4}U_1^{''}(\eta)e^{i\omega t}i\omega - \frac{M(1-im)}{(1+m^2)}U_1(\eta)e^{i\omega t} \\ & - \frac{1}{K}U_1(\eta)e^{i\omega t} + Gr\theta_1(\eta)e^{i\omega t} + GcC_1(\eta)e^{i\omega t} \end{aligned}$$

$$\frac{1}{4}i\omega U_1 - U_1^{'} = U_1^{''} - \frac{K}{4}U_1^{''}(i\omega) = \frac{M(1-im)}{(1+m^2)}U_1 - \frac{1}{K}U_1 + Gr\theta_1 + GcC_1$$

$$U_1^{''} + PU_1^{'} - P_3U_1 = P(Gr\theta_1 - GcC_1) \tag{20}$$

where

$$\frac{i\omega}{4} + \frac{1}{K} + \frac{M(1-im)}{(1+m^2)} = P_2$$

$$1 - \frac{Ki\omega}{4} = P_1$$

$$\frac{P_2}{P_1} = P_3; \frac{1}{P_1} = P$$

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$$\frac{1}{4}\frac{\partial\theta}{\partial t} - \frac{\partial\theta}{\partial\eta} = \frac{1}{Pr}\frac{\partial^2\theta}{\partial\eta^2}$$

$$\frac{1}{4}\theta_1(\eta)e^{i\omega t}i\omega - \theta_1^{'}(\eta)e^{i\omega t} = \frac{1}{Pr}\theta_1^{''}(\eta)e^{i\omega t}$$

$$\theta_1^{''} + Pr\theta_1^{'} - \frac{Pr}{4}i\omega\theta_1 = 0 \tag{21}$$

$$\frac{1}{4}\frac{\partial C}{\partial t} - \frac{\partial C}{\partial\eta} = \frac{1}{Sc}\frac{\partial^2 C}{\partial\eta^2}$$

$$\frac{1}{4}C_1(\eta)e^{i\omega t}i\omega - C_1^{'}(\eta)e^{i\omega t} = \frac{1}{Sc}C_1^{''}(\eta)e^{i\omega t}$$

$$C_1^{''} + ScC_1^{'} - \frac{Sc}{4}i\omega C_1 = 0 \tag{22}$$

Now the boundary conditions becomes

$$\left.\begin{aligned} &\frac{\partial U_1}{\partial\eta} = 0 \; at \; \eta = 0; \; U_1 = \lambda\frac{\partial U_1}{\partial\eta} \; at \; \eta = 1 \\ &\frac{\partial\theta_1}{\partial\eta} = 0 \; at \; \eta = 0; \; \theta_1 = 1 \; at \; \eta = 1 \\ &\frac{\partial C_1}{\partial\eta} = 0 \; at \; \eta = 0; \; C_1 = 1 \; at \; \eta = 1 \end{aligned}\right\} \tag{23}$$

Solving the equations (20),(21) and (22) using the boundary conditions equation (23) we obtain the velocity profile, temperature profile and concentration distribution.

$$U_1 = A_5e^{m_5\eta} + A_6e^{m_6\eta} + D_3e^{m_3\eta} + D_4e^{m_4\eta} + D_1e^{m_1\eta} + D_2e^{m_2\eta}$$

The velocity profile is

$$U = (A_5e^{m_5\eta} + A_6e^{m_6\eta} + D_3e^{m_3\eta} + D_4e^{m_4\eta} + D_1e^{m_1\eta} + D_2e^{m_2\eta})e^{i\omega t} \tag{24}$$

$$\theta_1 = A_3e^{m_3\eta} + A_4e^{m_4\eta}$$

The temperature profile is

$$\theta = (A_3e^{m_3\eta} + A_4e^{m_4\eta})e^{i\omega t} \tag{25}$$

$$C_1 = A_1e^{m_1\eta} + A_2e^{m_2\eta}$$

The concentration distribution is

$$C = (A_1e^{m_1\eta} + A_2e^{m_2\eta})e^{i\omega t} \tag{26}$$

Using the boundary condition equation (23), the values of the co- efficient A1, A2, A3, A4, A5, A6, D1, D2 ,D3 ,D4, m1, m2, m3, m4, m5 ,m6 are obtained. Using the equation (24), the skin-friction or the wall shear stress is

$$\tau = \left[\frac{\partial U}{\partial\eta}\right]_{\eta=0}$$

$$\frac{\partial U}{\partial \eta} = [A_5 e^{m_5\eta} m_5 + A_6 e^{m_6\eta} m_6 + D_3 e^{m_3\eta} m_3 + D_4 e^{m_4\eta} m_4 + D_1 e^{m_1\eta} m_1 + D_2 e^{m_2\eta} m_2] e^{i\omega t}$$

$$\tau = \left[\mu \frac{\partial U}{\partial \eta}\right]_{\eta=0} = [A_5 m_5 + A_6 m_6 + D_3 m_3 + D_4 m_4 + D_1 m_1 + D_2 m_2] e^{i\omega t} \tag{27}$$

Using the equation (25), the Nusselt number or the rate of heat transfer is

$$Nu = \left[\frac{\partial \theta}{\partial \eta}\right]_{\eta=0}$$

$$\frac{\partial \theta}{\partial \eta} = [A_3 e^{m_3\eta} m_3 + A_4 e^{m_4\eta} m_4] e^{i\omega t}$$

$$Nu = \left[\frac{\partial \theta}{\partial \eta}\right]_{\eta=0} = [A_3 m_3 + A_4 m_4] e^{i\omega t} \tag{28}$$

Using the equation (26), the Sherwood number or the rate of mass transfer is

$$Sh = \left[\frac{\partial C}{\partial \eta}\right]_{\eta=0}$$

$$\frac{\partial C}{\partial \eta} = [A_1 e^{m_1\eta} m_1 + A_2 e^{m_2\eta} m_2] e^{i\omega t}$$

$$Sh = \left[\frac{\partial C}{\partial \eta}\right]_{\eta=0} = [A_1 m_1 + A_2 m_2] e^{i\omega t} \tag{29}$$

The co-efficients A1, A2, A3, A4, A5, A6, D1, D2 ,D3 ,D4, m1, m2, m3, m4, m5 ,m6 are expressed in the Appendix.

4.RESULTS AND DISCUSSION

The objective of the present analysis is to study the effect of mass transfer and hall current on unsteady oscillatory flow of a viscoelastic fluid through a porous medium. The governing equations of the problem are solved analytically. In order to have an estimate of the quantitative effects of the various parameters involved in the flow analysis, MATLAB 2013a is used to depicted the graphs. The analytical results obtained for velocity, Temperature, Concentration, wall shear stress, rate of heat Transfer or Nusselt number, rate of Mass transfer or Sherwood number (Sh) are computed for various parameters like Hartmann number(M), thermal Grashof number(Gr), mass Grashof number(Gc), Prandtl number(Pr),Schmidt number(Sc).

Figure 1 , shows the fluid velocity for different values of Hartmann number(M). It is clear from the figure that an increase in the Hartmann number(M) increases the fluid velocity. It is observed that the maximum flow occurs in the presence of magnetic field. Figure 2 , shows the fluid velocity for different values of thermal Grashof number(Gr). It is clear from the figure that an increase in the thermal Grashof number(Gr) decreases the fluid velocity. Figure 3, shows that an increase in the mass Grashof number(Gc) increases the fluid velocity. Figure 4 , shows that an increase in the hall parameter(m) increases the velocity of the fluid (u). Figure 5, shows that an increase in the Viscoelastic parameter(K) increases the fluid velocity. Figure 6 , shows the fluid velocity for different values of Schmidt number(Sc). It is clear from the figure that an increase in the Schmidt number(Sc) increases the fluid velocity. Figure 7, shows that an increase in the Prandtl number(Pr) decreases the temperature (θ) of the fluid.

Figure 8 , shows the fluid concentration for different values of Schmidt number(Sc). It is clear from the figure that an increase in the Schmidt number(Sc)decreases the concentration (θ) of the fluid Figure 9 ,that an increase in the Hartmann number(M) decreases the skin friction of the fluid.This is because of the reason that effects of a transverse magnetic field on an electrically conducting fluid gives rise to a resistive type force called Lorentz force which is similar to drag force and upon increasing the values of M increases the drag force which has tendency to slow down the motion of the fluid. Figure 10 , shows that an increase in the Prandtl number(Pr) decreases the wall shear stress of the fluid. Figure 11 , shows that an increase in the Schmidt number(Sc) decreases the the Wall shear stress (τ).
Figure 12 , shows the Wall shear stress (τ) for different values of thermal Grashof number(Gr). It is clear from the figure that an increase in the thermal Grashof number(Gr) decreases the fluid velocity Wall shear stress (τ).Figure 13,shows that an increase in the mass Grashof number(Gc) decreases the Wall shear stress (τ). Finally the Figure 14, shows the Sherwood number (Sh) or the rate of mass transfer decreases for the increasing values of the Schmidt number (Sc).

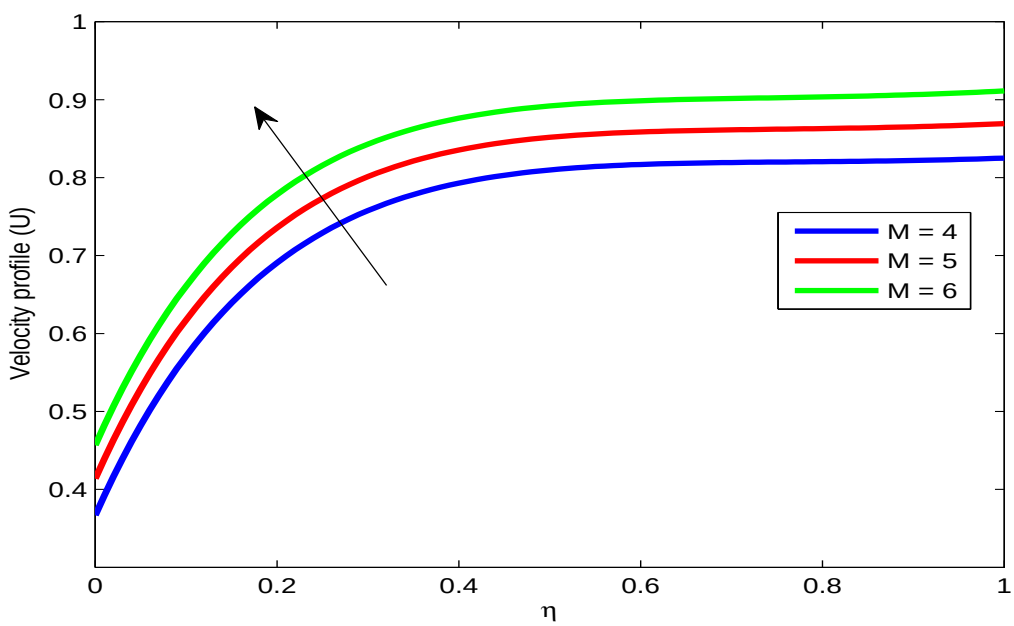

Figure 1: Variation of velocity (U) for different values of Hartmann number(M) for fixed $Sc = 2, Pr = 0.8, Gr = 4, Gc = 7, m = 0.5, K = 0.08, \lambda = 1$

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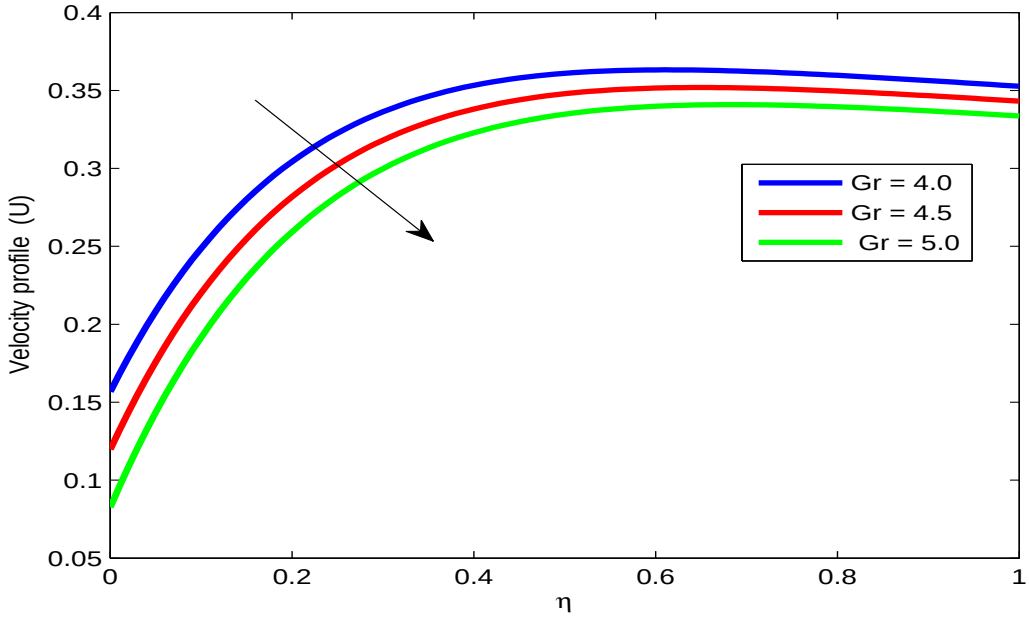

Figure 2: Variation of velocity (U) for different values of thermal Grashof number (Gr) for fixed $Sc = 2, Pr = 0.8, M = 5, Gc = 7, m = 0.5, K = 0.08, \lambda = 1$

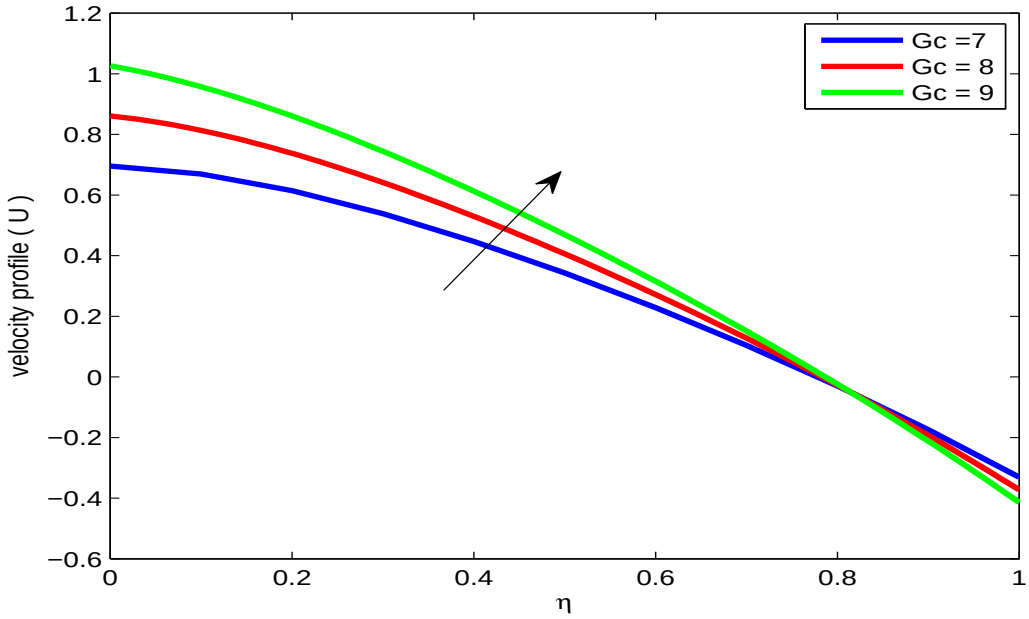

Figure 3: Variation of velocity (U) for different values of mass Grashof number(Gc) for fixed $Sc = 2, Pr = 0.8, Gr = 4, M = 5, m = 0.5, K = 0.08, \lambda = 1$

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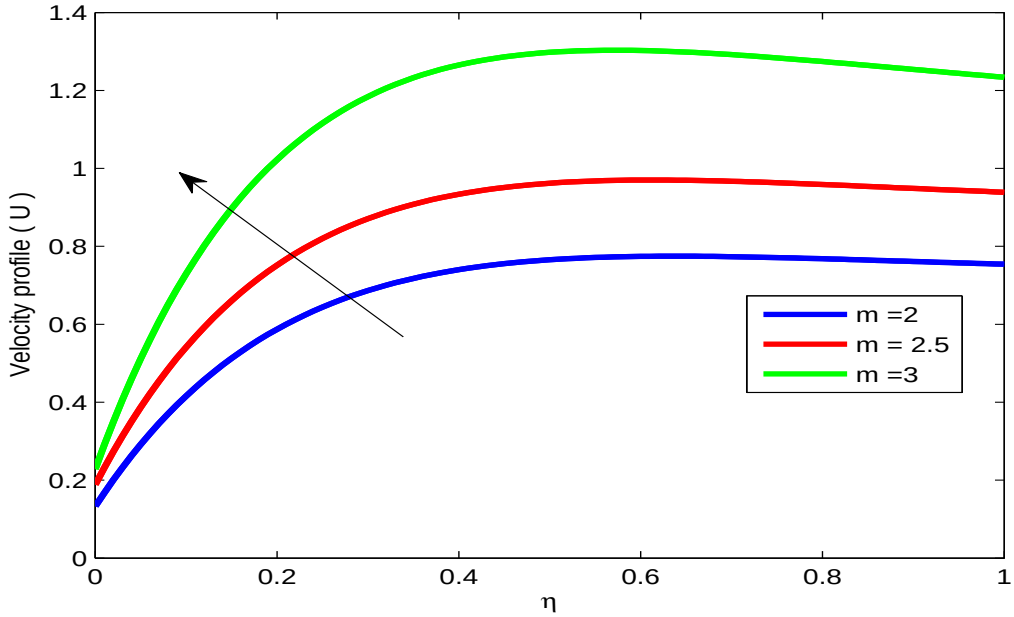

Figure 4: Variation of velocity (U) for different values of mass Hall parameter(m) for fixed $Sc = 2, Pr = 0.8, Gr = 4, Gc = 7, M = 5, K = 0.08, \lambda = 1$

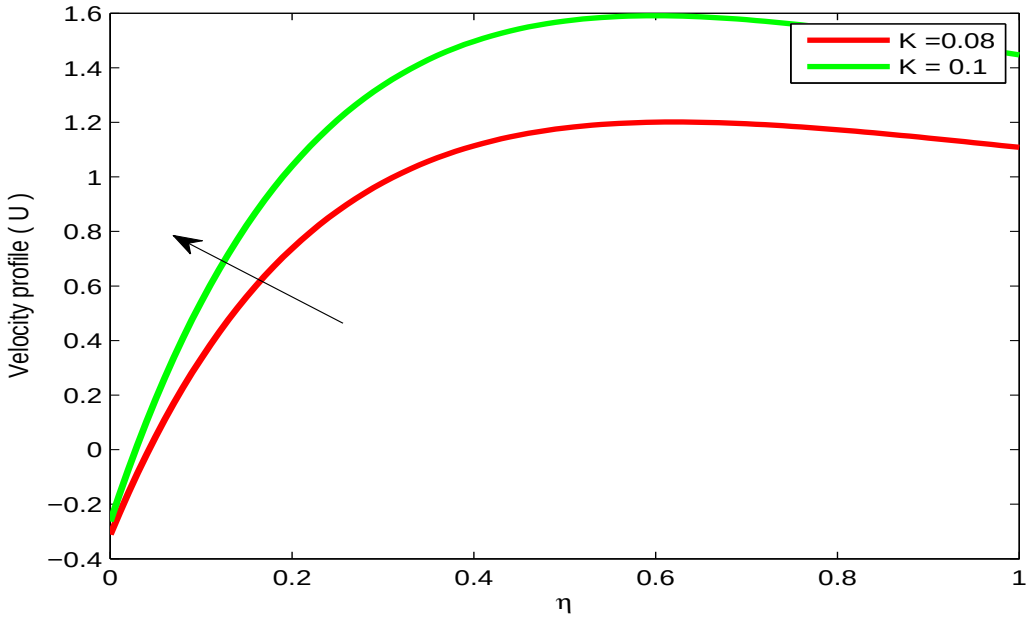

Figure 5: Variation of velocity (U) for different values of Viscoelastic parameter(K) for fixed $Sc = 2, Pr = 0.8, Gr = 4, M = 5, m = 0.5, \lambda = 1$

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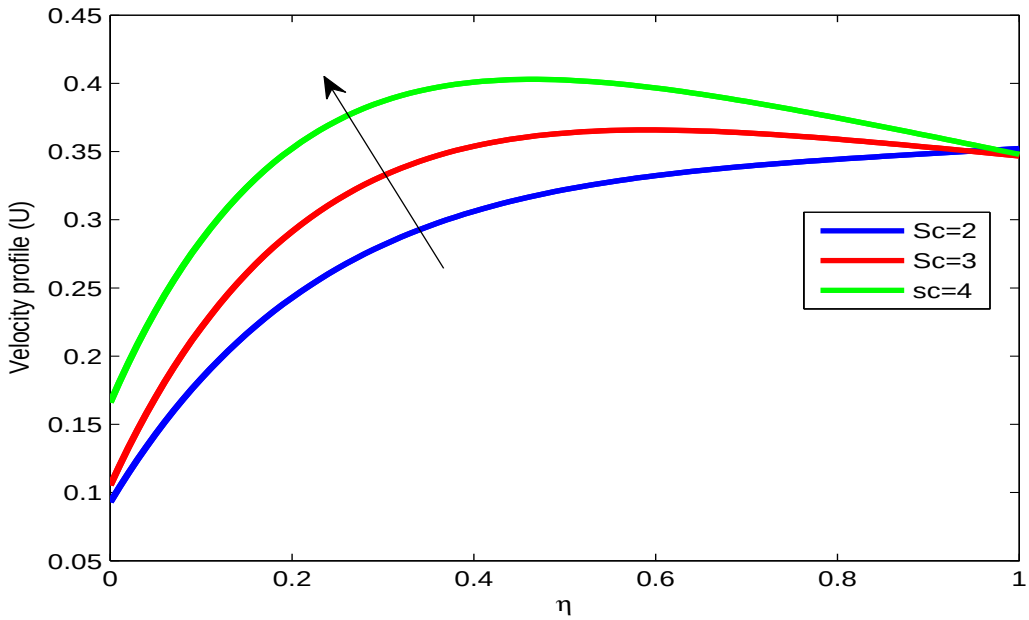

Figure 6: Variation of velocity (U) for different values of Schmidt number(Sc) for fixed $Pr = 0.8, Gr = 4, Gc = 7, M = 4, m = 0.5, K = 0.08, \lambda = 1$

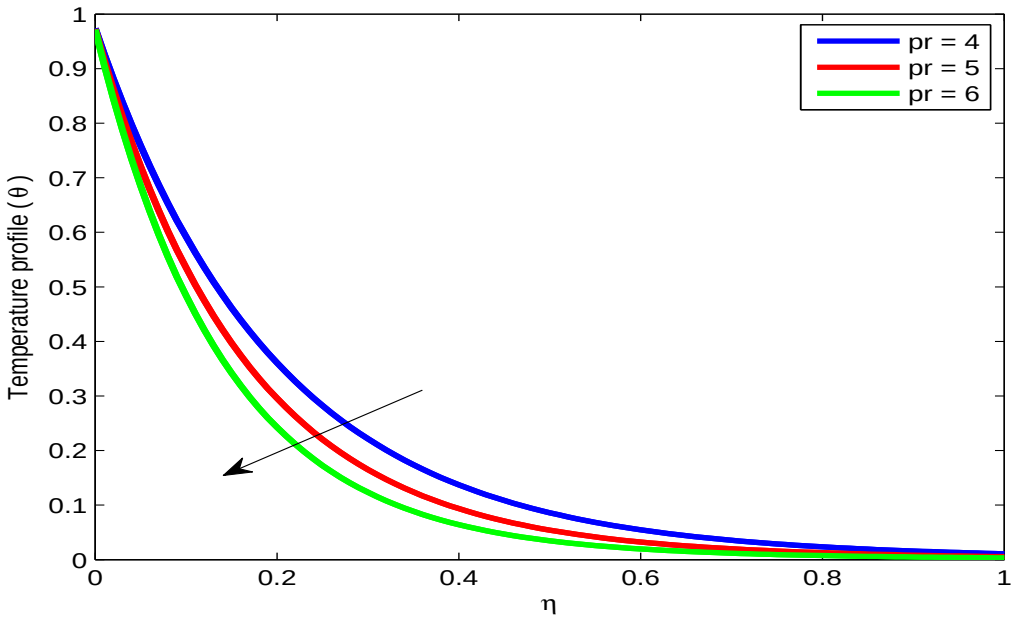

Figure 7: Variation of Temperature (θ) for different values of Prandtl number(Pr) for fixed $\omega = 1$

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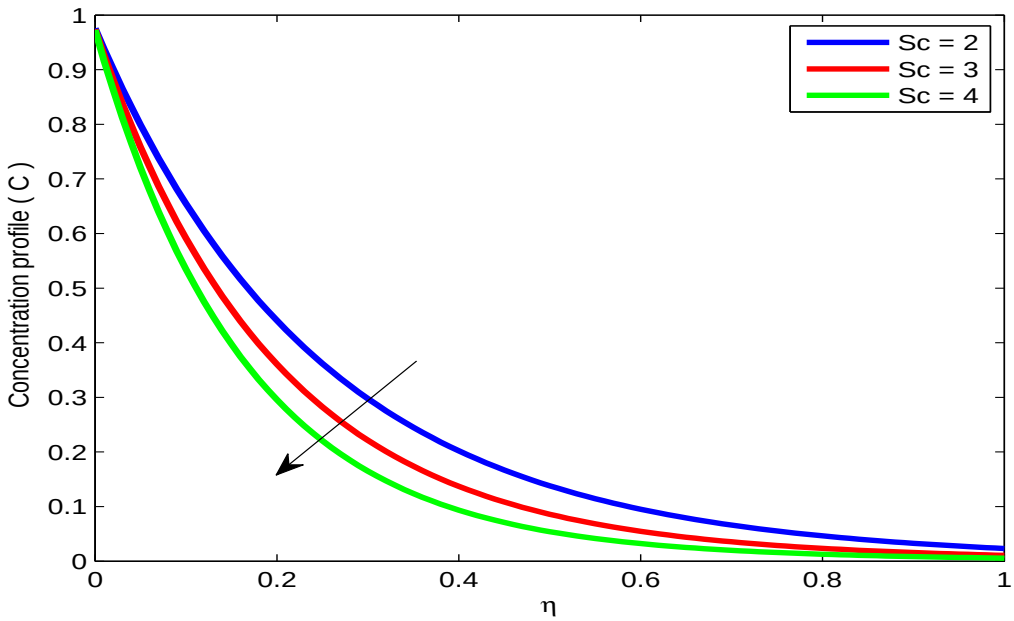

Figure 8: Variation of Concentration(C) for different values of Schmidt number(Sc) for fixed $\omega = 1$

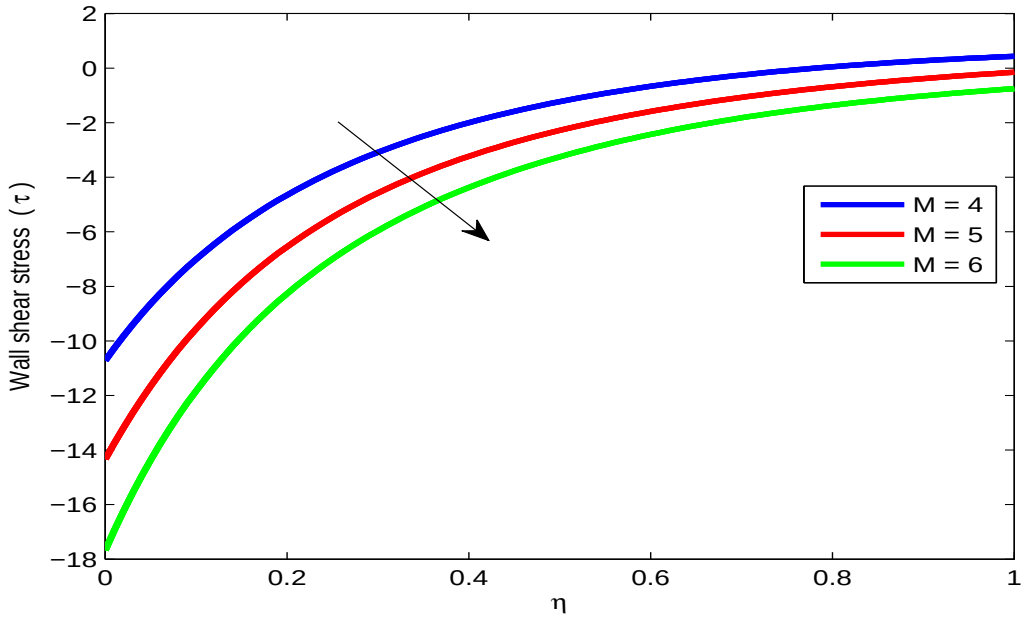

Figure 9: Variation of Wall shear stress(τ) for different values of Hartmann number(M) for fixed $Sc = 2, Pr = 3, Gr = 4, Gc = 7, m = 0.5, K = 0.07\lambda = 1$

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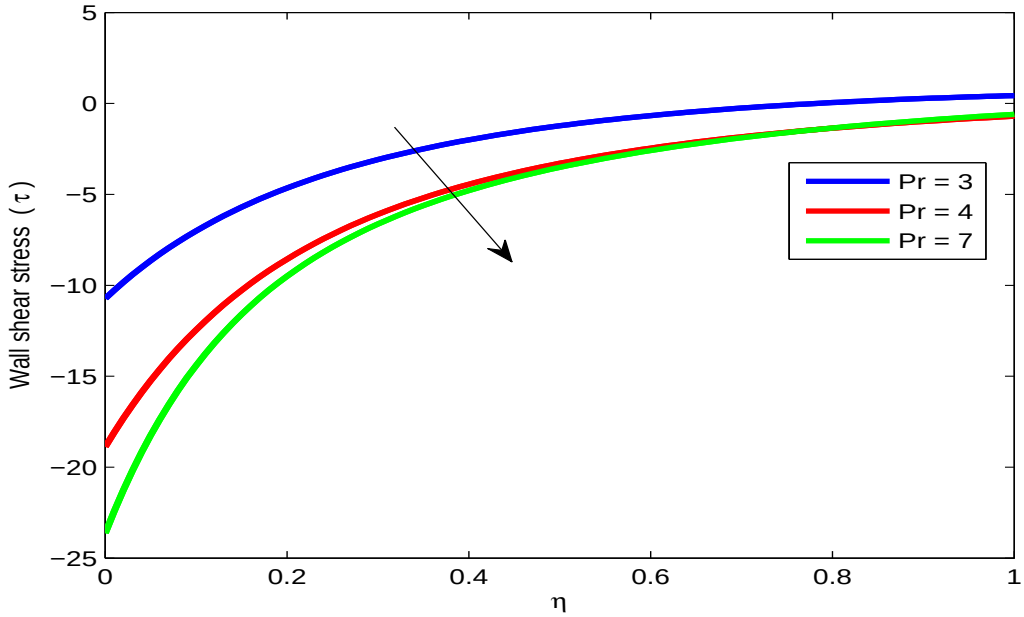

Figure 10: Wall shear stress(τ) for different values of for different values of Prandtl number(Pr) for fixed $Sc = 2, M = 5, , Gr = 4, Gc = 7, m = 0.5, K = 0.08, \lambda = 1$

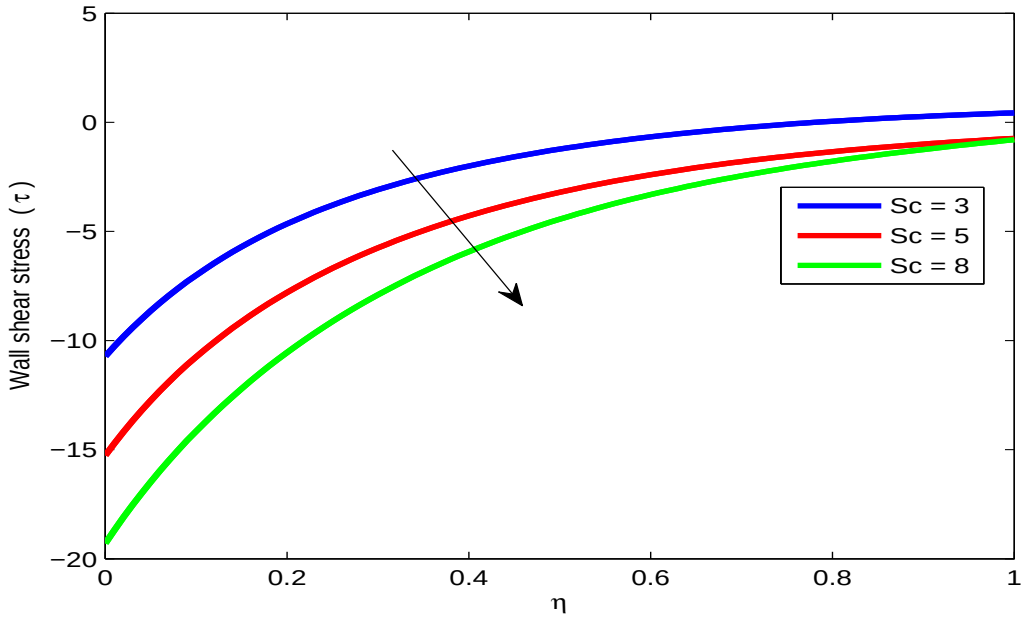

Figure 11: Variation of Wall shear stress(τ) for different values of Schmidt number(Sc) for fixed $Pr = 3, Gr = 4, Gc = 7, M = 4, m = 0.5, K = 0.08, \lambda = 1$

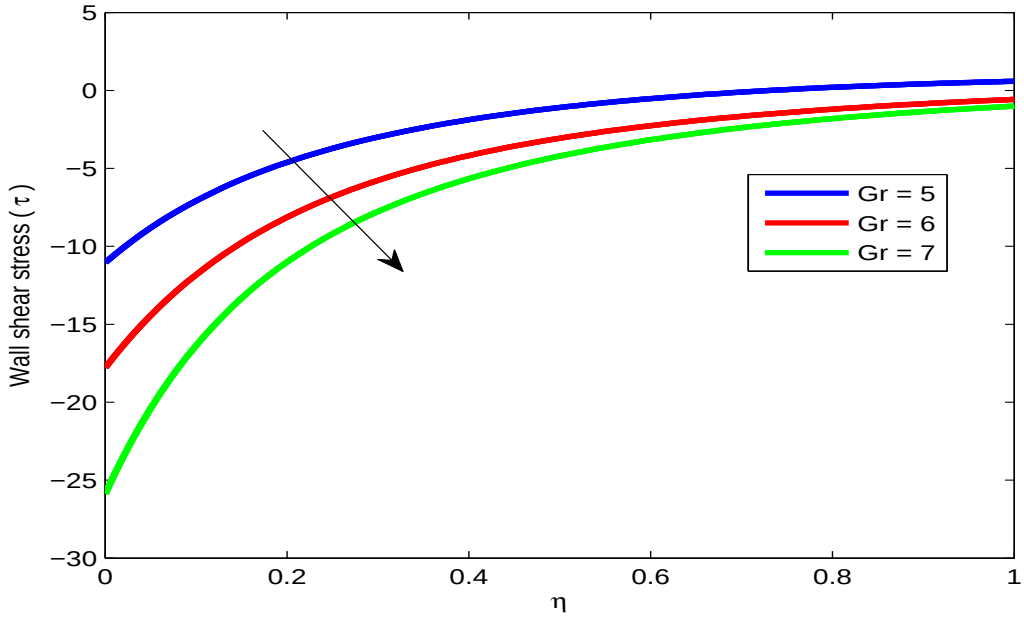

Figure 12: Variation Wall shear stress(τ) for different values of thermal Grashof number (Gr) for fixed $Sc = 2, Pr = 0.8, M = 5, Gc = 7, m = 0.5, K = 0.08, \lambda = 1$

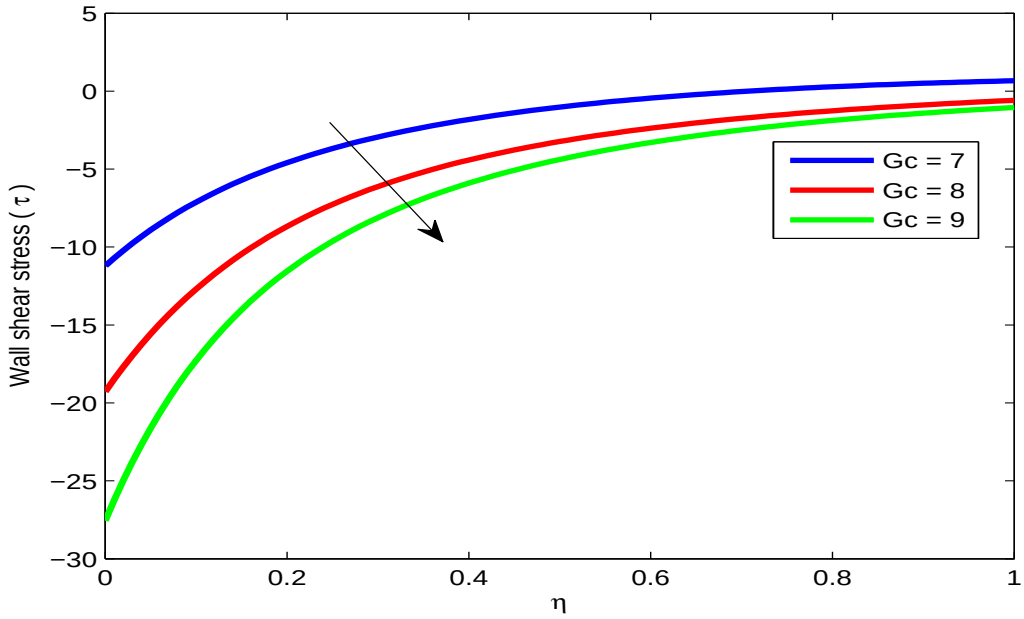

Figure 13: Variation Wall shear stress(τ) for different values of mass Grashof number (Gc) for fixed $Sc = 2, Pr = 3, M = 5, Gr = 5, m = 0.5, K = 0.08, \lambda = 1$

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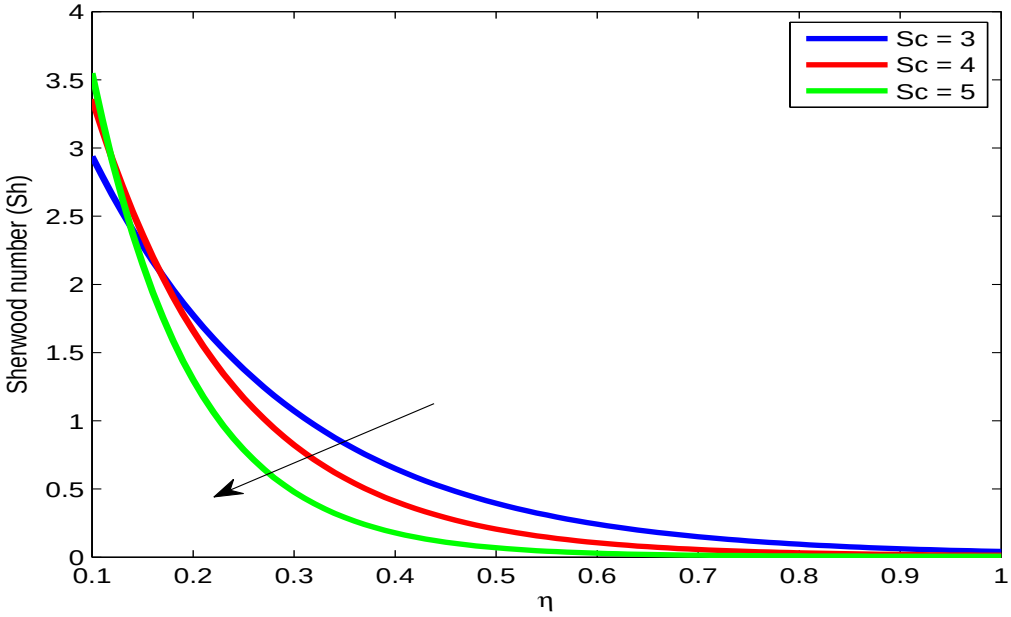

Figure 14: Variation of Sherwood number (Sh) for differnt values of Schmidt number(Sc) for fixed $\omega = 1$

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Appendix

$$m_1 = \frac{-Sc + \sqrt{(Sc)^2 + i\omega Sc}}{2}$$
$$m_2 = \frac{-Sc - \sqrt{(Sc)^2 + i\omega Sc}}{2}$$
$$m_3 = \frac{-Pr + \sqrt{(Sc)^2 + i\omega Pr}}{2}$$
$$m_4 = \frac{-Pr - \sqrt{(Sc)^2 + i\omega Pr}}{2}$$
$$m_5 = \frac{-P + \sqrt{P^2 + 4P_3}}{2}$$
$$m_6 = \frac{-P - \sqrt{P^2 + 4P_3}}{2}$$
$$D_1 = \frac{PGrA_3e^{m_3\eta}}{m_3^2 + Pm_3 - P_3}$$
$$D_2 = \frac{PGrA_4e^{m_4\eta}}{m_4^2 + Pm_4 - P_3}$$
$$D_3 = \frac{PGcA_1e^{m_1\eta}}{m_1^2 + Pm_1 - P_3}$$
$$D_4 = \frac{PGcA_2e^{m_2\eta}}{m_2^2 + Pm_2 - P_3}$$
$$A_1 = \frac{m_2}{m_2e^{m_1} - m_1e^{m_2}}$$
$$A_2 = \frac{-m_1}{m_2e^{m_1} - m_1e^{m_2}}$$
$$A_3 = \frac{-m_3}{m_4e^{m_3} - m_3e^{m_4}}$$
$$A_4 = \frac{m_4}{m_4e^{m_3} - m_3e^{m_4}}$$
$$A_5 = \frac{(A_6m_6 + D_3m_3 + D_4m_4 + D_1m_1 + D_2m_2)}{m_5}$$
$$A_6 = \frac{\begin{array}{l}\{D_3(m_5e^{m_3}(1-\lambda m_3) - m_3e^{m_5}(1-\lambda m_5)) + D_4(m_5e^{m_4}(1-\lambda m_4) \\ \quad - m_4e^{m_5}(1-\lambda m_5)) + D_1(m_5e^{m_1}(1-\lambda m_1) - m_1e^{m_5}(1-\lambda m_5)) \\ \quad + D_2(m_5e^{m_2}(1-\lambda m_2) - m_2e^{m_5}(1-\lambda m_5))\}\end{array}}{[m_6e^{m_5}(1-\lambda m_5) - m_5e^{m_6}(1-\lambda m_6)]}$$

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Frauds Avoidance of Digital Educational Certificates Using Blockchain

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Abstract- This research paper highlights the Blockchain technology for the educational certificates. The current paper proposed that Blockchain can be used to secure the educational data like academic credentials and academic certificates. This paper first introduces the core problem which we are facing in the educational sector and then talk about some use cases in education using Blockchain. We are using the Blockchain to reduce the frauds in education institutions. Another benefit of using Blockchain technology is to reduce the data management costs. Blockchain technology permits for consumers to verify the validity of certificates straight against the Blockchain, without the requirement to communicate with the organization that initially delivered them. At the end we will compare our proposed model with some other Blockchain models in education. This Blockchain technology can also be implemented for many other educational data with a little changes.

Index Terms- Blockchain, Frauds, Cost management, Bitcoin, Education, Security, Certificates, CAs, Third parties, Sharing, Ethereum

I. Introduction

Blockchain is a decentralized transaction and data management technology developed first for Bitcoin cryptocurrency [1]. Currently Blockchain technology can be seen in various fields such as cryptocurrencies in the financial area like Bitcoin, Ethereum, and Zcash etc [2]. Just like other industries, Blockchain has power to revolutionize the future of education. First of all we can deliberate our problem statement in education. Why Blockchain is important in education? Our educational system is centralized. All the educational certificates and other information are mainly managed by schools, colleges or universities. Our first and foremost problem in education is the fraudulent and illegitimate academic documentation. People want quick access to postsecondary or tertiary education so they obtain an illegal way to find fake certificates. A good example of fake certificates are "Diploma Mills". It can be easily generated by modern technology [3]. Some of the universities like Linköping University are issuing digital certificates. And no doubt that these digital certificates have reduced the waiting time for students. But still in this case hacking and modification is easy by hackers, if they access the administration access [4]. "Blockchain records are stored permanently, so documents such as degrees and course certificates can be secured and verified, regardless of whether or not a user has access to an institution's record-keeping system [5]."

The second problem is mutual verification done by institutions. In education system, manual verification is almost impossible due to bulk amount of data. Blockchain can eliminate fraud by avoiding manual verification of transcripts and other documents. Blockchain is a distributed database solution that maintains a continuously growing list of data records that are confirmed by the nodes participating in it. The best thing in the Blockchain is that all the nodes are all anonymous [1]. The third challenge in education industry is the sharing of documents and academic certificate in a safe and quick way. The Blockchain can give an opportunity for users or students to independently and privately verify that shared records are authentic and unadulterated.

Why we need a system for all educational certificates? We need a secure system to manage and authenticate all the student records. Mostly the authentication can be done by the schools, universities or an education commission by manual way. With the invention of this system, students can check and even manage their records easily, universities can authenticate the degrees and certificates by a secure and quick way. The most important feature is the detection of the frauds in the educational sector. Until so far, there is no standard platform for the online authentication of the educational records. Within education, activities likely to be disrupted by Blockchain technology include the award of qualifications, licensing and accreditation, management of student records, intellectual property management and payments Blockchain technology will provide Self-sovereignty, Trust, Transparency & Provenance, Immutability, Disintermediation and Collaboration [1]. What is the big challenge in the educational section? There is a constant regulations in the education sector. This problem is making an expectation gap because students want their needs met quickly and with zero error [5].

What we are going to do? We are making Blockchain smart contacts in the education sector. Everyone will have a smart contact. These smart contact can be tracked and managed with a minimum of effort. We can even link two or more smart contact. By doing this, two or more universities can be linked publically and they can share their records with imitations of access. Distributed ledger technology could help ease other administrative burdens as well [6].

II. Research Background

Blockchain is still new in education so there are not too many research papers on it. There is a prototype of educational certificate developed at the MIT Media Lab and by Learning Machine which is named as Blockcerts. Blockcerts is the first open standard for creating, issuing, viewing, and verifying Blockchain-based certificates [7]. There are several papers written on securing educational credentials. Educational Credentials must transferred in secure way. There is already a detailed publication by the Joint Research Centre (JRC), the European Commission's science and knowledge service on this topic. This paper presents the fundamental principles of the Blockchain focusing on its potential for the education sector [1]. This research paper has the same agenda but it try to hide some of their limitations. The JRC paper did not describe the cryptographic techniques but we will discuss some use cases to get some useful results by using cryptographic techniques. There is another recent research on education done by Cognizant. They discussed the 5 use cases in the Blockchain. They filled some gaps which were left by JRC research. They gave a detailed overview that how a student can store her information by using digital certificates.

Both of these paper covers the basics of Blockchain and how it work? But the use cases discussed in the both papers are totally different. We also got many information from some websites about the application of Blockchain in education. Like VTRADEtech discussed the use of Blockchain in primary schools. They are also agreed that keeping the records on a Blockchain-based system allows schools to assure the authenticity of any certificates and decrease the frauds [6]. Our main concentration of this paper is to furnish the existing use cases discussed in the recent research. We covered more use cases for writing this research paper. Of course, we took help from previous papers to apply the same methods but with some recent advances. We are going to provide a complete flowchart of our use cases. We will also make a prototype to prove some of the hypothesis done by JRC. Our main motive is to explore the limitations of previous research. Blockchain technology is growing really fast. Almost, 90% of European countries banks were reconnoitering Blockchain in 2018. It is estimated that the Blockchain market will upswing up to 20 billion dollars till 2024. Internet of Things (IoT) is struggling to make our lives better [9]. More and more people are involving in this technology and fresh revolutions can be grasped every day.

III. Method

We followed some steps for our research methodology. First one is literature review. Literature review can provide a systematic review and can increase the efficiency of our research paper. In the first method, we gathered the data from internet. This is a significant step to review the detailed procedure of Blockchain and it has many other aspects. This method also helped us to eliminate the irrelevant articles for research work and it also check the quality of the recent articles. Next step was the extracting the data from the selected articles. We only extract the data which are related to our problem statements. We searched the data from famous websites ACM Digital Library, Google Scholar, and IEEE Explore to find the relevant articles for our topic. Last step is to analyze the information which is collected by the previous steps. We also analyzed the Bitcoin to implement the technology of Bitcoin in the educational sector. The following section will describe how these steps were performed to make the use cases to reduce the frauds in education institutions.

All the research paper is based on three problem statements

Why Blockchain is important in education?

How mutual verification is done by institutions?

Why we need a system for all educational certificates?

In the first procedure, based on our problem statements we formulated some search query strings like "Blockchain and Education", "Application of Blockchain in Education" and so on (see Table 1).

Table 1. Searched Query Strings

Database	Query Strings
ACM digital library	(Blockchain in Education), (Application of Blockchain in Education), (Blockchain and Education), (Blockchain and Digital Certificates) and (Securing Educational certificates by Blockchain), (Certificates management)
IEEE Xplore	(Blockchain in Education), (Application of Blockchain in Education), (Blockchain and Education), (Blockchain and Digital Certificates) and (Securing Educational certificates by Blockchain), (Digital Certificates)
Google Scholar	(Blockchain in Education), (Application of Blockchain in Education), (Blockchain and Education), (Certificates management)

Next step is to exclude the articles and we defined some criteria to skip the articles. An article was declined if 1) it's not in English language. 2) If paper is available but incomplete. 3) If it's based on old technology 4) if it's more theoretical and not practical. 5) The articles having duplicate material also removed. In the last step, data was analyzed. We mostly focused on the headings in the selected articles like abstract, applications, drawbacks, future works, conclusion and challenges. We wrote all the use cases by the data analysis of all these headings.

IV. Use Cases

We developed three use cases based on asymmetrical cryptography. Our first use case is generation of digital certificate.

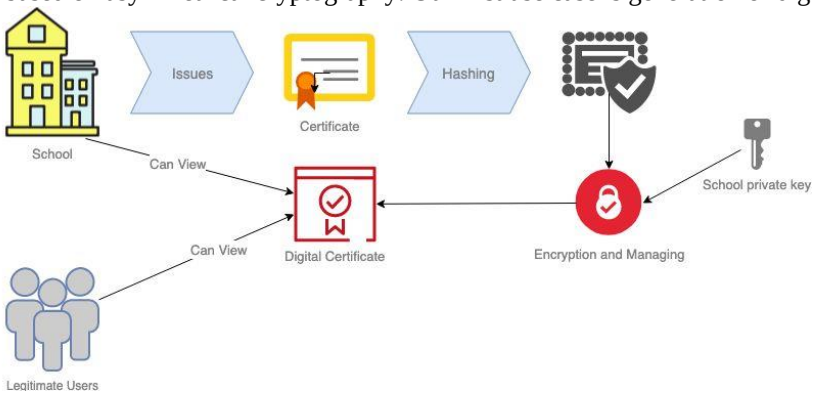

Figure 1: Creation of digital Certificate

1. The procedure of creating a digital certificate is really simple. This procedure is done by the school using some tools. First step is to hashed the certificate and generate a fixed length code. Next step is to use the asymmetric algorithm to generate the digital certificate by using school private key. This digital certificate is added to Blockchain and any legitimate user can see these details. A use case diagram is shown below. By using asymmetric cryptography we can also confirm that only school has the right to build this certificate. And only those users can view the certificates who are legitimate users. Once your information entered in Blockchain, then it's neither get lost nor tampered.

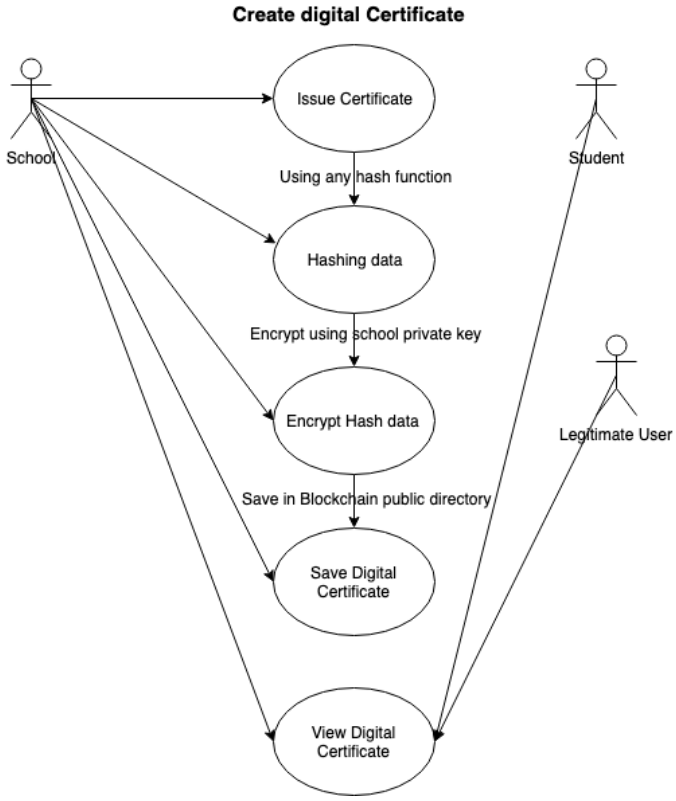

Figure 2: Use Case Diagram for Creation of digital certificate

2. The second use case is the verification of the digital certificate. As we know our second problem that "**Manual verification is impossible.**" Blockchain provides a perfect solution for verification. "Verifiability, for instance of the authenticity of academic qualifications, is a very important capability: Blockchain enables you to check that a record was genuinely made by who it says that it

was made, and that its content has not been tampered with. Another capability is that it is a 'multi-write database': it allows records to be added by different parties who do not necessarily trust each other. These parties should also be interested in the same data [8]." This kind of verification can eliminate the manual work and many middle parties which are involved in the verification of documents. It can also save significant amount of time and money.

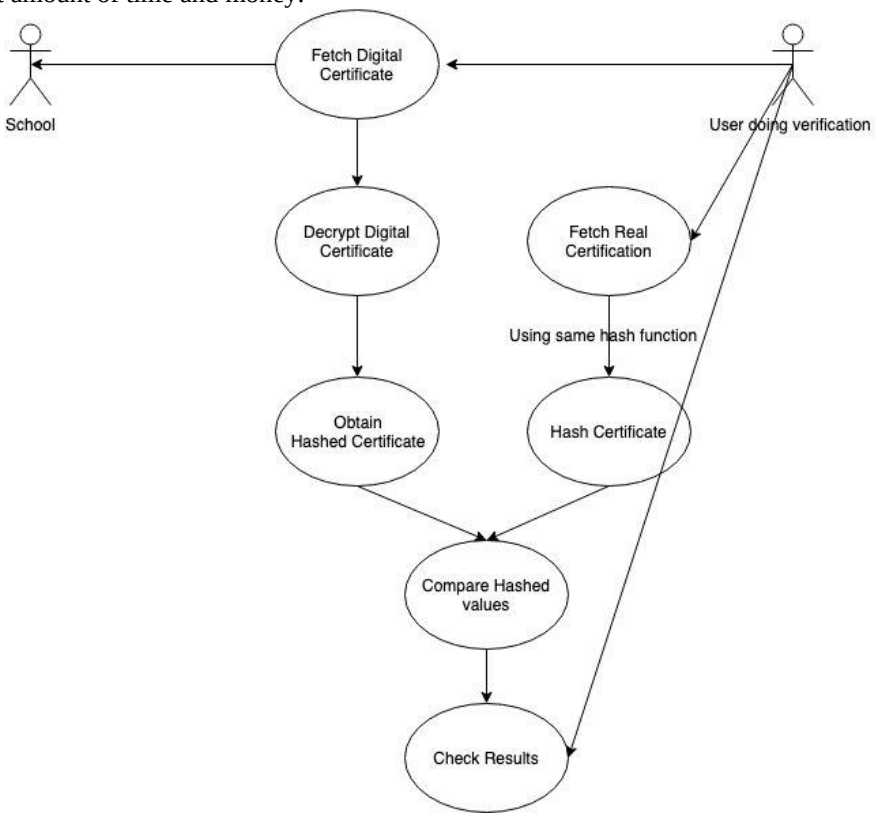

Figure 3: Verification of Digital Certificate

3. Once you got certificates from your school and it's also verified. The next step is sharing. You can be anyone, a Job seeker, advance learner or Job providers. Once your data is on Blockchain. There is no need for trusted parties or CAs. Anyone can authenticate educational certificates without interference from the certificate publisher. It's also simple to share the certificates with others using Blockchain. You just need to send a URL or badge via email or social media. There is no need to authenticate the certificates again and again once it is placed on the Blockchain.

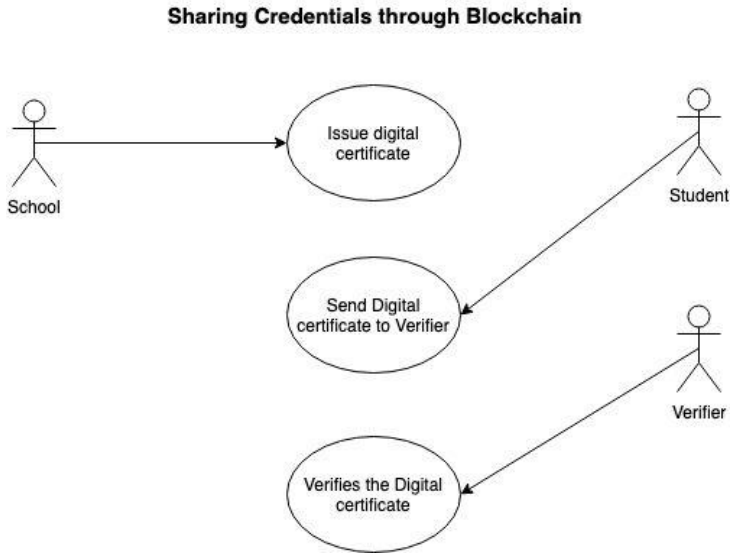

Figure 4: Sharing Credentials through Blockchain

V. CONCLUSION

What's the biggest problem in education section? Education is facing huge problem of frauds and tampering. U.S.-based Council for Higher Education Accreditation has projected that almost 100,000 fake degrees are sold yearly. One of the law professors from Ohio State also noticed that there are almost 500,000 Americans, who are having fake degrees. No doubt that universities are working to secure their credentials but still it's not enough. What we did in this research? We gave a Blockchain-enabled solution to verify the degrees issued by accredited universities to save time and money of students. These use cases can become a solid base for the implementation of fraud avoidance in education. We proposed a Blockchain certification platform to avoid from the CAs in school. Many big companies are working on it like IBM, Sony, MachineLearning, Blockcerts and RecordsKeeper.[10].

What can Blockchain do in future? Blockchain can overcome the loopholes in the current system. If we take the example of Bitcoin then it can be replaced with the PayPal or other money exchange system. Ethereum can make the world smarter and faster with more flexible smart contracts. If we relate this Blockchain technology back with the internet technology then both have something common. For the internet, no one cares today. For Blockchain, no one will care tomorrow.

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Hearing Loss: A Sequela of Prematurity: A Case Study

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Abstract*: Hearing impairment becomes a very common sensory deficit seen in premature infants and its association has long been recognized. Understanding the principal lead for hearing impairment in pre-term infants becomes difficult as they show spectrum of high-risk registers which may contribute to the hearing loss. An 8-month- old preterm baby was reported with the complaint of hard of hearing and failure of OAE tests. A detailed Audiological evaluation was done and the baby was diagnosed to have severe to profound hearing loss in both the ears. Further counseling was given regarding the better management options available. Objective of this case study is to show the prime pathophysiology behind the possible etiological factors for hearing loss and to emphasize the need for a detailed Audiological evaluation in preterm infants.*

Keywords*:* pre-term, high-risk registers, hearing loss, audiological evaluation.

1.Introduction

Prematurity is defined as the birth of the child before 37 weeks of gestation (World Health Organization, 2015). It is categorized as Late preterm, born between 34 and 36 completed weeks of pregnancy, Moderately preterm, born between 32 and 34 weeks of pregnancy, Very preterm, born at less than 32 weeks of pregnancy and Extremely preterm, born at or before 25 weeks of pregnancy.

The major causes of prematurity are conceiving through in vitro fertilization, problems with uterus, cervix or placenta, previous history of miscarriage or abortions, physical injury or trauma, intrauterine infections, vaginal bleeding, high blood pressure for the mother [1]. Hearing loss result as a consequence of prematurity [2]. The prevalence of hearing impairment is estimated to be 1 – 3% among the premature population and it may vary depending on associated risk factors that accompany [4].

Some high risk factors for hearing impairment in premature infants includes a family history of hearing loss, craniofacial anomalies, congenital anomalies in relation with congenital hearing loss , congenital infections(TORCH complex), very low birth weight (<1500g), low APGAR score, hyperbilirubinemia, ototoxic medications, bacterial meningitis which require mechanical ventilation and intensive care[2]. They have a higher probability of acquiring conditions such as sepsis, iron deficiency anemia, hypoxia, respiratory distress syndrome followed by which the prolonged intensive care with incubation and ventilation, antibiotic courses that are ototoxic may be given. These may in turn affects the otolith organs [2].

Since they have a better chance of acquiring hearing loss, it is therefore important to carry out a detailed Audiological Evaluation in order to categorize the diagnosis accurately and provide appropriate recommendations to prevent the difficulties faced by a hearing handicapped.

2.Case Study

An 8-Month-old/male baby was brought to the department of Audiology for a detailed Audiological evaluation in MERF Institute of Speech and Hearing (P)LTD on 10/09/2019, with the complaint of hard of hearing and delayed speech and language development. The onset of the problem was reported to be congenital and the severity has remained unchanged. Hearing screening was done by 8 months which revealed “Refer” in OAE test.

Pre-natal history revealed that the mother was under medication for calcium. Peri-natal history revealed pre-term delivery e with a low birth weight of 1.35kgs, APGAR score obtained was 7/10. Post-natal history revealed that the child had respiratory distress and neonatal sepsis, for which the child was shifted to SNCU (Sick Newborn Care Unit) and was under CPAP (Continuous Positive Airway Pressure). Pulmonary surfactant and antibiotics (AMIKACIN 20mg)

were stepped up. On day 5, there was a setback with intermittent gasping respiration, mottling of skin, tachycardia, and fresh bleed from oronasal cavity with apnea. The infant was then incubated and put on ventilator support. FFP (Fresh Frozen Plasma) was transfused. Ophthalmic opinion reveals Retinopathy of Prematurity and a single hemorrhagic spot with exudates in inferonasal region. This is Suggestive of (?) CMV Retinopathy and (?) Anemic Retinopathy. On day 8, the baby was diagnosed to have anemia and advised to have blood transfusion. But, it was denied by the parents and hence, not carried out. The child was further recommended for hearing and vision assessment considering various risk factors. This shows the necessity of carrying out a detailed audiological evaluation in this child.

3.Clinical Audiological Procedure

An Audiological Test Battery Approach begun with a detailed case history, followed by Behavioral and Electrophysiological tests.

Behavioral Observation Audiometry was done and it revealed (?) severe to profound hearing loss.

Immitance Audiometry was done with flute inventis and tympanometry finding shows bilateral 'A' type tympanogram, indicating no middle ear pathology in both the ears.

Oto-acoustic Emission was done with Intelligent hearing system (IHS), finding revealed absent DPOAE's which suggests Outer hair cell dysfunction in both the ears. As it is depicted in the figure A.

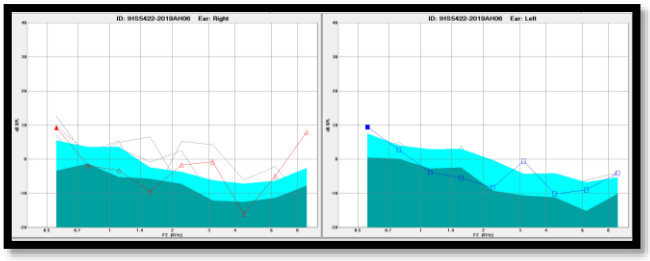

Figure A: Dp Gram showing absences of Dp OAE in both the ears

Auditory Brainstem Response was done using Intelligent hearing system (IHS) and findings shows that ABR V peak could not be obtained at 88dBnHL at the rate of 19.3/s using click stimulus which is presented in both the ears using ER3A-insert hear phones in both rarefaction and condensation polarity. It gives an impression that both ears have severe to profound hearing loss. As it is clearly depicted in the figure B.

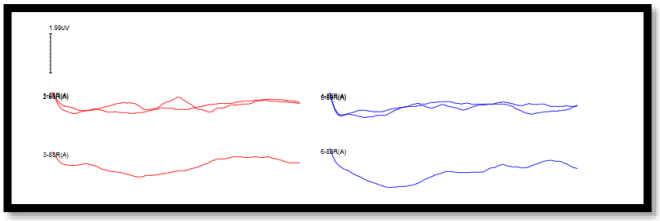

Figure B: ABR Waveform showing absence of Response in both the ears

Hearing Aid Trial was done using Beltone Boost BTE and shows that the aided responses are out of the speech spectrum. This shows hearing aid can only be used for awareness purpose not for speech perception.

Counseling regarding cochlear implant was done and baby was referred to undergo radiological evaluation in order to know the status of cochlear structures and the auditory nerve to continue with further management.

4.Discussion

Hearing loss remains a distinct cause for handicap in surviving pre-term infants and is notably associated with multiple factors than in general newborn population. The pathophysiology of hearing impairment in such infants is quite complicated and prematurity is not the only factor contributing, means that it is also linked with other high risk factors that influence the auditory system and impairing the hearing mechanism. Etiology of hearing impairment in pre-mature neonates is crucial to prevent such impairments, to promote early intervention and to promote better management options and recommendations.

One such factor says that the rapidity of fetal Audiological development occurs, during the course of 33-35 weeks of gestational age, with specific responses to different sound frequencies such as 250,500,1000 and 3000Hz [3]. Therefore, premature infants who are born before a complete development of the auditory system or during these weeks of gestation may pose as a threat for a hearing impairment.

Hearing loss among Low-birth weight infants is a common finding. Pre-term infants, with birth weight of $\leq$ 1500g are at a greater risk for hearing impairment as the incidence of high-risk registers is comparatively more confounding than those with birth weight >1500g. Even though hearing screening for such LBW fails due to transient middle ear fluid accumulation and other conductive hearing loss, it does resolve within weeks of discharge from hospital. The linkage of sensorineural hearing loss in infants with LBW still remains unknown but episodes of other risk-factors such as ototoxic drugs, hyperbilirubinemia, hypoxia, etc. may lead to progressive hearing loss. Moreover, it is also known that hearing impairment in early years and progression in later stages has an impact on central auditory processing and intellectual functioning. Thus, long-term

plans for monitoring the hearing status in infants with LBW and in those exposed to the risk factors are crucial [4]. Male individuals are more prone to the development of hearing loss as they are more vulnerable to severe neo-natal illness, such as sepsis and HMD [8].

In our study, several variables, such as a severe respiratory difficulty resulting from respiratory distress syndrome(hyaline membrane disease) which lacks a molecule surfactant in the immature lungs, are treated and have consequences such as an increased exposure to other risk factors such as acidosis, antibiotic courses, prolonged incubator and ventilator noise, which may result in hearing impairment and other neurological impairments[8].

Aminoglycosides and Non-Aminoglycosides have deleterious impacts in the cochlea and vestibular organs by causing hair cell death. Aminoglycosides that are cochlear specific contains neomycin, amikacin, kanamycin and vestibular specific drugs contains gentamycin, tobramycin and streptomycin. The pathophysiology behind these drugs show that the ionic currents are blocked via mechanoelectrical transduction channels in stereocilia which are then taken by the hair cells via apical endocytosis. Free radicals are formed that lead to cell damage via the reactive species and the damage predominantly affects the high-frequency and then progressing to the low-frequency [4]. These may have predicted a hearing deficit not because of specific ototoxicity, affecting the cochlear functions, but because of poor immune infants who are pre-term.

Hypoxia has a greater link with hearing loss due to inadequate oxygenation and perfusion which affects the cells of spiral ganglion. As the severity increases, it causes irreversible cellular damage to the cochlea especially the outer hair cells and stria vascularis, thus impairing the normal cochlear function. At this point, it is important to note that hyperventilation due to respiratory failure may further decrease the oxygenation of the auditory system [4].

An experimental study on otopathy due to sepsis showed that sepsis leads to significant hearing impairment. A prospective study was done on laboratory mice where regularly hearing animals were infected using cecal ligation puncture technique and a remarkable hearing loss was observed at all frequencies. The pathophysiology contributing to such loss is due to apoptosis in the supporting cells of organ of corti and glutamate excitotoxicity at the basal pole of inner hair cells. Thus, it was proven that hearing loss could occur in the absence of ototoxicity and it also highlights that hearing evaluation is a must for those suffering from sepsis syndrome [5].

Iron Deficiency Anemia is one of the major health problems and it posing as a causative variable for hearing impairment in neonates has been supported. Even though the exact cause for IDA leading to hearing impairment nor its treatment options promotes hearing restoration have not been supported, it's related to the sensitivity of the cochlea to vascular and neurologic effects of IDA. It is known that cochlea is supplied by labyrinthine artery and lack of its circulation might make it more prone to ischemic effect of IDA. Since, IDA compromises tissue oxygen delivery, cochlea becomes more vulnerable to reduced oxygen in blood and thus impairing its normal functions, resulting in a sensorineural hearing loss [6].

The long-term impact of neonatal and infant hearing loss are given major importance as it has an impact on all walks of life such as communication, behavior, cognition, social and emotional development, academic outcomes and other phases, too. Fortnum et al. reported that the prevalence of permanent hearing handicap continues to rise until the age of 9 years and 205 per 100,000 for the general population[4]. Similarly, the prevalence of hearing handicap for the high-risk infants is comparatively higher and hence, a need for a detailed Audiological evaluation per annum is necessary.

5.Conclusion

It is thus of highest priority, for those infants who are born pre-term and those with sensitive results from a neonatal hearing screening or with high-risk registers, to undergo a detailed hearing evaluation so that a correct diagnosis can be arrived at, in order to be recommended the immediate possible management options suitable for that particular individual. In fact, the early identification and intervention follows a better understanding of the pathophysiology of the associated conditions. The sooner and better the habilitation, the easier it is to overcome the difficulties of a handicapped.

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Effects of Climate Smart Agriculture Technologies on Household Food Security in Makueni County, Kenya

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Abstract: Food insecurity is a concern for households and government. It destabilizes social, economic and political wellbeing. Despite Kenya's government efforts in provision of incentives like climate smart subsidies to address food insecurity, Makueni County still experiences food deficit. This article focuses on effects of climate smart agriculture technologies on household food security. Findings revealed improvement in food security as 21.8 per cent households were food secured compared to 2 percent in 2012, attributing to existence of climate smart fund. From findings, access to farm input and practising Agroforestry increases crop yields and thus food availability, accessibility and affordability.

Keywords: *Cropland Practices, conventional farming, climate smart agriculture technologies, food security*

Introduction

There is global demand for agriculture to produce more on the same amount of land while adapting to a changing climate extreme weather events such as drought and floods (Steenwerth *et al*., 2014). A study by Nyongesa *et al*., (2017) cited climate change and vulnerability as one of the biggest environmental, social and economic challenges currently facing the World as well as undermining the drive for sustainable development, particularly in sub Saharan Africa. Further, the same study depicted a change in precipitation pattern that was consistent with projection that Kenya's vulnerable ASALs would experience an increase in the frequency and severity of droughts and significant declines in rainfall and river flows due to climate change and vulnerability necessitating adoption of CSA. FAO, (2014) found that CSA increases crop yields, enhance carbon content in soils and maintain soil moisture. In this regard, CSA contributes to the achievement of sustainable development goals by integrating the three dimensions of sustainable development (economic, social and environmental) to address food security and climate challenges FAO, (2013).

Across Africa, farmers are embracing "climate-smart" innovations against challenges of more frequent, intense and longer droughts, and floods which threaten sustainable development Nyasimi *et al.*, (2014). In 2011 more than 12.5 million people were affected by the prolonged drought and the result was catastrophic famine and hunger in the Horn of Africa. In response, Africa has put in place many initiatives on CSA technologies with capacity to increase agricultural productivity and build resilience. Despite these efforts, they remain unrecognized at the continental, regional and even national level (World Bank, 2015).

Further impact of the drought was felt in 2012 in Kenya where over 10 million people suffered from chronic food insecurity and poor nutrition, while 7.5 million people live in extreme poverty (Republic of Kenya, 2012). The country has continued to experience four consecutive rain seasons failures from the long rains of 2016 with population at risk increasing from 1.2 Million people in July 2016, to 2.5 Million people in February 2017 and 3.5 Million people in September 2017 (Republic of Kenya, 2014). This led to extreme drought situation in the 23 ASAL Counties and subsequent declaration of drought as a national disaster by the President in February 2017. In regard to this situation, Kenya is geared to transform its agriculture sector in order to meet the food demand for its growing population through sustainable land and water management practices (World Bank, 2015). The government efforts according to the World Bank, include scaling up of CSA technologies, practices and innovations through an institutional coordination approach as follows: the Constitution of Kenya devolves key agricultural sub-sectors to county government for timely agricultural decision making that accelerate the implementation of policies and incentivize CSA adoption; *Kenya Vision 2030* target agricultural investment in key areas such as productivity of agricultural enterprise, expansion of irrigated land for agriculture, improve market access and supply chains; the *Agricultural Sector Development Strategy 2010-2020* under the Ministry of Agriculture, Livestock and Fisheries focuses on transforming smallholder agriculture from low-productivity subsistence activities to a more innovative agribusiness.

Despite these different frameworks, policies and strategies developed over the years, coordination is critical for successful implementation of CSA interventions. In this regard, the government developed the *Kenya Climate Smart Agricultural Program 2015-2030 Framework* to provide effective coordination of CSA interventions in the country. Kenya and the World over is searching for technological and environmental solutions that can combat the resultant food deficit, change of eating habits and negative attitude towards new appropriate technological strategies (World Bank, 2015). In line with Vision 2030 and Agricultural

Sector Development Strategy 2010-2020 both have objectives of transforming agriculture into modern and commercial viable sector achieving an average GDP growth rate of 10 percent per year up to 2030 in Kenya.

Effect of Climate Smart Agriculture Cropland Practices on Crop Yield and Income

Wekesa *et al.,* (2018) while studying the effect of CSA technologies on household food security in smallholder production systems in Teso North subcounty, Busia County of Kenya, grouped the climate smart strategies into four categories. The groups were as follows: Crop management practices (use of improved crop varieties, efficient use of inorganic fertilizers, changing planting dates, use of legumes in crop rotation and cover crops); general field management practices (use of terraces, planting trees on crop land, use of live barriers); farm risk reduction practices (diversified crops, irrigation); and soil conservation practices (planting food crop on tree land, use of mulching).

Neufeldt *et al.,* (2011) while citing Norton-Griffith, (2008) showed that net returns- crop yields and incomes on adjudicated land was approximately three times higher than on un adjudicated land which has less secure tenure. In this regard, household investments in crop diversity, agroforestry and soil conservation were all significantly higher on more secured land tenure with resultant higher crop yields and income.

The researchers quantified the effect of using the categories of climate smart strategies and found that farmers who adopted climate smart strategies that included farm risk reduction practices- *diversified crops, irrigation*, has a positive impact on the welfare of farmers. This implied that farmers need to manage their farm risks to be assured of improved food security in the uncertain events of climate change. Further, farmers who adopted all categories of climate smart strategies (Crop management, general field management, farm risk reduction and soil conservation practices) were more food secure compared to their counterparts who did not use CSA technologies and had the greatest overall effect of 30.14 score on the welfare of farmers estimated using household food consumption score (Wekesa *et al.,* 2018).

Impact of Soil and Water Management Techniques on Crop Yield and Income

Branca *et al.,* (2011) while studying on promoting food security through adoption of soil and water management technologies found that there was increasing crop yields in low fertility and drier areas of sub Saharan Africa. For example, capturing rainwater where it falls, retention of soil moisture and increasing water productivity through irrigation can enhance overall crop yield. However, only 15-30 percent of rainfall is available for crop production during high runoff and low infiltration rates and thus adoption of soil and water management technologies such as water harvesting technologies, irrigation infrastructure and conservation agriculture can reverse this trend.

In line with observation made by Branca *et al.,* (2011), Tshuma *et al.,* (2012) stated that any farmer or agricultural system with access to sufficient inputs, knowledge and skills can produce large amount food, and thus food become available at household level. For instance, introduction of conservation agriculture (CA) by an NGO in Mangwe, Zimbabwe with provision of inputs and trainings, farmers interviewed confirmed that they harvested more grain on CA cultivated land than conventional farming despite being labour intensive. The findings on the potential of CA to improve yields and most likely food security too, were consistent with those of earlier studies conducted in different parts of the world. For example, Mazvimavi (2011) in Tshuma *et al.,* (2012) stated that CA plots produced higher yields than conventional plots as depicted by the harvest of the 2008/2009 season where on average maize yielded 1546 kg/ha on CA compared to 970 kg/ha on conventional farming thereby improving food availability. However, the impact of CA on yields as is currently practiced in Zimbabwe is still minimal.

Another study on whether more innovative farmers are more food secure, or whether food insecure farmers simply cannot invest in new technologies was analysed in a 2011 study of 700 randomly chosen farm households across five sites in Ethiopia, Kenya, Tanzania and Uganda by Dawnson *et al.,* (2013) on practicing agroforestry. The findings show that both innovation (CSA) and food security significantly influence each other. In this case, Neufeldt *et al.,* (2011) argued that if food security is dependent to some extent on the ability or willingness to innovate it is important to look at the innovations that are already being implemented and identify the institutional arrangements and technical, management, capital, financing and market-relevant factors which allow for successful up-scaling. On the other hand, the same researchers affirmed that if food insecure farmers are unable to innovate (adopt CSA) then safety nets such as cash credit and insurance will be critical before they can make significant changes to their farming practices.

The vulnerability models

The multi-dimensional nature of the vulnerability model as posted by Roxana *et al* (2013) investigates five dimensions of assessment in household vulnerability in Makueni County. First, the physical/functional dimension which relates to the disposition of a structure, infrastructure or service to be damaged due to the occurrence of a harmful event associated with drought; second was the economic dimension which relates to economic stability of a household endangered by a loss of production, decrease of income, or consumption of food due to the occurrence of a protracted drought. The third was the social dimension that relates with the presence of human beings, individuals or communities, and their capacities to cope with, resist and recover from impacts of hazards-climate change and drought. The fourth assessment was the environmental dimensions inferring

interrelation between different ecosystems and their ability to cope with and recover from impacts of hazards over time and space. Lastly, the political/institutional dimension which were the political or institutional actions such as livelihood diversification, risk mitigation strategies- insurance, credit markets, social safety net programs, government and donor-funded projects and agricultural extension or regulation control that determines different coping capacities and exposure to hazards and associated impacts.

The Bohle's vulnerability conceptual framework further illustrate the interaction between the interventions (CSA technologies) expected to increase household productivity and incomes as well as enhance resilience to impacts of hazards- climate change, drought and floods. Bohle's Vulnerability Conceptual Framework is a combination of famine and food insecurity vulnerability together with climate change and variability vulnerability (Shitangsu, 2013). The former explains vulnerability to famine in the absence of shortage of food or production failures as well as describing vulnerability as a failure of entitlements and shortage of capabilities according to Bohle *et al* (1993) as used in Shitangsu, (2013).

According to Bohle, (2001) vulnerability to food insecurity as well as climate change and variability has external and internal perspectives thereby referred to as double structure of vulnerability model. The external side of the model is related to the exposure of household to risks and shocks and is influenced by political economy approaches such as social inequities and disproportionate division of assets together with human ecology perspective which includes population dynamics and environmental management capacities. The Entitlement Perspective relates vulnerability to incapacity of household to obtain or manage assets through legal and customary rights to exercise command over food and other necessities of life (Mendes et *al.*, 2012). This complements the foregoing two models as advanced by Roxana *et al* (2013) and Bohle (2001) in strengthening and supporting the security of land tenure perspective which plays critical contribution to adoption and investment of climate smart agriculture technologies.

Methods and Materials

Study Area

The study was conducted in Makueni County in its three Agricultural Ecological Zones (AEZ) –Upper (1), Middle (2) and Lower (3) of the four (4) constituencies as follows: Mbooni-(Upper Zone-1), Kaiti/Kilungu (Upper and Middle Zones-1/2), Makueni / Kathonzweni (Middle and Lower Zones-2/3), and Kibwezi West/Makindu (Lower Zone-3). The County is characterized by a rapid growing population, water scarcity, falling food production and low resilience to climate change and variability (Republic of Kenya, 2014). The County has a total population of 883,671 people (2009 census) with an annual growth rate of 2.4%, which is projected to 922,183 in 2012 and further projected at 1,002,979 in 2018. This consists of 488,378 males and 514,601 females, out which 90% of the population settles in the rural areas (MCIDP, 2018-2022, Republic of Kenya, 2013; CBS, 2002).

Research design

Researcher used descriptive and inferential research design that employed cross sectional approach to examine the contribution of climate smart agriculture on household food security in Makueni County since the design facilitates a detailed description of the problem and inferences made in the study population as it "involves a close analysis of a situation at one particular point in time to give a snap shot result" (Neville, 2007).

Sample size

The sample size was drawn from a list of 784 villages obtained from the Kenya National Bureau of Statistics (KNBS) with projected population of 1,002,979 in Makueni County. A sample size of 32 villages was randomly drawn from the population frame out of which 400 households participated in the study. Key informants were representatives from the Ministry of Agriculture, Fisheries and Livestock; Kenya Agricultural and Livestock Research Organization (KALRO), National Drought Management Authority (NDMA) and Non-governmental organizations.

Data collection

Qualitative and qualitative data was collected through a household survey questionnaire, key informant interviews and focus group discussion were administered personally by the researcher and occasionally with the help of research assistants. Observation was used to corroborate information collected using the three data instruments. Data collection instruments were developed after analysis of similar studies through literature review, deliberations with practitioners in this field. Household questionnaire had a five point Likert scale designed to assess effects of climate smart agriculture technologies on household food security in Makueni County. A focused group discussion guide was used in selected households to explore issues related to food security and climate smart agriculture. Key Informant Interviews (KII) guide was developed and administered to experts from various organizations that formed part of respondents. Obtained data was used to triangulate questionnaire survey feedback given that experts were purposively chosen to participate as KII. All instruments were pre-tested during piloting and adjustments made accordingly before its final administration. Piloting was mainly used to validate the tools.

Data analysis

Both quantitative and qualitative approaches were used for data analysis. Quantitative data from the questionnaire were coded and entered into the computer for computation of descriptive and inferential statistics. Statistical Package for Social Sciences (SPSS) was used to analyze collected data while qualitative data from key informants were manually processed and presented verbatim.

Results and discussion

Assessment on the Status of Household Food Security

Researcher sought to assess overall household status of food security. Responses from respondents were given on figure 1.

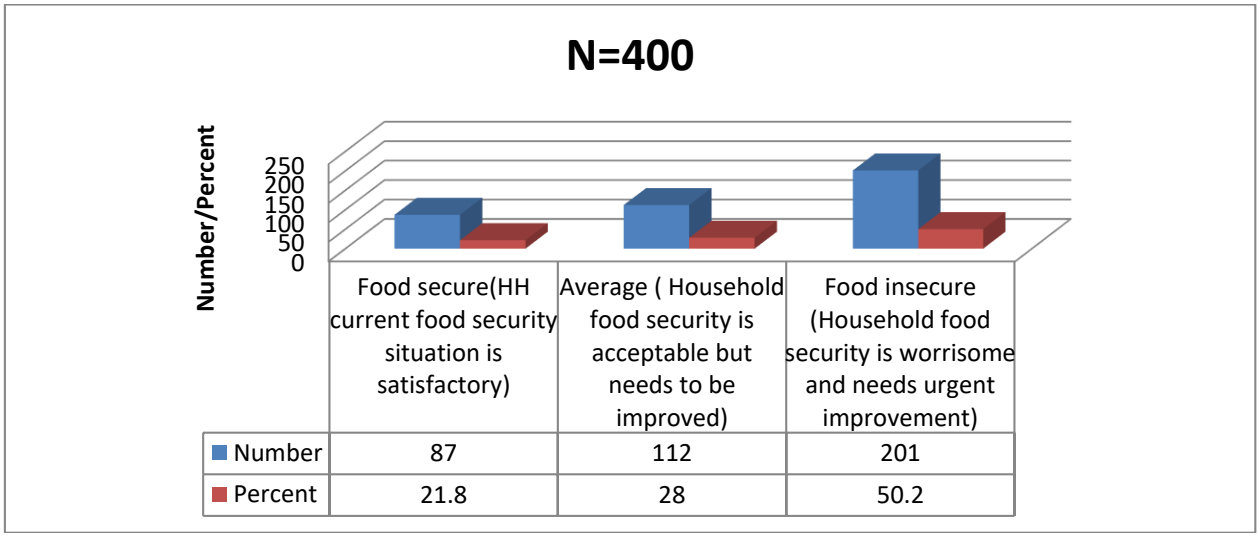

Figure 1 Household Assessment on the Status of Food Security

Figure 1 shows that majority of households at 50.2 per cent feel that they were "food insecure" at the time of data collection which agrees with another finding in this study that majority of households (59%) did skip or ate fewer meals in a day at different levels because there was no enough food while 21.8 per cent of households were "food secure" in all the 24 months. This feedback is corroborated by Key informants and focus group discussion members who mentioned that despite several programmes to make Makueni food secure, the results have not yet been fully realized. Focus group discussion members reported that households feel they are food insecure due to the number of meals per day that households prepare and the level of living standards.

Key informant interviewees attributed the high score on food insecurity to poor rains and pests that attack food crops. Focus group discussion member in Kibwezi said "If we had regular rain we would not be begging for food from organizations and government. It is not dignifying to beg for food every year. National government and county government should help us with extension services which will educate us" However, there has been significant improvement on the status of food security as households responded to be "food secure" at 21.8 per cent in Makueni County as a result of investments on CSA technologies compared to a Baseline Household Survey in Makueni County conducted by Mwangangi *et al.,* (2012) who indicated that only 2 percent of households are "food secure" all year long and 97 percent of households struggle to get enough food to feed their family for more than 2 months out of a year. The improved household food security is attributed to increased crop yields and incomes from sales as result of combined investment in CSA diversified crop practices and high capital-intensive technologies that reduces the risk of harvest failure in times of drought and/or extreme climatic events according to Tshuma *et al.,* (2012). This implies that the accessibility and availability dimensions of food security are ultimately improved resulting in increased household food security in Makueni County.

Effects of CSA on household food security

This objective sought to find out how climate smart agriculture (CSA) technologies affects household food security in Makueni County. The researcher sought to find out the effect of the following CSA technologies namely farm inputs, credit access, agroforestry practices, land tenure and size, irrigation technology, agricultural extension services, conservation agriculture and water harvesting practice on household food security. Respondents were further asked to indicate their assessment of various statements in relation to household food security. Information from households is presented on Table 1.

Table 1: Effects of CSA on Household Food Security

Variable	Score	Frequency	Percent
Access to farm input significantly increased crop yields	Strongly disagree	21	5.3
	Disagree	12	3.0
	Neutral	20	5.0

	Agree	124	31.0
	Strongly agree	223	55.8
	Total	**400**	**100**
Access to farm input has not changed production	strongly disagree	189	47.3
	Disagree	58	14.5
	Neutral	26	6.5
	Agree	38	9.5
	Strongly agree	89	22.3
	Total	**400**	**100**
Access to credit significantly increased crop production/yield	Strongly disagree	150	37.5
	Disagree	24	6.0
	Neutral	77	19.3
	Agree	89	22.3
	Strongly agree	60	15.0
	Total	**400**	**100**
Access to credit has not changed production	Strongly disagree	180	45.0
	Disagree	50	12.5
	Neutral	68	17.0
	Agree	26	6.5
	strongly agree	76	19.0
	Total	**400**	**100**
Agro forestry practice brought additional income	Strongly disagree	25	6.3
	Disagree	12	3.0
	Neutral	41	10.3
	Agree	115	28.8
	Strongly agree	207	51.8
	Total	**400**	**100**
Agro forestry has significantly enhanced crop production/yield	Strongly disagree	26	6.9
	Disagree	18	4.5
	Neutral	58	14.5
	Agree	94	23.5
	Strongly agree	204	51.0
	Total	**400**	**100**

N=400

Results from table 1 showed that overwhelming majority of respondents at 86.8% agrees that access to farm input significantly increases crop yields while another proportion at 61.8% disagree that access to farm input doesn't change farm production. This shows that farm input access is favored by households who want to increase crop yields and farm income.

These findings are corroborated by key informants and focus group discussion members who opined that access to farm inputs increased their farm production. One member of focus group in Mbooni said

> "I have been able to improve my farm produce because I got farm inputs which I could use on my own. If other households are able to access farm inputs like myself then they will surely improve their production".

This result is in line with observation made by Branca *et al.*, (2011) and Tshuma *et al.*, (2012) that any farmer or agricultural system with access to sufficient inputs, knowledge and skill can produce large amount of food, and thus enhancing food availability at household level. The high yields is attributed to farmers when given access to credit, it will enable them to acquire more technologies which might be expensive to purchase. This agrees with the findings of Amao and Ayantoye, (2015) in Ojoko et al., (2017) who opined that access to credit in the form of loanable funds can be used to expand production through the purchase and use of modern improved inputs. However Wekesa *et l.*, (2018) observed a negative influence of credit access to

usage of improved crop varieties and agroforestry suggesting that these farmers diverted credit to fund non-farming expenses like school fees and medical.

Regarding credit access, the study showed that very small minority of households at 43.5% disagreed that credit access increases crop yields and production significantly. 19% of household representatives scored neutral which is attributed to the fact that 78.5% did not access credit during the period under review. Also 57.5% of respondents disagree that access to credit does not change household production in any way. Further discussion with key informants showed that majority of respondents thought that credit access alone did not increase crop yield and production automatically. A key informant member said

> "Even if we access credit we shall not improve our production if we put that credit to non-agricultural and unproductive use such as paying school fees and paying dowry and debts".

The results revealed that households think credit access as an incentive and not necessarily as the automatic guarantee for higher yields and production. In this regard, most CA implementers in Zambia use hybrid seeds and fertilizer on credit, allowing them to use more CA inputs and increase their chances of successfully practicing CA. Additionally, the credit accessed was likely and potentially used for unintended purposes in the household other than agriculture which is agreed by Wekesa *et al.*, (2018).

On agroforestry, majority of households at 80.5% agreed that agroforestry has enabled them to earn some additional income for their household food consumption whereas 74.5% of households agreed that agroforestry has significantly enhanced their crop production/yields. Agroforestry is recognized as an important component in climate-smart agriculture for its potential to stabilize crop yields in drought conditions, in addition to adaptation and mitigation roles. For example, in Zambia, agroforestry practice increased maize yield from 2.8 tons/ha to 7 tons/ha according to Kipkoech *et al.*, (2015). According to Dawson *et al.*, (2013) the increased yields is attributed to its potential for the diversification of crop production, planting of trees as green fertilizers and nutritionally balanced fruits as well as fuel wood. In contrary Dawson *et al.*, (2013) argued that the planting of tree commodity crops can result in a risk that food crop will be displaced from farmland and FAO & IFAD, (2012) agrees that often agroforestry is viewed specifically within agricultural production-based strategies designed to improve nutrition.

Table 2: Effects of CSA on Household Food Security

Variable	Score	Frequency	Percent
Land tenure system improved income and consumption	Strongly disagree	39	9.8
	Disagree	19	4.8
	Neutral	10	2.5
	Agree	128	32.0
	Strongly agree	204	51.0
	Total	**400**	**100**
Land tenure system has improved crop production and yields	Strongly disagree	34	8.5
	Disagree	19	4.8
	Disagree	16	4.0
	Agree	116	29.0
	Strongly agree	215	53.8
	Total	**400**	**100**
Farm size increased income and food consumption	Strongly disagree	25	6.3
	Disagree	26	6.5
	Neutral	48	12.0
	Agree	122	30.5
	Strongly agree	179	44.8
	Total	**400**	**100**

N=400

Table 2: presents results on land tenure systems and farm size practices. Under land tenure, the study depicts that majority of households (83%) think favorably of the prevailing land tenure in Makueni County where respondents said that it has enabled them to earn some additional income for their household food consumption. In addition, the study indicates that majority of households at 82.8% agreed that existing land tenure has significantly enhanced their crop production/yields. This can be attributed to security of land tenure that incentivize promotion of investing in CSA practices and technologies as well as being an

enabler to access credit from financial service providers. This agrees with the findings of Neufeldt *et al.*, (2011) who opined that crop yields and incomes on adjudicated land (land with title as security of tenure) was three times higher than on un adjudicated land which has less secure tenure.

The researcher also sought to know what households think of farm size and how it relates to food security. Majority of respondents at 75.3% are satisfied with their farm land size currently in use which they reported to have increased their income for household food consumption while similar proportion (76%) agree that their current farm land size has significantly enhanced their crop production/yields. This finding is attributed to response whether household's practice intensive farming and majority of households (64.8 per cent) were engaged in intensive agriculture on their land whereas more than half of respondents at 91 per cent used less than 3 acres of land for cropland food production during the period under study. This is consistent with study by Lewin and Fisher, (2010) who revealed that an increase of 0.25 ha per capita of cultivated land would increase the likelihood of food insecurity by 22, 24, and 27 per cent in the north, central and south regions of Malawi, respectively.

Table 3: Effects of CSA on Household Food Security

Variable	Score	Frequency	Percent
Using irrigation increases income and food consumption	Strongly disagree	61	15.3
	Disagree	26	6.5
	Neutral	59	14.8
	Agree	115	28.8
	Strongly Agree	139	34.8
	Total	**400**	**100**
Use of irrigation has significantly enhanced crop yield compared to rain fed agriculture	strongly disagree	61	15.3
	disagree	26	6.5
	Neutral	59	14.8
	Agree	115	28.8
	Strongly Agree	139	34.8
	Total	**400**	**100**
Use of harvested water increased crop yields	Strongly disagree	97	24.3
	Disagree	18	4.5
	Neutral	61	15.3
	Agree	138	34.5

	Strongly Agree	86	21.5
	Total	**400**	**100**
Water harvesting increased yields that increased incomes	Strongly disagree	105	26.3
	Disagree	27	6.8
	Neutral	70	17.5
	Agree	113	28.3
	Strongly Agree	85	21.3
	Total	**400**	**100**
Agricultural extension services increases yields and incomes	strongly disagree	33	83.0
	Disagree	12	3.0
	Neutral	30	7.5
	Agree	125	31.3
	strongly agree	200	50.0
	Total	400	100.0
Extension services have become more expensive today	strongly disagree	143	35.8
	Disagree	31	7.8
	Neutral	29	7.3
	Agree	82	20.5
	Strongly Agree	115	28.8
	Total	400	100

N=400

Table 3 presents results for irrigation and water harvesting techniques. According to respondents, majority of households at 63.5 % accepted that the use of irrigation had enabled them to earn some additional income for their household food consumption whilst similar proportion at 63.5% agreed that use of irrigation has significantly enhanced their crop yields compared to rain fed agriculture. This finding is in consistent with the study of McCarthy & Brubaker (2014), who stated that increased use of irrigation leads to food security and adaptation benefits by increasing crop yields and decreasing variability of yields. Similarly, their study revealed that supplementary irrigation maximizes productivity in a shortened growing season due to delayed onset of rains. In this regard, new irrigation projects with high investment cost may ultimately prove to be unsustainable in the long-run due to climate changes in precipitation and evaporation rate, requiring in-depth feasibility studies to avoid failures of collective action in operation and maintenance.

The study finding showed that most households at 81.3% agreed that food production was higher in yields than previously as a result of use of agricultural extension services while 49.3% agree that agricultural extension services have become more expensive today than in the past. This finding is in accordance with National Agricultural Sector Extension Policy (NASEP, 2012) that indicated extension services through sharing knowledge, technologies and agricultural information enhances promotion of household food security, improving incomes and reducing poverty. In the contrast, Kipkurgat *et al.*, (2015) found little information on the impact of decline in extension services on food security. In this regard, this finding attributes to cost of extension services to the households and indeed Abdi & Worth *et al.*, (2011) agreed that commercializing and privatizing public extension services renders it very expensive and compromising public interest.

On water harvesting, the study found out that 56% of the households agree that water harvesting use has increased crop yields while a lower proportion of respondents at 49.5% said that water harvesting had significantly enhanced yields which increased household incomes. The low score of respondents who agreed that water harvesting practices increases yields and incomes was attributed to few respondents who practice water harvesting for agricultural production (21.5%) in Makueni County. Additionally, this finding depicted the trade off in the water use as majority used for domestic as well as the cost involved in the use of other harvesting techniques.

This finding was attested by Mwangangi *et al.,* (2012) who revealed that only 9 per cent of the household were practicing irrigation most of which is under kitchen garden and 17 per cent had tanks for water harvesting in Makueni County. However, there was significant improvement in the adoption of the water harvesting technology as depicted by this finding where households practicing agricultural production using rooftop water harvesting increased from 9 per cent to 21.5 per cent. As a result, increased crop yields and incomes, is seen to increase food security. This is consistent with findings of Branca *et al.,* (2011) that water harvesting in Senegal changes the yields of millet from 75 per cent to 195 per cent.

In line with Sendai Framework for Disaster Risk Reduction (UNISDR, 2018), Climate Smart Agriculture (CSA), reduces vulnerability of households' food insecurity caused by hazards of drought, floods and climate change through enhanced adaptive capacity to change in climate, increased resilience to climate change and agricultural productivity as well as promoting policies intervention especially that aim at the adoption of CSA technologies. Additionally, CSA addresses disaster risk with respect to vulnerability of households through promoting climate smart subsidies, access to credit, and creation of market and extension services. This is in agreement with a study of Kipkoech *et al.,* (2015) who stated that elements of CSA relate to improving resilience through the adoption of sustainable agricultural land management such as agroforestry, water-use efficiency, drought tolerant varieties and risk avoidance. This study contributes to attainment of sustainable development goal number 2 of reducing hunger and to realization of the Sendai framework priority for Action 3 that underpins investing in DRR for enhanced resilience to hazards.

The researcher sought to establish households that practice conservation agriculture and to assess whether conservation agriculture increases yields and incomes as well as whether is more productive than the conventional farming (normal land preparation practices -ploughing). Households were asked to evaluate and gave their responses on table 4.

Table 4: Effects of Conservation Agriculture and Conventional Farming

Description	**Score**	**Frequency**	**Percent**
Did you practice Conservation Agriculture (CA) in the years 2017/2018?	Yes	176	44
	No	224	56
	Total	**400**	**100**
CA is more productive in yields and incomes	strongly disagree	131	32.8
	Disagree	26	6.5
	Neutral	26	6.5
	Agree	106	26.5
	Strongly Agree	111	27.8
	Total	**400**	**100.0**
CA meets my food requirements better than conventional farming	strongly disagree	121	30.3
	Disagree	33	8.3

Neutral	41	10.3
Agree	90	22.5
Strongly Agree	115	28.8
Total	**400**	**100.0**

N=400

Table 4 showed that few households (44%) practice conservation agriculture (CA) however majority of respondents (54.3%) accept that CA is more productive in yields and incomes. Further, the study revealed that majority of households (51.3%) agreed that practicing CA enabled them to meet their food requirements better than conventional farming. . This result is in line with that of Tshuma *et al.*, (2012) in Mangwe, Zimbabwe where 84 respondents' farmers were asked to make comparison in terms of crop yields of conservation agriculture (CA) and conventional farming (CF). In this case all respondents indicated that CA had a better yield output compared to CF. Study by Malachy *et al*, (2010) attribute this finding to CA realizing social and financial capital through building partnership between groups within community to access credit and also counteract the labour intensity of CA especially for weeding.

Another argument for higher crop yields from CA was that CF waits for the first rains of the season to soften the soil before preparations or ploughing for sowing. This negatively affect households without tractors or oxen plough resulting in waiting for several weeks before getting the farm machinery, and thus delayed land preparations and planting. For instance, a study in Zambia found that this delay in planting reduced harvest with 1.5 per cent of potential maize yields lost for each day delayed after the first opportunity to plant (Mazvimavi, 2011). On the other hand, households practicing CA can prepare their land during dry season in advance of the rains, reducing the labour demand peak at the start of the rains. In the contrary, CF proponents argued that the CA methods of permanent soil cover and minimum tillage are still labour intensive in the first year though it reduces in the following seasons. This study finding has filled the gap of inadequate knowledge which Malachy *et al.*, (2010) indicated that the impact of CSA technology on food security and livelihood of households has largely been assumed.

Summary

Majority of 81% of households consider that Agro-forestry and prevailing land tenure have enabled them to earn some additional income for their household food consumption and enhanced their crop production/yields. This was attested that crop yields and incomes on adjudicated land was three times higher than on un adjudicated land which has less secure tenure (Neufeldt *et al.*, 2011). Although 54% of households consider that conservation agriculture is more productive than conventional farming, only 44% of them actually practice it in their farms citing resource constraints and limited access to extension services. However, from the findings, there was realization of improvement in food security as households 21.8 per cent were food secure in Makueni County compared to 2 per cent in 2012 which could be attributed to the existence of climate smart fund that support climate related activities of CSA programs.

Conclusions

The study showed that most of households did not receive any subsidized certified seeds and fertilizers from government or from private sector and NGOs as well as not accessing credit during the period under review. This result has exhibited the synergy of CSA technologies and policy makers can be guided by the findings to reconsider the provision of smart subsidies to farmers as in Malawi the fertilizer subsidy resulted in insignificant transformation of the agricultural sector. Therefore, subsidies should be provided as institutional support, pre-financing or policies that recognize and reward practice of CSA or facilitate trade of CSA technologies.

Lastly, farm input access and practising Agroforestry increases crop yields and income and thus food availability, accessibility and affordability. However, majority of households were not able to eat the kinds of foods they preferred because of lack of resources while others ate limited variety of foods due to lack of choices in the market.

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Modeling of an Energy-Efficient Wireless Sensor Networks for Monitoring Restricted Areas in an Airport

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Abstract- Wireless Sensor Networks (WSNs) is an attractive solution for myriads of communication applications. The deployment of WSNs in restricted areas, where battery replacement or recharging is difficult, demands that energy be sparingly utilized. In this study, a model of energy-efficient Wireless Sensor Networks (WSNs) for monitoring Aircraft Runway was developed to prolong the life-span of the deployed network using a non-hierarchy and hierarchy based cluster configurations for two sampled Runways (R/W). A routing protocol which involved hierarchical data transfer along any shortest path to the Base Station was developed. The approach promotes rotation of Cluster Head (CH) during every transmission round based on residual energy of nodes and proximity to Base Station. Simulations were carried out for 5000 transmission rounds in MATLAB environment for the non-hierarchical and other levels of hierarchy; six clusters and eighteen clusters. Results of simulation revealed the lifespan of the network as: 3375 and 3750 rounds for the non-hierarchical configurations, 3912 and 4660 rounds for six clusters hierarchical configurations, while in the eighteen clusters hierarchical configurations the network lasted for 4434 and above the estimated 5000 rounds. Thus, the best solution in terms of network life-span of the proposed model was obtainable in the highest possible cluster formed.

Index Terms- Energy-Efficiency, Hierarchy-Based Cluster, Network Life-span, Residual Energy, Restricted Areas, Wireless Sensor Networks

I INTRODUCTION

Wireless Sensor Networks (WSNs) consist of variable number of static or mobile nodes deployed across an area of interest to obtain, process and transmit relevant information. Wireless sensor node consist of several parts powered by battery [1], these includes: Sensing unit; this is capable of sensing temperature, humidity, visual, acoustic, location and many more. Micro-controller for processing the obtained data and a radio transceiver for transmitting the processed data to the Base Station (Sink) through a radio frequency channel. Sink node being a resourceful node having un-restricted communication, computational capability and additional energy source acts as an interface between wireless sensor networks and resource management center[2].The event being observed using WSNs may be static or dynamic depending on application scenario. Wireless Sensor Network have been used in many applications such as: Home automation and security, military applications for boarder control, intelligence and reconnaissance surveillance [3], environmental applications such as fire forest detection, health application for patient monitoring, agricultural usage, vehicle tracking, inventory management, civil aviation and a host of other applications. In addition to the numerous usage of WSNs, it equally provides a bridge between the physical and virtual world and allows the ability to observe the previously unobserved at a fine resolution over large spatio-temporal scales [4]. Therefore, the relevance of this work to Aviation Industry cannot be over emphasized as WSNs is envisioned to effectively monitor trespass on restricted areas. Depending on application scene, wireless sensor node can be randomly distributed or uniformly placed [5].Wireless Sensor Networks are envisioned to operate in an autonomous and unrestricted fashion and its deployment has the potential to overcome the limitations associated with wired sensor networks, perimeter fencing and security patrol team as a way of monitoring trespass on Airport restricted areas.

Due to the cost and small size of wireless sensor nodes, they have been equipped with small batteries having limited energy source thereby leading to a major energy constraint of wireless sensor nodes in terms of their lifespan. Sensing and processing of information by wireless sensor nodes consumes a minimal amount of energy but transmission and reception of information requires a significant amount of energy [6],[7].Therefore, performing such energy consuming task reduces the lifespan of the entire network and consequently results into system meltdown. Since energy harvesting and battery replacement may not be feasible in certain environmental condition, there is a need to sparingly utilize the available energy. This could be achieved through the development of an energy-efficient data routing protocol to set up paths between wireless sensor nodes and the Base Station. The routing protocol must be such, that enhances load balancing and the path selection must be able to maximize the life-time of the network [8],[9].

Recently, many clustering algorithm have been developed with different protocols to prolong the life-span of WSNs. Even though other techniques exist, clustering had proven to be one of the effective approaches used to save energy in WSNs [10],[11],[12]. Clustering is a method of organizing sensor node into different groups called clusters [12], (a bunch of intra-connected sensor nodes). In each cluster, wireless sensor nodes are given different roles to play; cluster head, member node and gateway node. A Cluster Head (CH) is a group leader in each cluster that receives sensed data from member nodes, aggregate and transmits to other Cluster heads or Base Station. The role of member node is to sense data from the environment. Gateway nodes are nodes belonging to more than one cluster and their role is to transmit data between two clusters or between a Cluster head and Base Station. Since clustering enhances Wireless Sensor Networks performance in terms of life-time through even distribution of role among wireless sensors and multi-hop transmission of data to the Base Station, its suitability in delivering improved intelligence, monitoring and surveillance system cannot be over-emphasized. Deploying WSNs; a technology that can provide smart environment, obtain accurate information in restricted environment may require that the network life-span be prolonged. Thus, hierarchical clustering configurations would be adopted in this work to extend the life-span of the model of energy-efficient WSNs proposed to monitor restricted areas in an Airport.

In WSNs, energy is one of the major issues which need to be carefully consumed by the sensor nodes to maximize the network lifetime [13].To deploy a WSN that will monitor restricted areas in an Airport, it is expected that the network life-time be prolonged. Since Wireless Sensor nodes are mostly powered with small batteries, absolute dependence on the battery which is the major power source not only limits the sensors life-time, but also that of the deployed network. Hence there is a need for efficient design to extend the lifetime of the deployed network.

II. REVIEW OF RELATED STUDIES

Authors in [7], proposed the first known clustering protocol; Low Energy Adaptive Clustering Hierarchy (LEACH). The protocol was aimed to prolong the life-time of WSNs and reducing the energy consumption of sensor nodes. LEACH is hierarchical, probabilistic, distributed and single-hop protocol. Cluster formation is based on the strength of received signal, while cluster head act as default gateway to the Base Station.

Authors in [8], proposed an Energy Efficient Cluster Based Protocol (EECP) which is an extension of the LEACH protocol for heterogeneous network, some sensors of higher energy than the regular nodes which were called Gateway Nodes (GN) were embedded in the network. Gateway nodes change the method of sending the data to the Base station. The main goal of the protocol was to efficiently maintain energy consumption of Wireless Sensor Networks (WSNs) and extend the lifetime of the network. EECP used a new distancebased probability scheme for the election of Cluster Head. Also, a few percentages of the nodes in EECP are more energy enriched than others. Making EECP a bit different from LEACH. The proposed model achieved a longer lifespan, stable throughput in the network as compared to LEACH.

Authors in [10], proposed a new energy efficient data aggregation protocol in Wireless Sensor Networks. A homogenous WSN consisting of N sensor nodes that are uniformly and randomly distributed within an area of L by W meter square and the sink node located at (L+W, W/2) coordinates. The key ideal behind the algorithm was to recursively divide the sensor network into four partitions symmetrical about a centroid node. Furthermore, a set of cluster heads in the middle of each partition were defined to aggregate data from cluster members and transmit these data to cluster heads in the next hierarchical level. The new algorithm adopts the concept of hierarchical clustering which prevents cluster heads from sending their data for long distances and thus the energy consumption of the sensor nodes was significantly reduced. The algorithm focused on avoiding the overhead of dynamic clustering, reducing the transmission path between sensor nodes and cluster head nodes and minimizing the direct communication between the sink node and cluster heads. Simulation results showed that the proposed algorithm achieved better performance in comparison with the LEACH-C algorithm in terms of energy consumption, network life-span and number of dead nodes.

Authors in [15] opined a multi-hop clustering routing protocol. The scheme utilized a multi-level hierarchical data gathering sensor network architecture. At the lowest level, wireless sensor nodes send data to the Cluster Head, and Cluster Head sends data to the gateway nodes. The gateway nodes, which formed the next level of hierarchy, were programmed to communicate with the Sink located outside the network field. Cluster Heads are selected based on LEACH protocol. As soon as a Cluster Head is formed, it selects a gateway node which lies closest to it. The implementation of Gateway nodes enhanced the network in terms of minimum energy consumption and longer network life as compared to LEACH.

Authors in [16] introduced a new method of cluster heads selection and cluster formation algorithm. 100 sensor nodes were assumed to be deployed in a 100 by 100-meter square field and base station at (50, 350) coordinates. The algorithm partitioned the sensor field into different clusters and elects a node as the cluster head for each cluster. Each node within the cluster sends its data to the Cluster head with single hop transmission and cluster heads receives, aggregate the data and transmit to the base station through multi-hop

transmission. The adopted method conserves energy dissipation of sensor nodes in the clusters. Simulation result revealed that the algorithm conserves more energy than LEACH and TL-LEACH protocol due to short range data transmission of sensor nodes and election of cluster heads based on residual energy of each node.

An Event Driven Hierarchical cluster-based routing protocol for Wireless Sensor Network which is an energy efficient hierarchical routing technique in which cluster heads are selected based on the prediction of transmission energy through shortest possible distance to the base station for transmitting the event driven information proposed by authors in [17]. In this, cluster of the sensor nodes were geographically created, Cluster head role were rotated and the optimization of the CH selection by the help of energy prediction used for transmission in every rounds of simulation. When event occurs, CH aggregates event data before transmitting it to the Base station. The important features which include: Cluster formation and rotation, Cluster head election and rotation, and cluster optimization of the proposed event driven hierarchical routing technique in transmitting event driven data to the Base station were analyzed. The analysis revealed that energy efficiency of WSN can be further improved by using the event driven hierarchical routing technique. In the algorithm, the clusters were geographically formed into different sizes to see how it could affect the network lifetime of WSN. With energy awareness and event driven protocol, the proposed protocol, which use the prediction of smallest transmission energy through the shortest possible path to send data to the Base station proves that it offers more reduced energy consumption and increases the lifespan of the WSN. From the result, the proposed protocol shows better performance for second level of hierarchy than first level hierarchical routing protocol and non-hierarchical technique.

III. SIMULATION TOOLS AND PARAMETERS

A.TOOL

The model of energy-efficient wireless sensor networks developed in this research work is validated with simulation in Matlab environment. With regards to simulating WSNs, Matlab provides communication toolbox set to building the hardware architecture of transmitting nodes, modeling the communication channel and receiving node architecture.

B.WIRELESS SENSOR NODES

The wireless sensor nodes in the deployed networks are homogeneous in nature (have the same capacity in terms of computational capability and power). The initial energy of all the nodes are set to 10nJ, each has a unique identity and are evenly distributed along the perimeter of the experimental region.

C.SINK NODE

The Sink node represents the Base Station which is a resourceful node with unlimited capacity in terms of computational capability and power. The data routed from wireless sensor nodes are received at the Base Station through the Cluster heads. The Sink node serves as the data management center. The detailed information such as location and identity of wireless sensor nodes, energy content of nodes and other information in the deployed network are regulated at the Sink node. In the MATLAB simulation environment, the location of the Sink node is set to (-30, -10) coordinate of the experimental region. Other simulation parameters are itemized on Table 1.

IV.METHODOLOGY

Sensor nodes are evenly distributed over the entire perimeter of the experimental region. Clusters are thereafter geographically formed based on equal division of the perimeter to be monitored. Having formed the first non-hierarchical cluster (a single cluster), other levels of hierarchy; level six and level eighteen are formed. All clusters contain equal numbers of sensor nodes at each level of formation. Cluster head (CH) selection within each cluster formed at all levels is done by election of a node that requires the least transmission energy for a particular transmission round, and is rotated among the sensor nodes of each cluster at every transmission round. At the beginning of every transmission round, new energy estimation is carried out to determine the CH to be elected next, ensuring significant reduction in nodes energy consumption and increase the lifespan of the network. A hierarchical routing protocol is developed in phases after even distribution of the sensor nodes along the experimental regions perimeter as follows: Phase one: Clusters are formed geographically around the runways perimeter.

Phase two: Cluster head (CH) selection is made in each cluster formed. This phase is based on energy prediction technique using the first order radio energy model [18].

Phase three: In this phase, data collected by the CHs from the sensor nodes within their clusters are gathered.

Phase four: Here, all data collected by the CHs are further transmitted to the BS or sink. A comparison of the network lifespan of the non-hierarchical and the various hierarchical configurations would be carried out for the perimeter surveillance model. An investigation into the optimal level of hierarchy, that is; the effect of increasing the cluster size to six and eighteen on the network lifespan would be determined. Finally, the result would be validated by simulating in MATLAB environment.

A. SENSOR NODES DEPLOYMENT

A total of 306 nodes were uniformly deployed around the perimeter of an Airport Aircraft Runway (R/W) with dimensions: 3000m by 60m (Port Harcourt International Airport Aircraft Runway) [19] and 2700m by 45m (Sam Mbakwe Airport Aircraft Runway) [20]. Cluster head selection was predicted for 5000 rounds for the non-hierarchical and the hierarchical configurations. Simulation was thereafter executed in MATLAB environment, while Figures 1, 2, 3, 4, 5 and 6 illustrate the various deployments. The following assumptions are made:

1. The proposed area of interest is rectangular shaped with dimension (L by B) meter square.
2. All nodes are homogeneous; having equal capacity in terms of computation, communication and power, in nature and static.
3. All the nodes have the same initial energy.
4. RN transmits directly to their respective CHs within a particular cluster.
5. CHs transmit data to the Sink by multi-hop routing.
6. The Sink is located at the origin (-30, -10) of the experimental region and has the information about the identity and location of each node.
7. The Communication link between the nodes is symmetrical.

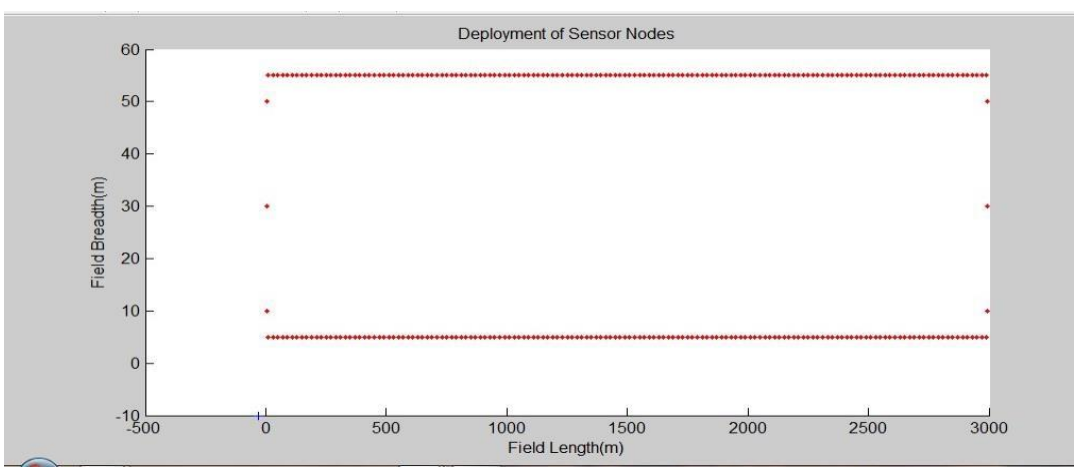

Figure1: Sensor Nodes Deployment (Non-hierarchical) for 3000m by 60m R/W

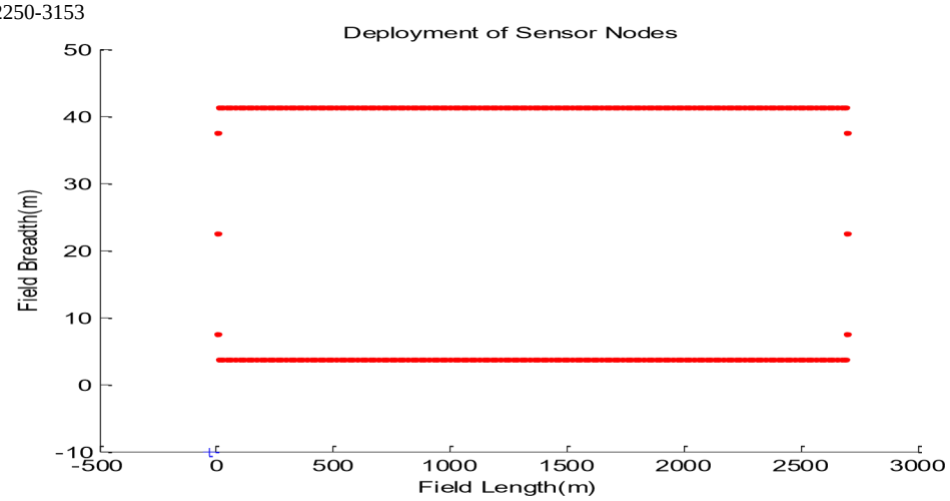

Figure 2: Sensor Nodes Deployment (Non-hierarchical) for 2700m by 45m R/W

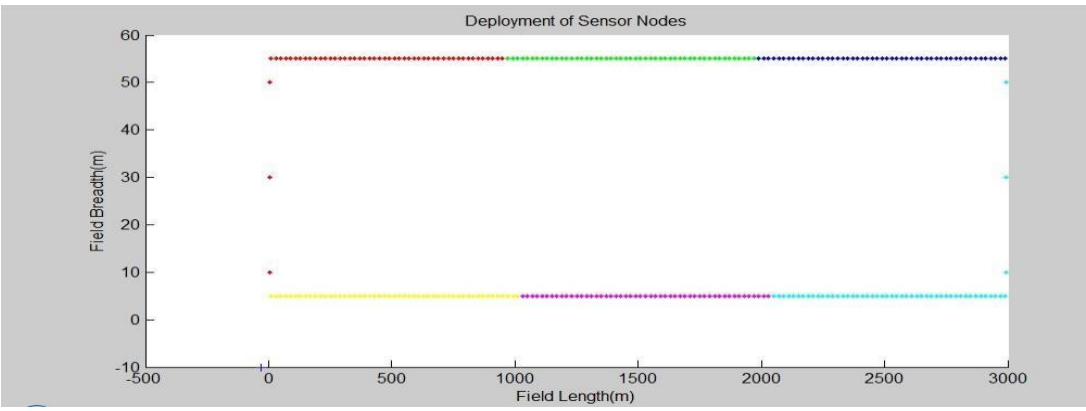

Figure 3: Graph of Sensor Nodes Deployment (6 clusters) for 3000m by 60m R/W

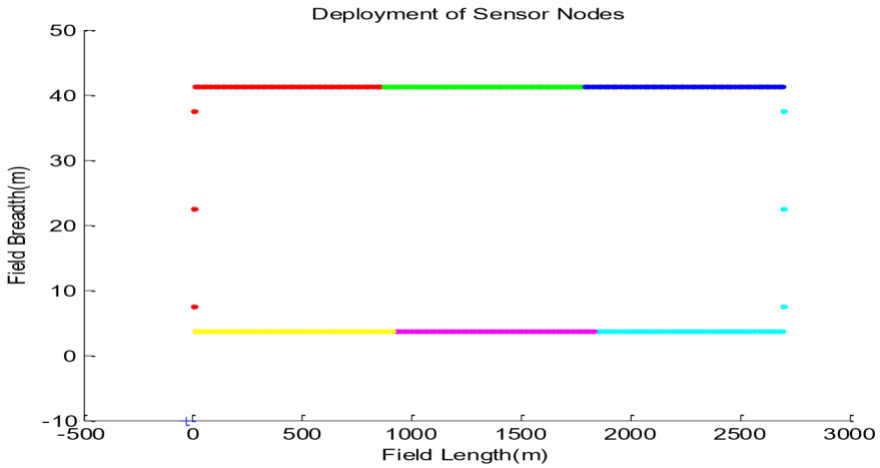

Figure 4: Graph of Sensor Nodes Deployment (6 clusters) for 2700m by 45m R/W

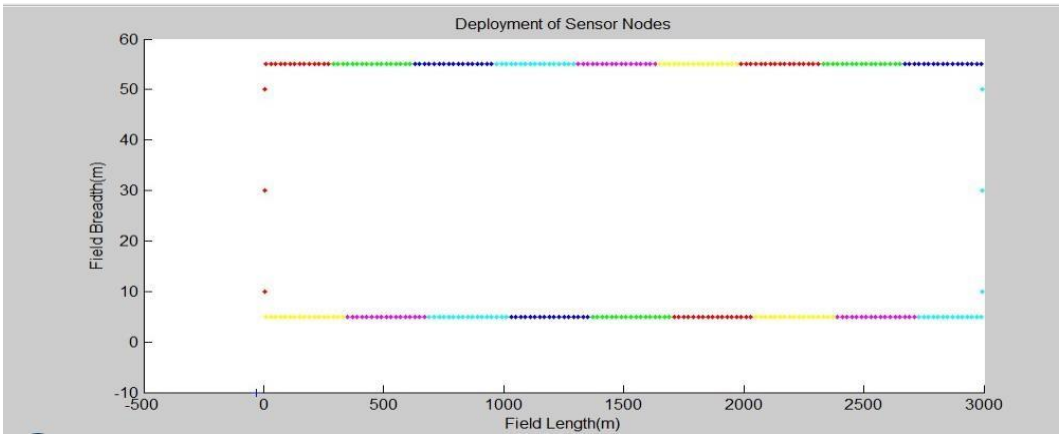

Figure 5: Graph of Sensor Nodes Deployment (18 clusters) for 3000m by 60m R/W

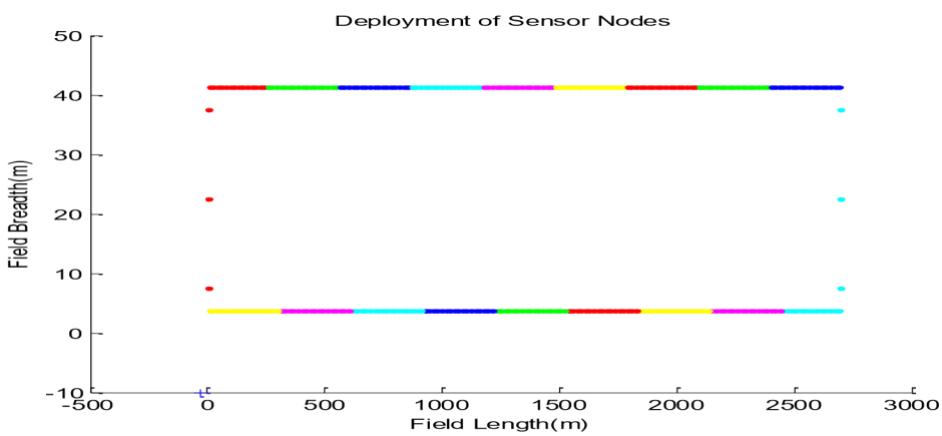

Figure 6: Graph of Sensor Nodes Deployment (18 clusters) for 2700m by 45m R/W

B. ENERGY MODEL FOR SENSOR NODES COMMUNICATION

In this work, a simple model for the radio hardware energy dissipation where the transmitter dissipates energy to run the radio electronics and the power amplifier, and the receiver dissipates energy to run the radio electronics; $E_{TX(elect)}$ and $E_{RX(elect)}$ is set to 50nJ/bit while $\in_{amp}$ is set to 100pJ/bit/m^2 for the transmit amplifier to achieve an acceptable E_b/N_o (energy per bit over noise spectral density) [18]. The cost to transmit a message depends on the distance between the transmitter and receiver. Thus, to transmit a *k*-bit message a distance *d*, the radio expends energy [18]:

$$ETX(k,d) = k * E_{TX(elec)} + k * d^2 * \in_{amp} \quad (1)$$

E_{TX} (k, d) is the energy required to transmit a k bit data through a distance d. $E_{TX(elect)}$ is the transmitter electronics energy, $\in_{amp}$ is the free space transmit amplifier.

To receive this message, the radio expends energy [18]:

$$E_{RX}(k) = k * E_{RX(elect)} \quad (2)$$

k is the size of the data in bit, and $E_{RX(elect)}$ is the receiver electronics energy. Figure 7 illustrates the communication model.

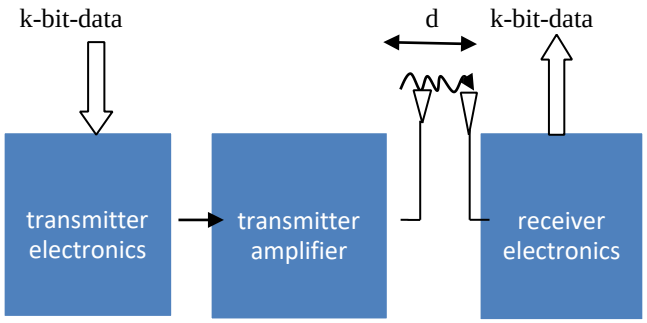

Figure 7: Block diagram of communication model

Where'd' is the distance between the sources and Sink. Using a direct communication protocol, each sensor sends its data directly to the Base Station. If the Base Station is far away from the nodes, direct communication will require a large amount of transmit power from each node. This will quickly drain the battery of the nodes and in turn reduces the network lifespan. Nodes route their packet to the Base Station through intermediate nodes. Thus nodes act as routers for other nodes in addition to sensing the environment. The existing routing protocol considers the energy of the transmitter and neglects the energy dissipation of the receiver in determining the routes in equation 1. Depending on the relative cost of the transmit amplifier and the radio electronics, the total energy expended in the system might be greater in multi-hop transmission than direct transmission to the Base Station. Assume that there is 'n' number of intermediate nodes (hops) to reach at the destination and also each adjacent node is differentiated with distance 'r' between them. So, the total distance between sources to BS is (n∗d), and for a single hop from one CH to another CH, distance 'd' in equation 1 is taken as 'r' thereby reducing the energy to be dissipated by a CH to transmit data through a distance 'd' in a single hop to the BS. Considering the energy expenditure at each node while transmitting a single k-bit message from source node N to Base Station, a node located with a distance from the Base Station using the direct communication approach is in equation 1 and 2. From equation 1;

$$E_{direct} = E_{Tx}\,(k, d; d = n*r) \quad (3)$$

$$E_{TX} = E_{TX\,(elec)} * k + \epsilon_{amp} * k\,(n*r)^2 \quad (4)$$

$$E_{TX} = E_{TX(elec)} * k + \epsilon_{amp} * k(n^2 * r^2) \quad (5)$$

Packet passes through the n intermediate nodes to reach at the destination means it required n times transmit and n-1 times receive from equation (2);

$$E_{RX} = (n-1)E_{RX} * k \quad (6)$$

So total energy expended to reach at the destination is:

$$E = E_{TX(elec)} * k + \epsilon_{amp} * k\,(n^2 * r^2) + (n-1)E_{RX} * k \quad (7)$$

$$E = k(E_{TX(elec)} + \epsilon_{amp}(n^2 * r^2) + (n-1)E_{RX(elect)}) \quad (8)$$

In the direct communication with the Base Station, the energy expended is

$$E = E_{TX} + E_{RX} \quad (9)$$

$$E = E_{TX(elec)} * k + k * d^2 * \epsilon_{amp} + E_{RX(elec)} * k \quad (10)$$

C. PROPOSED AIRCRAFT RUNWAY ROUTING PROTOCOL

The proposed Aircraft Runway protocol is based on hierarchical data transfer along any shortest path through the cluster heads to the Base Station located at the point (-30, -10) coordinates of the Aircraft Runway. Cluster head selection is based on the energy levels of the nodes and Sensor nodes are uniformly distributed over the entire perimeter of an Aircraft Runway. Non hierarchy-based cluster (uniform distribution of nodes around the runway perimeter) and hierarchy-based cluster (segmentation of the runway perimeter to the maximum possible cluster size) are formed. The BS (sink) starts the process by asking nodes to form clusters. The CH election phase proceeds after the cluster formation phase. The selection of CH(s) within each cluster formed is carried out by electing a node that require less transmission energy (to the BS) to be the CH for a particular transmission round. Due to draining activities being constraint on a Cluster Head during data aggregation and transfer phase, Cluster Head role is rotated among the sensor nodes of each cluster at every transmission round. A completely new estimation of energy is carried out at the beginning of every transmission round to elect a new CH for the cluster and thereby energy wastage is being reduced to its minimum and utilization of each nodes' energy is being maximized to ensure a prolonged network lifetime. The approach promotes the rotation of the CH role among the nodes of the cluster in order to prolong the node's lifespan.

The hierarchy-based energy-efficient routing protocol developed for an Airport Aircraft Runway is summarized as follows:

1. Geographical node deployment and cluster formation phase.
2. Selection of cluster head in each cluster formed.
3. Data aggregation phase which involves the gathering of collected data by the cluster head from the sensor nodes within its cluster, the data aggregation phase is based on energy prediction technique using the first order radio energy model [8]. This is described thus:

a. The initial energy, E_{in} of each node (RN or CH) is measured.

b. The distance, d_n between each regular node (RN) and the CH, where, $n = 1, 2, 3, \ldots$ is measured.

c. Energy required by each node for transmission within the cluster is estimated using the formula:

$$E_{rn} = \epsilon_{amp} * k * {d_n}^2 \quad (11)$$

Where E_{rn} is the energy required by regular nodes for intra-cluster communication, ϵ_{amp} is the free space transmit amplifier and d_n is the distance between regular node and CH.

d. The maximum energy after the subsequent transmission round for each node (RN) is estimated and selection of CH is done using the formula:

$$E_{rn}(\max) = E_{in} - \left(\epsilon_{amp} * k * {d_n}^2\right) \quad (12)$$

E_{rn} (max) is maximum energy of regular node, E_{in} is the initial energy of nodes, $\boldsymbol{\epsilon_{amp}}$ is the free space transmit amplifier, k is the data size in bit and d_n is the distance between regular node and CH, and the next CH selection will take place after the completion of the current round.

4. Data transmission phase which involves the transfer of all data from the nearest cluster head(s) to the BS.

The performance of the proposed Airport Aircraft Runway surveillance was evaluated by using the lifespan of network, that is, number of Active nodes versus simulation rounds. Figure 8 illustrates with flow chart, the proposed Aircraft Runway Routing Protocol. The energy model proposed by [8] is used to verify the operation of the proposed network while the numerical correctness of the model was validated using Matlab tool box.

TABLE 1: SIMULATION PARAMETERS

Parameters	**Quantity**
Total number of nodes	306
Initial sensor node energy (J)	10
Packet size (bits)	2000
Rounds	5000
Data period (seconds)	1
Transmit electronic energy (nJ)	50
Receive electronic energy (nJ)	50
Transmit power amplifier energy (pJ)	100
Base station coordinate	(-30, -10)

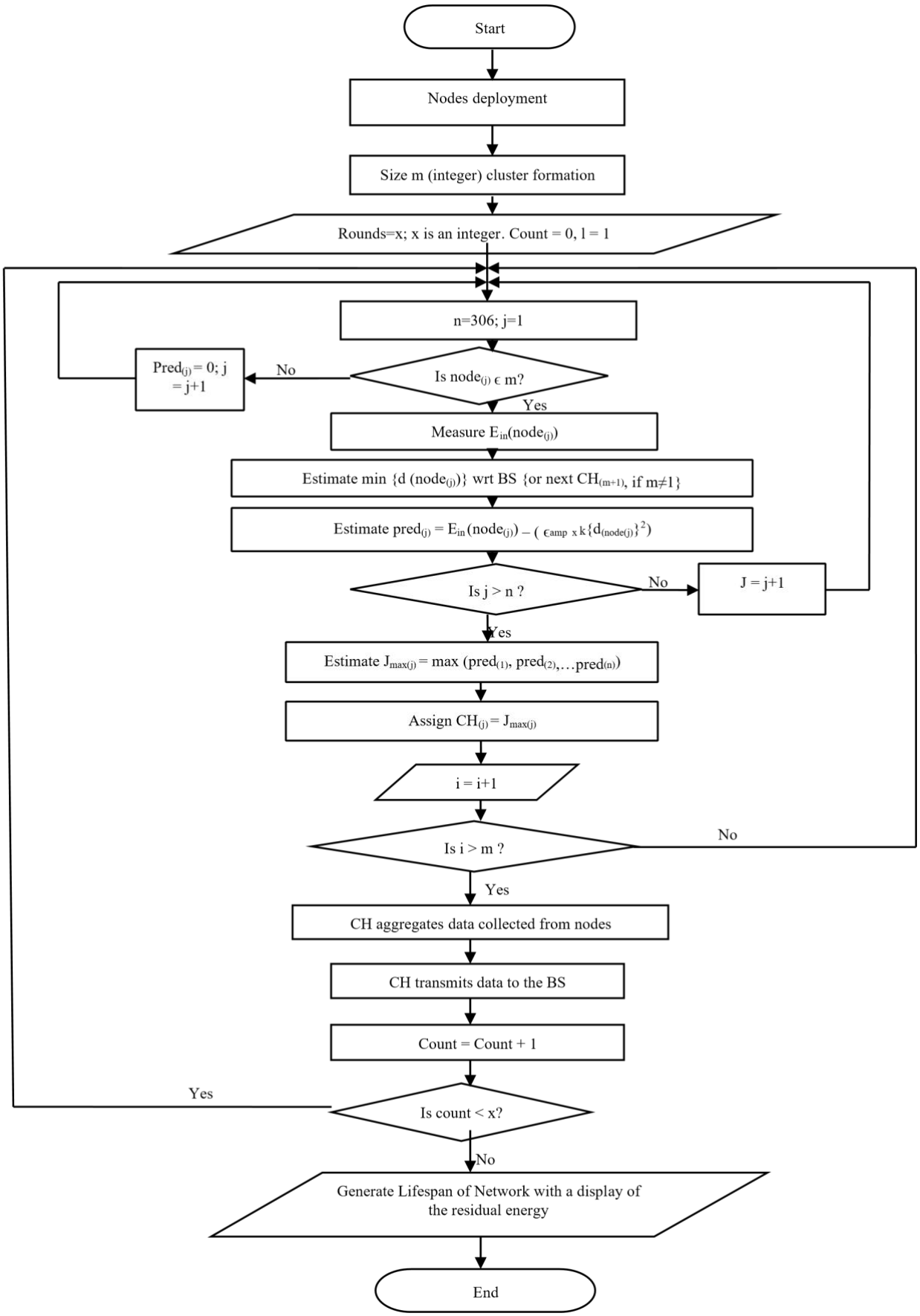

Figure 8: Flowchart of Proposed Aircraft Runway Routing Protocol

V. RESULTS AND DISCUSSIONS

A. RESULTS

The simulation results were realized in Matlab environment and the simulation condition was selected for the perimeter of two different Aircraft Runways, with dimensions; 3000m by 60m [19] and 2700m by 45m [20]. The implemented simulation parameters are shown on Table 1.

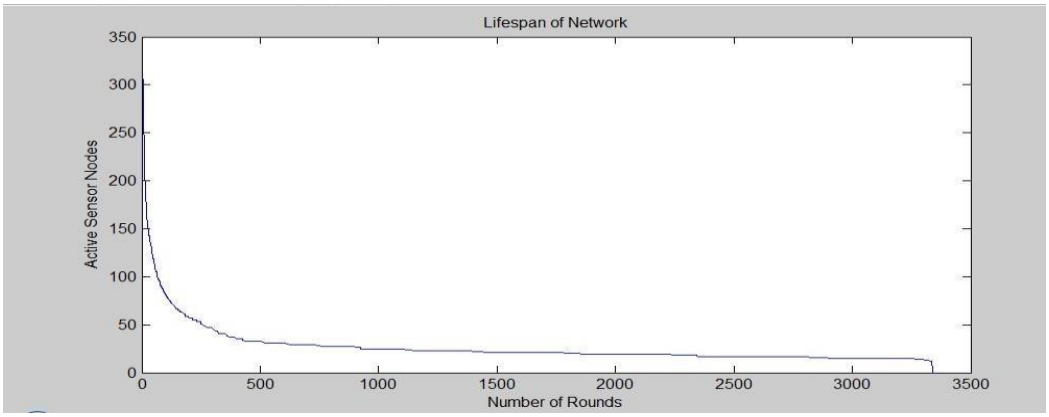

Figure 9: Graph of lifespan of non-hierarchical network (3000m by 60m R/W).

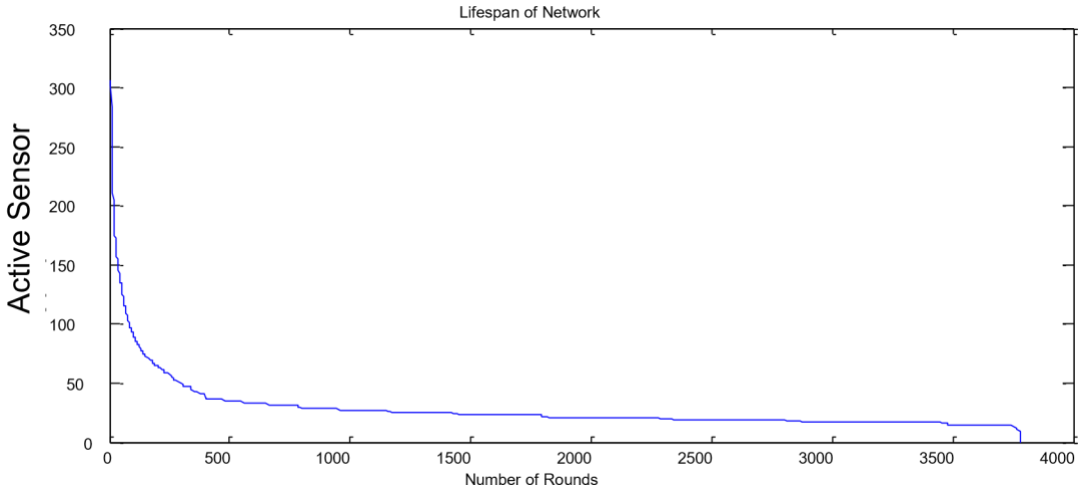

Figure 10: Graph of lifespan of non-hierarchical network (2700m by 45m R/W).

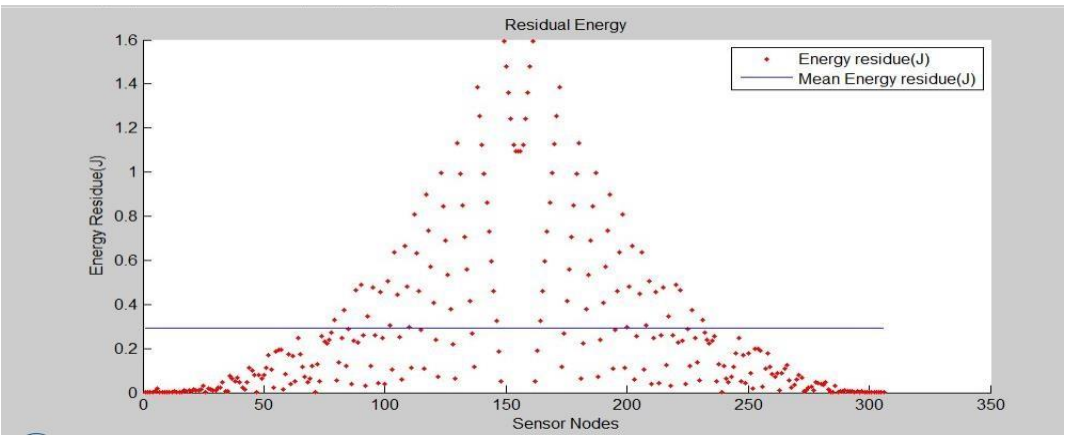

Figure 11: Graph of mean energy residue of non-hierarchical network (3000m by 60m R/W).

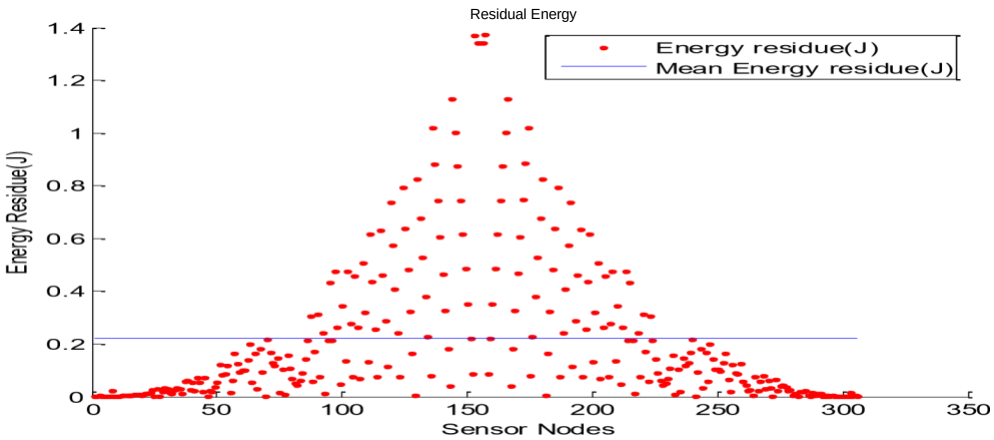

Figure 12: Graph of mean energy residue of non-hierarchical network (2700m by 45m R/W).

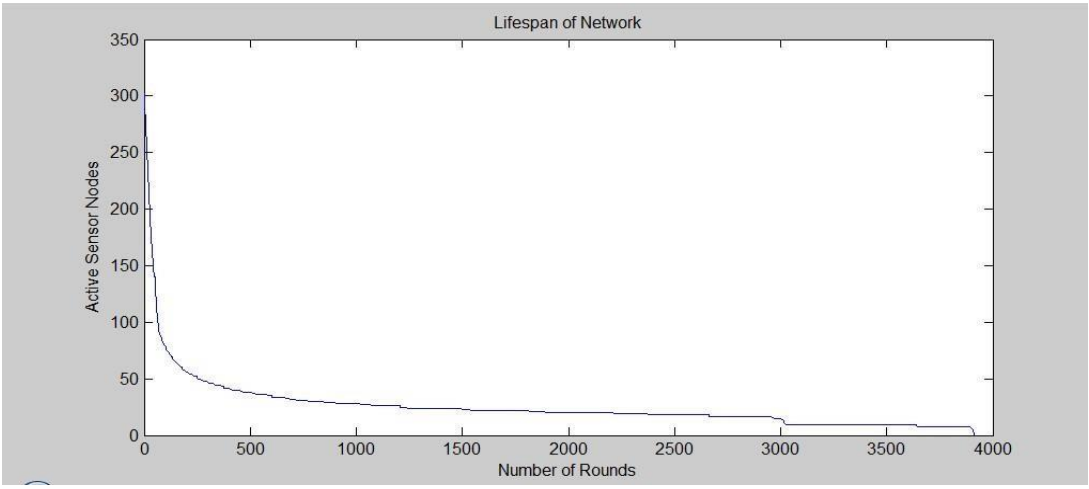

Figure 13: Graph of lifespan of hierarchical (6 clusters) network (3000m by 60m R/W).

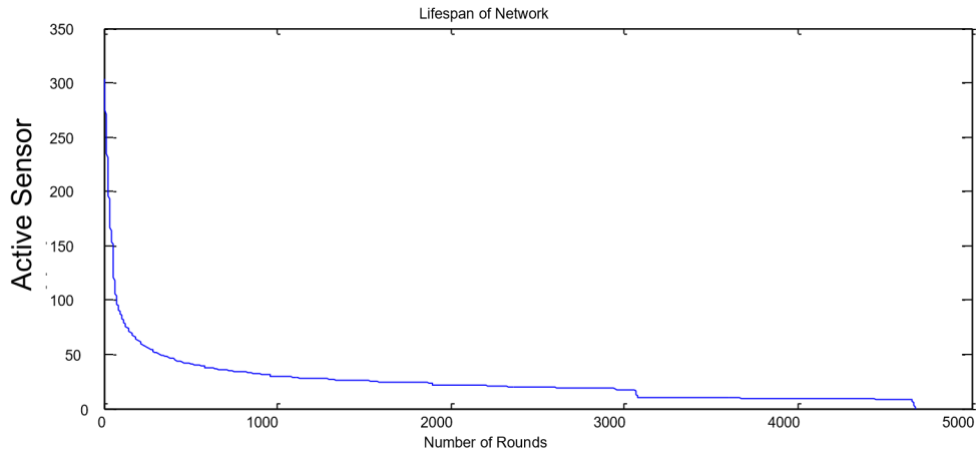

Figure 14: Graph of lifespan of hierarchical (6 clusters) network (2700m by 45m R/W).

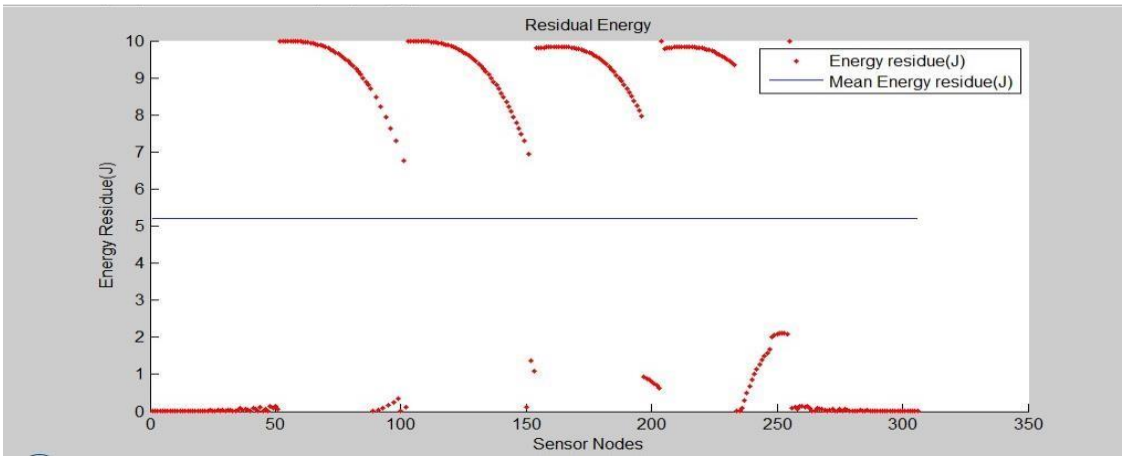

Figure 15: Graph of mean energy residue of hierarchical (6 cluster) network (3000m by 60m R/W).

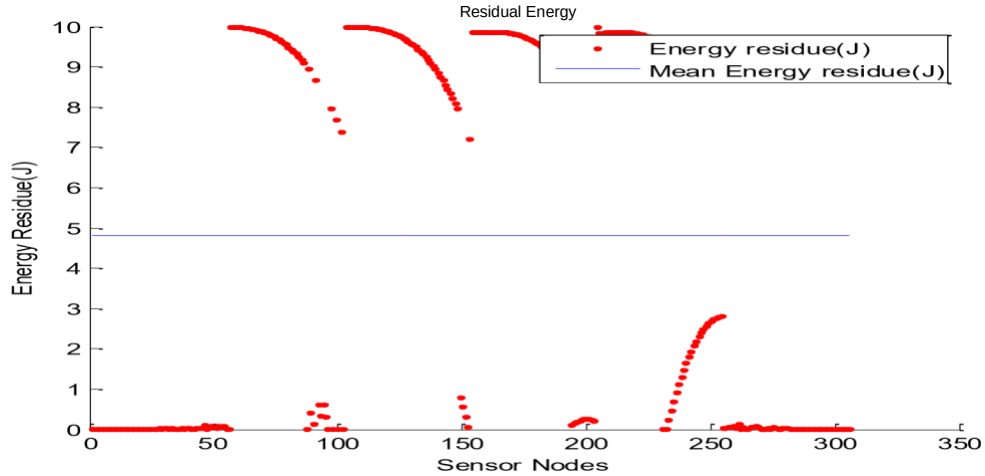

Figure 16: Graph of mean energy residue of hierarchical (6 cluster) network (2700m by 45m R/W).

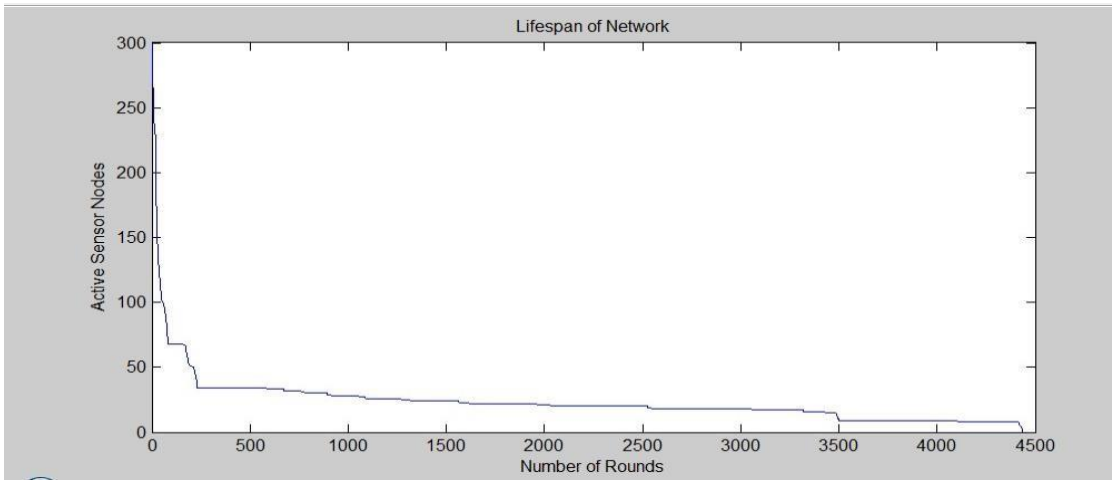

Figure 17: Graph showing the lifespan of hierarchical (18clusters) network (3000m by 60m R/W)

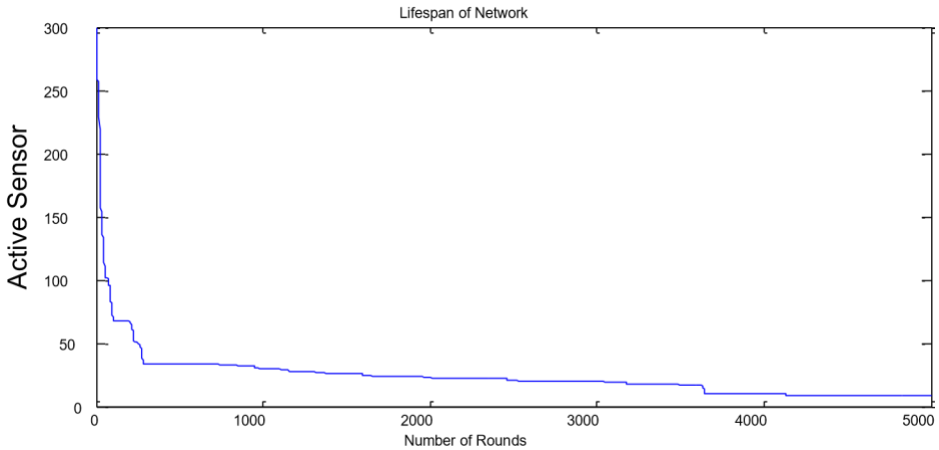

Figure 18: Graph showing the lifespan of hierarchical (18clusters) network (2700m by 45m R/W).

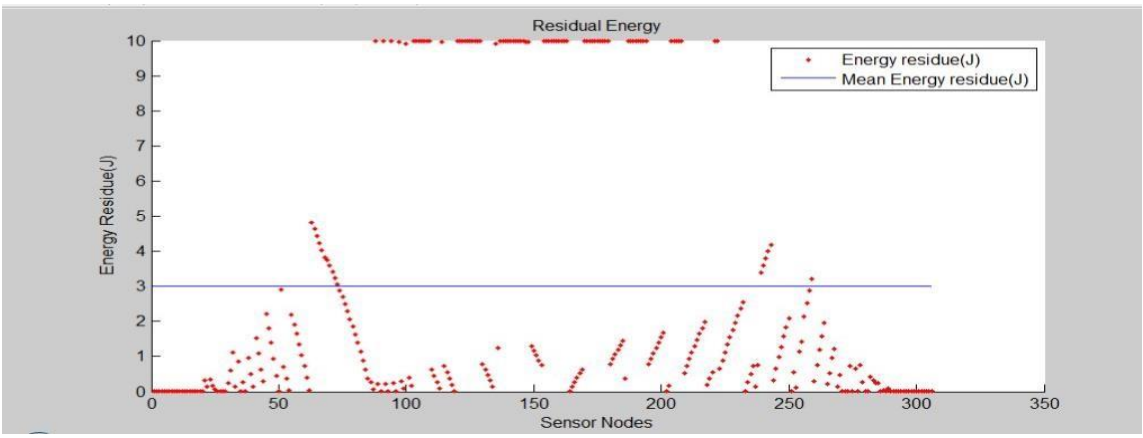

Figure 19: Graph of mean energy residue of hierarchical (18 cluster) network (3000m by 60m R/W).

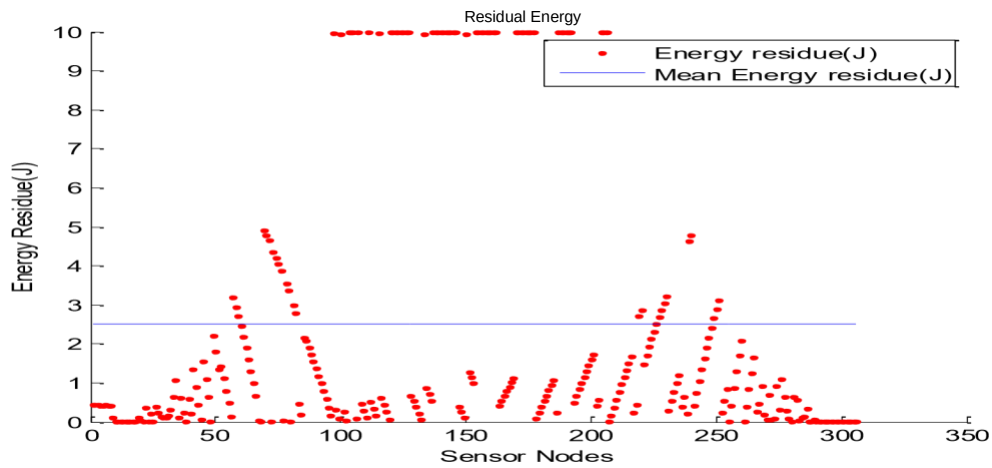

Figure 20: Graph of mean energy residue of hierarchical (18 cluster) network (2700m by 45m R/W).

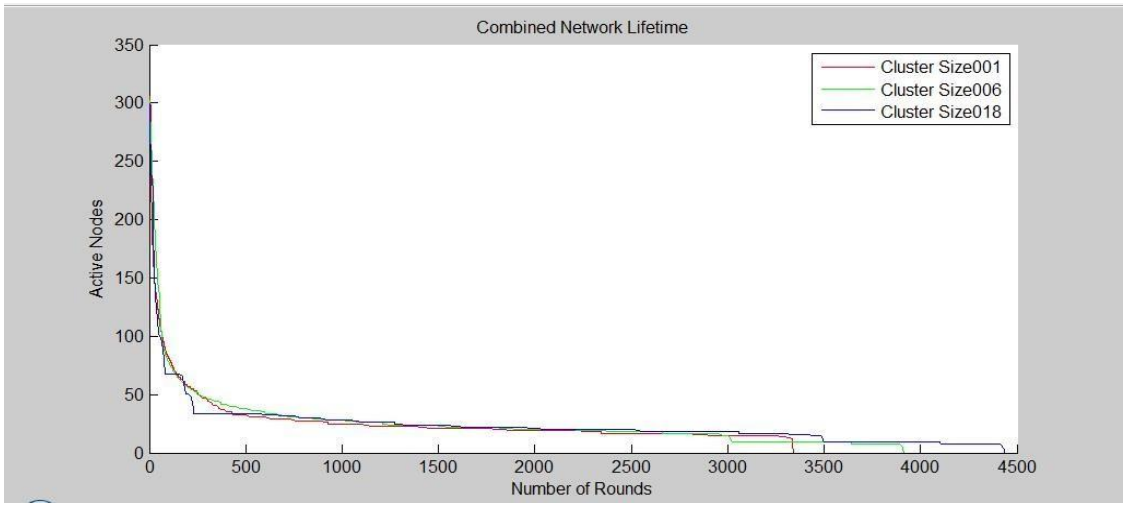

Figure 21: Graph of combined network lifetime (3000m by 60m R/W).

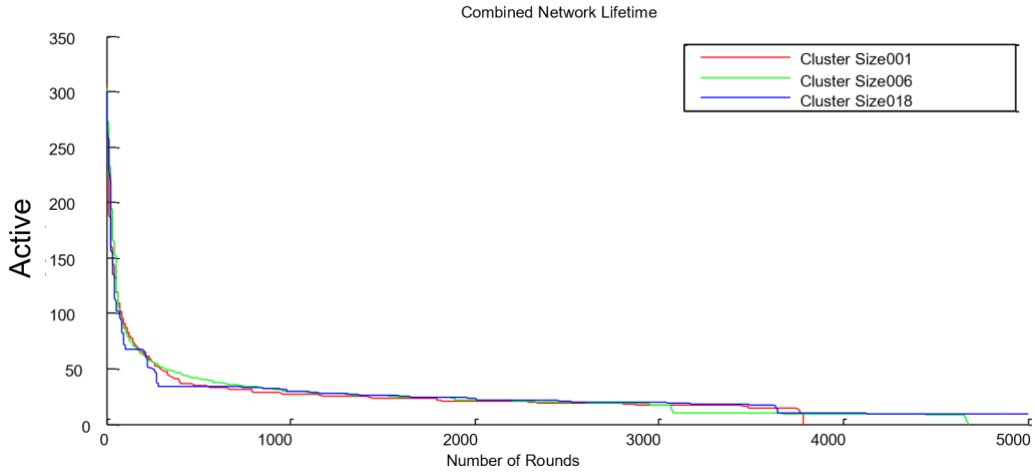

Figure 22: Graph of combined network lifetime (2700m by 45m R/W).

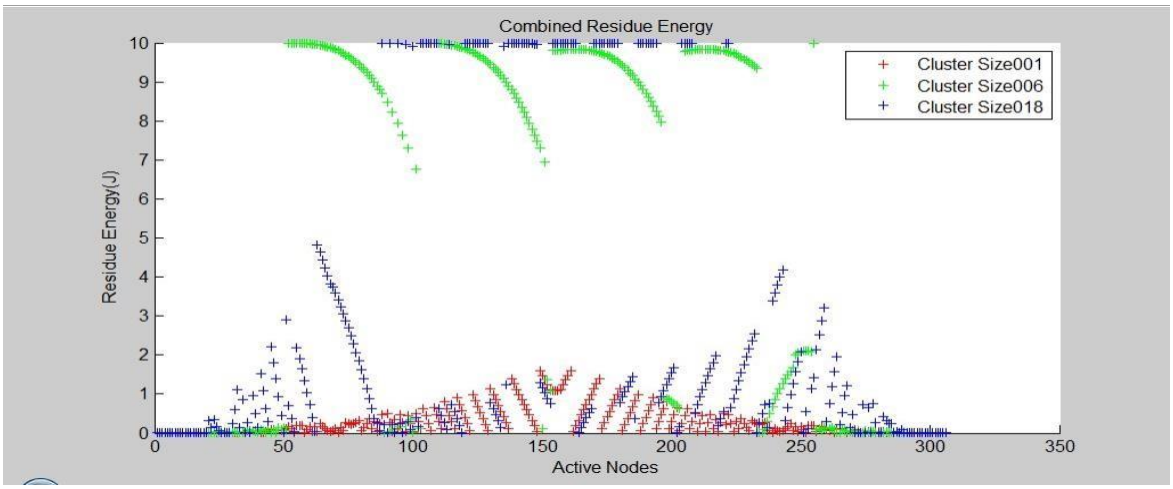

Figure 23: Graph of combined residue energy (3000m by 60m R/W).

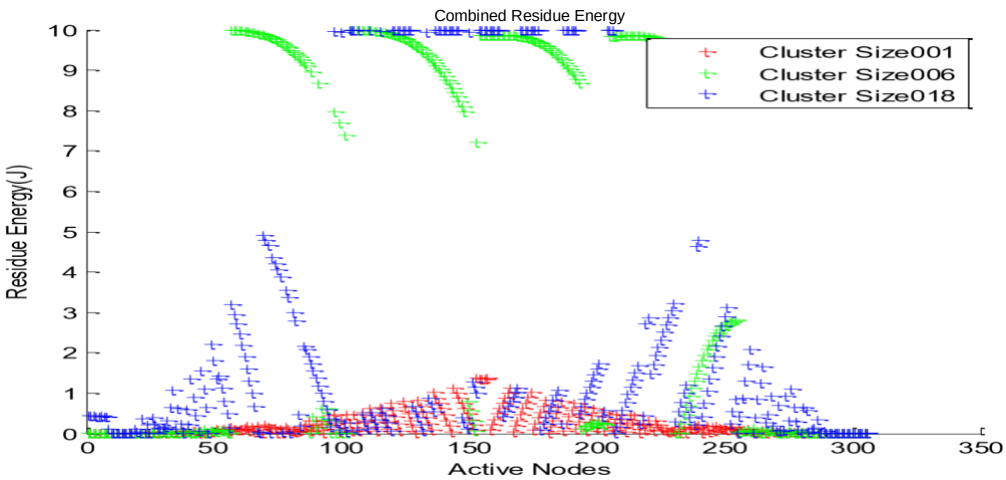

Figure 24: Graph of combined residue energy (2700m by 45m R/W).

B. DISCUSSION OF RESULTS

It had been revealed and equally justified in this work that hierarchical routing protocol among other protocols offered a better performance in improving the life-span of WSNs. Hierarchical routing reduces the number of nodes involved in transmission which consequently reduces communication over-head [7],[12]. The performances of the hierarchical routing protocol in this work evaluated based on network life-span proved that hierarchical routing of data to the Base Station enhances the lifespan of WSNs. Thus, making clustering protocol the most suitable and compactable for WSNs [7]. A total of 306 nodes were evenly distributed along the perimeter of the selected Aircraft Runways with dimensions; 3000m by 60m [19] and 2700m by 45m [20] with the Sink node located at (-30,10) coordinates. The initial energy level of all nodes were set at 10J, transmitter electronics E_{TX} and receiver electronics E_{RX} set to 50nJ/bit, Transmitter power amplifier electronics ϵ_{amp} set to 100PJ/bit/m^2 to achieve an acceptable energy per bit over noise spectral density[18] and the packet size of the sensor data set to 2000 bits. The first order radio model equation proposed in [18] was used to predict the minimal transmission energy level for Cluster head selection, data aggregation and transmission phase for 5000 rounds of cluster sizes 1, 6 and 18. In each cluster, CH aggregate the data received from other sensor nodes, fuses with its own data and transmit through the least path to the Sink. Every communication made incurs energy loss for every node, thus, Cluster head rotation was adopted to prolong the life-time of the network. Figure 9 and 10 illustrates the lifespan of the non-hierarchical deployment of wireless sensor nodes on the selected Aircraft Runways. More data are being processed and routed to the Base Station through the node assigned for routing in each round since the network is a replica of single cluster deployment.

The lifespan of the networks lasted for 3375 and 3750 rounds of simulation respectively for the selected Aircraft Runways. The mean energy residue is 0.3J and 0.22J respectively as illustrated on figures 11 and 12. The results displayed on figures 13 and 14 illustrate the lifespan of 6 cluster hierarchical configuration which enhances a reduction in communication overhead at the Cluster head. The sampled networks lasted for 3912 and 4660 round of simulation while the mean energy residue is 5.2J and 4.8J respectively as illustrated on figures 15 and 16. Figures 17 and 18 displayed the lifespan of 18-cluster hierarchical network configuration being the maximum possible cluster in the deployed samples. The increased number of cluster greatly reduces the size of data routed by each Cluster head to the Base Station, since a reduced number of nodes send their data to the Cluster head where the data is being aggregated and routed to the BS. The significant reduction in data transmitted to the Base Station enhances the lifespan of the network as it lasted for 4434 rounds of simulation and exceed the pre-estimated 5000 rounds while the mean residue energy are 3.0J and 2.5J as displayed on figures 19 and 20. Considering the mean residue energy of the 6-cluster and 18-cluster hierarchical configurations, and comparing with the nonhierarchical configuration, it was observed that the values displayed; average value of reserved energy otherwise regarded as mean energy residue after simulation rounds in the hierarchical configurations far exceed the non-hierarchical. Table 2 and 3 illustrates the performance of each network in terms of simulation rounds (Life-time) based on the pre-estimated 5000 simulation round. The displayed mean energy residue in the network is the average energy content of nodes when the network could no longer establish transmission to the Base Station.

Table 2**:** NETWORK CONFIGURATION, NETWORK LIFESPAN AND MEAN RESIDUAL ENERGY FOR 3000m by 60m R/W

Network. Configuration	Network. Life - span	Mean Residual Energy (J)
Non-hierarchical	3375	0.3
6-Cluster hierarchy	3912	5.2
18-Cluster hierarchy	4434	3.0

Table 3: NETWORK CONFIGURATION, NETWORK LIFESPAN AND MEAN RESIDUAL ENERGY FOR 2700m by 45m R/W

Network Configuration	Network Life-span	Mean Residual Energy (J)
Non-hierarchical	3750	0.22
6-Cluster hierarchy	4660	4.8
18-Cluster hierarchy	> 5000	2.5

Comparing the simulation results of the sampled runways as illustrated on tables 2 and 3, all simulation parameters being constant, the only varied parameter being the dimension of the runways. The effect of this enhances the performance of the model on the 2700m by

45m runway compared with the 3000m by 60m dimension in terms of the simulation rounds. Because of the increase in the dimension of the 3000m by 60m runway compared with 2700m by 45m, this consequently increases the distance demand on wireless sensor nodes to transmit data. Thus, the increase in distance increases the energy needed to transmit from source to destination.

VI. CONCLUSIONS

In this work, an Energy-efficient Wireless Sensor Networks for Aircraft Runway was modeled. Energy-efficient hierarchical routing technique where Cluster heads are selected based on residual energy and proximity to the Base Station was adopted. Equally, rotation of Cluster head role and optimization of Cluster heads selection based on the prediction of energy used for transmission in every transmission round and proximity to BS were considered. Analysis of hierarchical routing technique in transmitting data to the Base Station was conducted and the result lends credence to the fact that hierarchical routing technique offers a better approach to elongate the network lifetime. In the routing protocol, the networks were formed into different cluster size to reveal how it could affect the network life-time. With energy awareness being the core interest, the proposed routing protocol which uses the prediction of least transmission energy through the shortest distance to send data to the Base Station proves that it offered more energy savings and consequently increases the lifespan of the deployed network. From the simulation result, the deployment of 306 wireless sensor nodes along the Runway perimeters with dimension 3000m by 60m and 2700m by 45m, the Sink node being located outside the perimeter at (-30, -10) coordinates, for the non-hierarchical and hierarchical deployments showed that the hierarchical deployment performances exceed the non-hierarchical and the 18 hierarchical deployment (the highest possible cluster size) yielded the longest network life-time.

VII .RECOMENDATIONS AND FUTURE WORK

The increasing challenge of energy resources in Wireless Sensor Networks particularly when deployed in regions with limited access could pose a constraint to its usage as constant recharging and replacement is not a viable option recommendations are made: The model of WSNs in this work can be applied for monitoring any size of Aircraft Runway and similar perimeter as only a slight modification will be needed. Future improvement on the developed model is also recommended to cater for other challenges such as scalability, quality of service, network coverage and security. The variations in mean residue energy metric also require further studies.

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The Perception of Healthcare Workers Toward Infection Prevention and Control Practices in Two Hospitals in Bo City

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Abstract- Infection Prevention and Control (IPC) practices are kin practices and essential to excellence health care setting. It attends to issues associated to and from staff to patient or among staff. An infection Prevention and Control practice is something we cannot do without if we want to ensure a safe health delivery services and limit the spread of infections in the health-care setting or /and the community thereby, minimizing the risk of spreading infections. This research seeks to assess the perception of healthcare workers on IPC practices in two hospitals in Bo City.

A descriptive cross-sectional study design, qualitative and quantitative data collection methods were used. In-depth interviews were conducted in the two hospitals with one hundred and forty (140) respondents. Using a structured self-administered questionnaire and a participatory discussion the data was collected.

The study discovered that the greater part of junior nurses lack awareness of infection control principles. Factors that slow down nurses from proper infection prevention and control practice includes; lack of knowledge, forgetfulness, lack of time and lack of resources were identified. The study showed high levels of awareness in IPC practices due to lack of information on IPC. It was also found that most available resources for IPC practices were gloves 67.7% and compliance with IPC guidelines were reasonable. From the findings of the current study, it can be concluded that, despite performing well in knowledge and showing a positive attitude towards infection prevention and control, health care workers (HCWs) had unsatisfactory practice levels regarding infection prevention and control. The majority 60.71% (85) was knowledgeable with high knowledge; followed by 28.57% (40) who had some knowledge and 10.71% (15) had low knowledge. HCWs had sub-optimal 55% (77) low compliance levels with standard infection control guidelines and 45 % (63) of all participants had high level of compliance with all infection control policies. 31.43% (44) of the respondents had never attended any IPC training workshop and 68.57% (96) had attended workshops. Hence, it is needful for policy makers and administrators to provide both human and material resources as well as provide timely and well planned in-service training to the health care workers. Strengthening infection prevention and control practice through regular in-service training/workshop; ensure that resources are available all the time, observing health care workers' practices and provide feedback will be of great help.

Index Terms- Access, Attitudes, Availability, Compliance, infection prevention and control, Knowledge, Practices.

I. Introduction

1.1 BACKGROUD INFORMATION TO STUDY

The total population of Sierra Leone is 7,076,641 in millions. The official language of the country is English but locally Krio and Temne is widely spoken (UNDP, 2015b). The life expectancy at birth is 50 years both male and female (WHO-Sierra Leone, 2016a). The country's public health expenditure rate in percentage of Gross Domestic Product (GDP) is approximately 11.8%. The percentage of expenditure is relatively high compared to other countries (UNDP, 2015a).

However, the healthcare system is very poorly structured with high percentage of communicable burden of diseases by 70% and 30% of non-communicable diseases (WHO-Sierra Leone, 2016a). Number of doctors is significantly low; there are only 4 out of 100,000 people (WHO-Sierra Leone, 2016a). Clark (2011) asserts that nurses have so many factors that impede them from proper practice of IPC. A study on this problems and solutions, found that 36% of the nurses had problems in forgetting to practice the sterile technique and 44% lacked knowledge on infection control principles. As a result of this, supporting the in-service training among nurses to with the new trends and developments of infection control and sterile technique principles in order to become increasingly efficient and effective at preventing infections.

A successful (IPC) program is essential to quality health care because the potential benefits of reducing disease burden on patients, health institutions and the nation as a whole (MOH/GHS, 2009). In the last two decades, healthcare associated infections have been recognized as a significant problem in terms of quality of care and cost to patients/clients, healthcare facilities and governments. Health care associated infections have long been recognized as critical factors affecting the quality and outcomes of health care delivery. IPC is an essential, ongoing requirement to protect the communities, patients and health care workers (HCWs) from the spread of infectious. The Ebola virus disease (Ebola) epidemic in Sierra Leone highlighted how actions in health care settings can contain or amplify an epidemic threat in a community. The first cases in the region were recognized in Guinea in March 2014 and consequently spread across the border.

Early in the outbreak, several groups of EVD were reported in health facilities all over the country which occurred in portions due to poor infection prevention and control (IPC) practices. The first cases in the region were recognized in Guinea in March 2014 and consequently spread across the border. These first cases in the country and, several clusters of EVD reported in healthcare facilities were due to poor infection prevention and control (IPC) practices. Infection-related diseases are still the main cause of death in Sierra Leone, with a burden of HIV, TB, Hepatitis, Typhoid, Malaria, respiratory infections and other infectious conditions. Preventing transmission from affected patients to the community and the implementation of IPC best standards practices has been one of the pillars of the response to the Ebola outbreak.

Early in the epidemic, several groups of EVD were reported in healthcare facilities all over the country which occurred in fragment due to poor infection prevention and control (IPC) practices. Sierra Leone was profoundly impacted by the Ebola virus disease (EVD) epidemic in West Africa, documenting 14 122 cases and 3955 deaths. It's first confirmed was in 24th May2014. According to WHO-Sierra Leone, the cumulative confirmed cases are 8,706 and registered deaths are 3,590 from the data recorded until 27th March 2016. The initial outbreak in Kailahun, the eastern districts of Sierra Leone spread to all districts. The incidence among healthcare workers (HCWs) became 100 times that of the general population, leading to the deaths of nearly 10% of the workforce. Lack of IPC policies, strategies and trained professionals also add to the extent of the problem. The EVD outbreak in Sierra Leone is extraordinary in many ways, including the high number of doctors, nurses, and other healthcare workers who have been infected. This has had a overwhelming impact on the already fragile health workforces of the country.

According to Sydnor & Perl (2011) Infectious patients are admitted into hospitals and therefore hospitals have become common settings for transmission of diseases. In hospitals, infected patients are a source of infection transmission to other patients, health workers and visitors. Hand wash is the single most important intervention to prevent transmission of infection and should be a quality standard in all health institutions. An attitude of not washing hands among individuals involved in the provision of health care can increase the rate of hospital-acquired infections. Efficient knowledge, good attitude and best practices by health care workers in infection prevention and control may contribute to decreasing in infection rate in the hospital. In the last two decades, healthcare associated infections have been recognized as a significant problem in terms of quality of care and cost to patients/clients, healthcare facilities and governments. Health care associated infections have long been recognized as critical factors affecting the quality and outcomes of health care delivery. Infection prevention and control is an essential, ongoing requirement to protect the communities, patients and health care workers (HCWs) from the spread of infectious.

1.2 STATEMENT OF THE PROBLEM

The advantage of IPC in high-quality health delivery and attain patient satisfaction ensures less expenditure on health care in any country. The World Health Organization (2009), estimate that 5% to10% of patients, will be acquired one or more infection within health care settings, the risk reminds higher in developing countries. Their role to prevention and control of infection spread is critical in nursing process especially in patient care. This is mainly for junior nurses who are doing most of the work in the wards because of acute shortage of skilled competent. The nurses may do the work hurriedly and in the process, fail to follow correct procedures of preventing infection, thereby putting the patient at risk of acquiring infection in the hospitals. The findings on infection control problems found that 36% of the nurses had problems in forgetting to practice the sterile technique and 44% lacked knowledge on infection control principles. Hence, reinforce the importance of in-service training among nurses to keep them efficient with new trends and developments of infection control and sterile technique principles in order to become more and more efficient and effectual at preventing infections.

Health sector indicators show some making level of progress during the EVD outbreak and experienced a significant decline at a rapid pace particularly in the IPC. The unavailability of supervision and monitoring coupled with inaccessibility of trained staff, and availability of WASH facilities. The World Health Organization reported on the 18 February, HCWs had been reported infected (WHO, 2015). Smith (2009) reported that the factors which hamper nurses from practicing IPC were: lack of knowledge, lack of time to bring proper infection control due to low nurse patient ratio, lack of gear and absentmindedness. Furthermore, Dyer (2010) also highlighted lack of resources as a factor impeding nurses from proper infection control practice. Swanson (2002) pointed out that lack of information is a major factor that impedes in proper infection control practice. He found that most of the nurses have no sufficient input on infection control principles. He further suggests that nurses should get some in service training on the principles.

1.3 JUSTIFICATION OF STUDY

The impact and severity of the Ebola outbreak have had reflective effect on the health sector. An infection Prevention and Control (IPC) practice is the key to health sector policy. The result of this study will ensure excellent client-centered care and maximize protection against infections for all groups of health staff, patients/clients and communities.

The Centers for Disease Control and Prevention approximated that two million patients suffer from hospital-acquired infections every year and nearly 100,000 of them die. Most of these medical errors are preventable. Hospital-acquired infections result in up to $4.5 billion in additional healthcare expenses annually. In the healthcare setting, the infection control department is classified as non-revenue-producing. Funds dedicated to capital such as staff, educational programs, and prevention procedures are vastly limited. Hospital leaders will need to balance the upfront cost needed to prevent hospital-related infections with the non-reimbursed expense accrued secondary to potentially preventable infections. Infection control and prevention is critical to delivering safe and high-quality care to all when compliance with the Infection prevention and control guidelines.

The result of this study will ensure excellent client-centered care and maximize safety against infections. This study seeks to assess the perception of healthcare workers on IPC practices; in terms of compliance with guidelines, continuality, availability and

access to IPC materials. The result will help guidelines with information on the extent to which non-compliance with IPC practice is prevalent.

1.4 AIM AND OBJECTIVES OF THE STUDY

1.4.1 Aim of Study

This research seeks to assess the perception of healthcare workers on IPC practices in two hospitals in Bo City.

1.4.2 Objectives of Study

The specific objectives of the study are to:

a. Determine the perception/level of healthcare workers of current Infection Prevention and Control(IPC) practice;
b. Evaluate the compliance with the dictates of the Infection Prevention and Control Policy by health workers at these facilities;
c. Determine the barriers (supervision; availability and access to Infection Prevention Control material supplies) to infection prevention and control practice among healthcare workers in these hospitals; and

1.5 SIGNIFICANCE OF THE STUDY

We are devoted to preventing and controlling the transmission of healthcare associated infections to patients, clients, residents, healthcare workers, visitors and others. Preventing infections is a high priority, and ensure all measures are taken to reduce infections and prevent transmission. They are a important patient protection issue, and can also be Safety issue. A well-functioning Infection Prevention and Control program helps minimize these risks for our patients, residents, visitors and our staff. Infection-related diseases are still the main cause of morbidity and mortality in Sierra Leone (WHO, 2015).

Providing edification to patients and staff members, study of infections or epidemic, prevention of infections during activities such as monitoring hand hygiene or auditing practices, renovation of existing spaces and research is a paramount aspect. Significant microbiological evidence exists reflecting the increased risk of infection transmission specifically through inadequately Infection prevention and control guidelines. Significantly, it was recently discovered that widely-used high level Infection prevention and control guidelines increasingly apparent and attention must be paid to it. The guidelines and standards are comprehensive however the challenge is in general awareness and effective implementation into practice. The purpose of this paper is to present case studies that assess the perception of healthcare workers on IPC practices at two Hospitals in Bo and present strategies that address it.

II. REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

IPC practices are a kin practice to public health and it is practiced within the confines of a particular health-care delivery system rather than at the public level as a whole. It tackles factors related to the spread of infections within the health-care setting and from staff to patient or among staff (WHO, 2002). An infection Prevention and Control practice is something we cannot do without if we want to ensure a healthy and safe health delivery services in our country. Infection Prevention and Control (IPC), refers to policies and procedures used to reduce the risk of spreading infections, especially in humans and healthcare facilities.

An effective Infection Prevention and Control (IPC) program is necessary to excellence health care. This is because it has the possible benefits of reducing disease burden on patients, health institutions and the nation as a whole (MOH/GHS, 2009). Although infection is most prevalent in patients upon admission, healthcare workers also act as potential vectors for pathogenic agents. Hospitals provide a favorable transmission pathway for the spread of infections owing, partly, to poor infection control practices among health workers on one hand and overcrowding of patients in most clinical settings on the other (Bello et al., 2011)

2.2 PERCEPTION AND PRACTICE OF IPC

During the Ebola outbreak in Sierra Leone, one of the key issues was that from the first stage of infection, many people were not aware of the disease. Since it was the first time when Ebola outbreak happened in Sierra Leone. In addition, since people were not fully aware of it, infected patients was hiding from hospitals and following their own way of treating disease such as going to traditional healers or herbalist for medication (Quist-Arcton, 2014). Not only the behaviour of population avoiding hospitals, there was lack of healthcare facilities in Sierra Leone during the Ebola outbreak and nothing was prepared to fight against Ebola. Therefore, even for patient who willingly go to hospital find it difficult to seek medical help (Swartout, 2014) Furthermore, there was very limited insight and practice of IPC by Healthcare workers in health facilities in Sierra Leone. A study from South Africa demonstrated that HCWs in high HIV burden area were significantly more likely to be hospitalized with infectious diseases than were non-health care workers (O'Donnell et al., 2010).

2.3 HEALTHCARE WORKERS COMPLIANCE WITH IPC

WHO (2009) recommends particulate respirators for use by HCWs when caring for infectious or suspected in being infectious patients. For patients surgical masks are recommended to reduce spread of pathogens. Respiratory protection is acknowledged as a complementary level of protection for HCWs after other strategies have been implemented, and recommendations made to elaborate low-cost, non-disposable, of better appearance respirators allowing verbal communication with the patients (Nardell & Dharmadhikari, 2010). A comprehensive training program for HCWs on correct and routine use of particulate respirators was recommended by WHO (2009), however, some studies report that fit-testing program is neglected (Nardell & Dharmadhikari, 2010). Due to regular modification of lifestyles and environments, new diseases are constantly appearing that people are susceptible to, making protection from the threat of infectious disease urgent. Many new contagious, emerging and re-emerging diseases have been identified in recent past years such as AIDS, Ebola and Hantavirus (WHO, 2002). In Sierra Leone, a localized health emergency escalated into a major crisis due to a weak health system compounded by poor provision and access to basic public services. The crisis also highlighted the countries' infrastructural weaknesses, including inadequate provision of water, sanitation, electricity and education.

Infection control is an essential component of care and one which has too often been underestimated in modern years. It is an necessary but often under-recognized and under supported part of the infrastructure of healthcare. Infection prevention and control is a key component of practice for all healthcare professionals, not only for their health, but also to reduce infections, thus improving patient safety (MOH, 2005)

Infection control addresses factors related to the spread of infections within the healthcare setting whether patient to patient, patient to staff, staff to patient or among staff, including prevention (via hand hygiene, cleaning/disinfection/sterilization, vaccination, monitoring/investigation) of demonstrated suspected spread of infection within a particular healthcare environment. Research has demonstrated that up to one third of hospital acquired infection can be prevented with high intensity of Hospital Acquired Surveillance and Control Program (MOH, 2005).

Therefore a orderly move toward to detect deficiencies in infection control practices and to implement effective and affordable solution is urgently needed. Another factor that has been linked with compliance is incorporation of IP strategy in health care workers' curricular and in-service training on IP Protocol and Guidelines. According to Yamin ***et al***., (2012), health-care workers must show leadership in infection prevention and control by using their knowledge, expertise and immediately apply decisions to start appropriate measures for their protection.

2.4 BARRIERS TO IPC PRACTICE AMONG HEALTH WORKERS IN THE HOSPITAL

It may seem paradoxical that, the place where you go to be healed can make you ill. Hospitals are havens for infection-causing bugs, but by following a few practical tips, you can have a healthier hospital stay (Dove and Mann, 2006). The healthcare workers themselves can spread infection if they are not watchful about washing of their hands and changing gloves every time they move from patient to another. Hospital infection can also be the result of contaminated ventilation or water system.

Conversely, there are very many reservoirs, the one from which infections arise is usually called the source (WHO, 2002). Identification of the correct source is necessary to arrest the spread of the virus. The sources of spread can be classified along the same lines as the types of infection. For examples, the spread from community-acquired infection to other patients in the hospital can be through the respiratory tract as in tuberculosis and respiratory viruses, infected blood, as with viral hepatitis and HIV/AIDS. These infections arise from many different sources and are regularly associated with operative or other invasive procedures carried out in operating theatres, wards, x-ray departments and clinics. The groups at high risk of obtain infection due to diminished defenses require additional protection especially, in hospital areas where there are enhanced invasive procedures (WHO, 2002).

Infection is the invasion and increase of micro-organisms in the body tissues. The infection process is similar to a circular chain with each link representing one of the factors involved in the process. An infectious disease occurs if each link is present and in proper sequence. An additional mode of transfers, such as the air current, hands, vector fomites or other means by which the pathogens can move from one place or person to another. Open wounds and reproductive tract are also means through which the pathogens can enter the body of susceptible host (MOH, 2005). According to (Burke, JP 2003) germs that cause infection spread through; Airborne (the germs are carried by the air such as the chicken pox virus), Droplet spread (infectious droplets of moisture are coughed or breathed out during infection). These settle on surface and may be conveyed to another person's eyes or mouth usually by their hands. Direct Contact (by touching someone that has the infection, such as scabies and Indirect Contact by contact with dirty equipment or other materials.

2.5 AVAILABILITY AND ACCESS TO MATERIALS FOR IPC AT HEALTH FACILITIES.

All health workers (e.g. nurses, physicians, housekeepers and cleaners) need to know why infection prevention is important. Knowledge of clinical infection control practices is continually growing and varying. While the principles of infection control (prevention, transmission and control) do not change, though specific clinical practices may evolve as a result of new evidence (MOH, 2009). Knowledge on disease transmission cycle, use of routes of infection and how to break the cycle, use of Standard Precaution when dealing with all patients and methods of minimizing disease transmission. Accessibility of Infection Prevention (IP) materials has been cited as important determinants of compliance with IPC practices. A study conducted revealed that inadequate supply of gloves in southern province-based health facilities led to the spread of infection among women during vaginal examinations (Mukwato ***et al***., 2003).

In another study behavior at the same hospital, it was reported that general hygienic actions taken to reduce the risk of HIV infection were insufficient and that many inadequacies stemmed from the lack of supplies (Mukwato ***et al***., 2003). Punctual access to resources for IP practices is crucial to effective and successful IPC practices in developing countries where infection rate is high (Mukwato ***et al***., 2003). Therefore, one way to increase IPC practices in hospitals must provide sufficient resources to support the program.

Successful program for preventing the spread of infectious diseases in healthcare facilities are based on understanding the scope of the trouble, prioritizing activities and successfully using accessible resources are habitually limited, careful planning, implementing and monitoring activities on a regular basis, whether in a small clinic or a busy district hospital are all essential (Tietjen ***et al***., 2003).

Managerial controls are among the most important steps in prevention and control of infections. Therefore administrative support and commitment is essential in the helpfulness of all other measures (Rak, 2010). Hospital authorities must understand that without the proper resources, hospitals can be high risk areas. Therefore healthcare authorities must establish and support a comprehensive, effective national objective and develop strategies, guidelines and policies for specific infection control issues which are regularly updated (Rak, 2010).

Implementing IPC program in low- and middle income countries is frequently hampered by financial constraints, inadequate logistics/materials, limited laboratory ability and insufficient staff training in areas such as hand hygiene, handling and disposal of clinical waste, handling and disposal of sharps,

decontamination and sterilization of used instruments and quality improvement.

The literature review suggests that infection includes non-clinical staff within a health-care setting. Therefore, the focal point should shift from "health-care workers" to "health workers" In wrapping up, the fact that healthcare workers may have numerous possible exposure makes it difficult to ascertain whether they acquired infections in the community or the workplace.

III. RESEARCH METHODOLOGY

3.1. INTRODUCTION

This chapter includes the research methodology that was applied to assess the perception of healthcare workers on infection prevention and control practices in two hospitals in Bo city. The research design, population, study area, and sampling procedures, data collection, data analysis methods and ethical considerations are also discussed. Its purpose is to provide a detailed explanation on the procedures to be used in carrying out the research.

3.2 RESEARCH DESIGN AND METHOD

The research was a descriptive cross-sectional study. A combination of qualitative and quantitative data collection methods was used. In-depth interviews were conducted to both patients and health providers at the two hospitals. The researcher and the interviewee agreed to sit in a private place and conduct the interview. The interview was conducted in Creole the language that was convenient for the interviewees. The survey employed self-administered questionnaire and observational show to collect data. One hundred and forty (140) respondents participated in the study. IPC performance was evaluated using interaction analysis of audio-taped clinical encounters. Patient perspectives were evaluated through exit interviews. Health provider perspectives about the relevance of IPC were evaluated through a self-administered questionnaire followed by a participatory discussion. Some variables were quantified and others explored in depth, thus generating descriptions.

3.3 DESCRIPTION OF STUDY AREAS

The study was conducted at Bo Government Hospital and UMC Mercy Hospital in Bo. The Bo Government Hospital is a referral centre in the southern Provinces while Mercy is a Faith Based Non-Governmental Organization, both providing general and particular services for the city and surrounding areas. Both hospitals have staff strength encompasses doctors, nurses, laboratory technicians, pharmacists and other health workers. The hospitals were chosen for the study because the researcher wanted to get a clear picture on the perception of healthcare workers on IPC practices at two Hospitals in Bo City and the compliance in IPC practices.

The place where this study is conducted is the second largest city in Sierra Leone in the Southern Province. The city serves as the capital and administrative centre of Bo District. It is a major urban centre, and lies approximately 155 miles south-east of Freetown. The city of Bo is one of Sierra Leone's six municipalities and the municipality of Bo had a population of 149,957 in the 2004 census and a current estimate of 250, 266.

The city is home to a large population of many Sierra Leone's ethnic groups, with no single ethnic group forming a majority of the city's population. The Krio language is most widely spoken in Bo and is used as the primary language of communication in the city. The city's population is religiously diverse among Muslims and Christians. Bo lies on the main rail line east and south of Freetown which was closed in 1974. From 1930 until independence 1961, it was the capital of the Protectorate of Sierra Leone. After Freetown, Bo began its modern development with the coming of the rail road in 1889 and became an educational center in 1906, when the Bo Government Secondary School was established.

The inhabitants of Bo are known for their resolve, resistance and hospitality. The town was named after its generosity. An elephant was killed close to what is now known as Bo Parking Ground. People from the surrounding villages came to receive their share. Because the meat was so large, the hunter spent days distributing it and the words **"Bo-lor"** which in Mende language means **t**ranslates to "this is Bo."

3.4. POPULATION OF THE STUDY

Two hospitals, including Bo government hospital and Unite Methodist Church Mercy (UMC) Hospital were assessed on the perception of healthcare workers on IPC practices in Bo City between May–August 2018. These hospitals were selected because they are the major referral health centers and hospitals that offer many services. The study population consisted of 220 participants includes healthcare workers at these hospitals.

3.5 SAMPLE AND SAMPLING TECHNIQUES

This study used a descriptive cross-sectional research design. A sample of 220 participants includes healthcare workers were selected using simple random sampling technique. As a result of limited time within which the study was carried out and the shift system run by the hospital staff, expediency sampling method was employed to enable the investigator get a sensible sample size for the study. All data were collected by the key study.

Inclusion criteria: All Health care workers working in the medical, surgical (female & male), children and maternity wards including theatre at the Hospitals in the selected hospitals for the last four months of commencement of the studies.

Exclusion criteria: People visiting the hospitals (patients and relatives) and other health care workers who do not work in the selected hospitals. Health care workers who work in these hospitals less than four months of beginning of the studies were not interrogated.

3.6 SAMPLE SIZE DETERMINATION

The sample size formula (Daniel, 1999) is used, which is $n = \frac{Z^2 P(1-P)}{d^2}$ If your population more than 10.000

Where **n**: is the sample size where the sample size is more than 10,000, **Z**: statistic for a level of confidence. (For the level of confidence of 95%, which is conventional, Z value is 1.96). **P:** expected prevalence or proportion. (P is considered 0.5) and **d**: precision. (d is considered 0.05 to produce good precision and smaller error of estimate)

$$\mathbf{n = Z^2P\,(1\text{-}P) / d^2}$$

P = 0.5, d = 0.05, Z = 1.96 (i.e., for a 95% C.I.) Therefore:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

n = (1.96)2 × 0.5 (1-0.5) / (0.05)^2
n = 3.8416 ×0.5 (0.5)/ (0. 0025)
n = 0.9604/ (0. 0025)
n = 384.16

Thus, the study should include at least **384.16** subjects.

Adjusted sample for population less than 10.000, because the above sample is to be taken from a relatively small population where N = 220 (N<10,000) the required minimum sample will be obtained from the above estimate by making some adjustment. Where **n**: is the sample size where the sample size is more than 10,000 and **N** is the population.

Sample = n ÷ {1 + (n ÷ N)}
Sample = 384.16 ÷ {1 + (384.16 ÷ 220)}
Sample = 384.16 ÷ {1 + 1.74618182}
Sample = 384.16 ÷ {2.74618182}
Sample = 139.888771
Sample = 140 subjects

3.7 INSTRUMENTS FOR DATA COLLECTION AND PRESENTATION

In this study, the dependent attribute was compliance with IPC practices by the healthcare workers at the facility. The independent variables were the knowledge of IPC, availability and access to materials for IPC. Responses were coded and later presented using tables, figures and percentages. The study also used simple statistical like average mean, median to analyze the collected data. Data were also presented in a table to facilitate easy analysis and computation. Self-administered questionnaire used to collect data from the staff of the facilities were developed in English from specifically for this study and had four sections: **Section A**: Demographic data, **Section B:** comprised of health workers' perception/level of current Infection Prevention and Control (IPC) practice (Awareness of infection prevention and control and then the practice of sterile technique principles. Awareness of infection prevention and control was measured using scoring); **Section C:** compliance with the dictates of the Infection Prevention and Control Policy by health workers at these facilities; and **Section D:** the barriers (supervision; availability and access to Infection Prevention Control material supplies) to infection prevention and control practice among healthcare workers in these hospitals. The highest possible score was 20, those who attained below 10 had poor awareness, those who scored 10 to 14 had moderate awareness and those who attained 15 to 20 had outstanding awareness.

Observational guides were also used to assess the IPC practices amongst healthcare workers at the facilities using an observation checklist. Observations were made on the compliance with IPC practices by the healthcare workers at the health care facilities and the knowledge of IPC, availability and access to resources for IPC. (If these were available the answer, "Yes" was circled and if not available, "No" was circled.)

3.8 PROCESSING AND ANALYZING DATA

The data entered into Excel were exported and analyzed using Epi Data Analysis. Comparisons of the overall IPC implementation before and after the interventions, disaggregated by facility ownership, were performed. The proportions of facilities with no, partial or full implementation for specific components and disaggregated by facility ownership, were compared.

3.9 ETHICAL CONSIDERATION/ISSUES

Ahead of the beginning of this investigation, a study proposal and etiquette was designed and submitted for approval. The consent of District Medical Superintendent at Bo Government Hospital and the Medical officer at United Methodist Church Mercy (UMC) Hospital Bo was granted. Before collecting the data a written letter of consent was administered to the potential respondents/study subjects for their approval to be enrolled in the study.

To be accuracy, self-administered questionnaire was edited and pretested before used to ensure consistency. Two (2) interviewers with adequate awareness in IPC practices, policy and protocol were recruited and trained on the use of standard checklists, data collection and field procedures. Study respondents filled an informed consent form before they were enrolled into the study. They had the options to withdraw at any time if they so desire and that they were not being compelled for taking part in the study.

3.10 LIMITATIONS TO STUDY

The study attempts to describe the compliance with these practices by the healthcare workers, availability and access to IPC resources at the facilities utilizing a combination of qualitative and quantitative approach. The key limitation was the incapacity to get the sample size. Due to operational reasons the sample was reduced from the planned to 140 respondents. The possibility that, the staff could alter their behaviour from their normal practices during ward observations was obvious. However, the findings of this research could be generalized in to the study population.
Further, self-reported behavior which should be considered in future studies. The period of the study was short therefore the investigation did not include every study participants within the target area or population. Inadequate resources make it very complicated for the researcher to be able to access all the necessary respondents and data necessary for this study.

IV. DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

The themes were chosen because it sought to address some of the issues pertaining to the objective of the study. Socio-demographic characteristics of the respondents; healthcare workers' perception/level of current Infection Prevention and Control practice (awareness of infection prevention and control and then the practice of sterile technique principles, awareness of infection prevention and control was measured using scoring); compliance with the dictates of the Infection Prevention and Control Policy by healthcare workers at these facilities; and the barriers (supervision; availability and access to Infection Prevention Control material supplies) to infection prevention and control practice among healthcare workers in these hospitals. The research findings showed fascinating and upsetting situations that

requires instant attention by Healthcare workers, policy makers and government.

4.2 DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

A total of 140 were included in the In this study as presented in Table 1 below. The female accounted for 58.57% (82) and were in the majority for both hospitals. The ages of participants varied from 14-24 years were 10.71% (15) and 25-35 years and 36-46 years were 32.14% (45) each. At the Bo government Hospital the age 36-46 years were in majority 36.73% (36) while at Mercy Hospital the age 25-35 years were in the majority 54.76% (23). 49.29% (69) of the respondents were married while 7.86% (11) were widowed. Majority, 88.1% had completed College/University program as their highest educational level for both hospitals. The largest professional 71.43% (100) group that participated in this study was nurses. The other staff formed the minority with 28.57% (40). Of the 71.43% (100) group that participated in this study that were nurses 12% (12) of the participants were charge nurses, 62% (62) were junior nurses and 26% (26) were senior nurses. About 72.86% (102) work between 15 years in their present positions of job and 27.14% (38) work less than 5 years in the health facility.

Table 1: Socio-Demographic Characteristics of Respondents (N=140)

Category	Characteristic	Bo Government Hospital (N=98)	Percentage (70%)	Mercy Hospital Bo (N=42)	Percentage (30%)	**Total (N=140)**	**Total (%=100)**
sex	Male	42	42.86	16	38.10	**58**	**41.43**
	Female	56	57.14	26	61.90	**82**	**58.57**
Total		98	100.00	42	100.00	**140**	**100.00**
Age	14 – 24 years	12	12.24	3	7.14	**15**	**10.71**
	25 – 35 years	22	22.45	23	54.76	**45**	**32.14**
	36 – 46 years	36	36.73	9	21.43	**45**	**32.14**
	47 – 57 years	28	28.57	7	16.67	**35**	**25.00**
Total		98	100.00	42	100.00	**140**	**100.00**
Marital status	Single	33	33.67	7	16.67	**40**	**28.57**
	Married	37	37.76	32	76.19	**69**	**49.29**
	Widowed	10	10.20	1	2.38	**11**	**7.86**
	Divorced	18	18.37	2	4.76	**20**	**14.29**
Total		98	100.00	42	100.00	**140**	**100.00**
Educational Level	Below primary	8	8.16	3	7.14	**11**	**7.86**
	Primary	1	1.02	0	0.00	**1**	**0.71**
	Secondary	5	5.10	2	4.76	**7**	**5.00**
	College/University	84	85.71	37	88.10	**121**	**86.43**
Total		98	100.00	42	100.00	**140**	**100.00**
Qualification	Doctor	2	2.04	1	2.38	**3**	**2.14**
	Nurse	68	69.39	32	76.19	**100**	**71.43**
	Lab. Tech.	6	6.12	2	4.76	**8**	**5.71**
	other (specify	22	22.45	7	16.67	**29**	**20.71**
Total		98	100.00	42	100.00	**140**	**100.00**

Source: Author's Research Data, 2018.

4.3 HEALTH WORKERS' PERCEPTION/LEVEL OF CURRENT IPC PRACTICE

The health workers' perception of current IPC practice and sterile technique principles were observed. Knowledge of infection prevention and control were measured using scoring. Score out of 20 is showed in fig. 1; poor knowledge 21.4% (30) was below 10, moderate knowledge 50% (70) was between 10 and 14 and excellent knowledge 28.6% (40) was between 15 and 20.

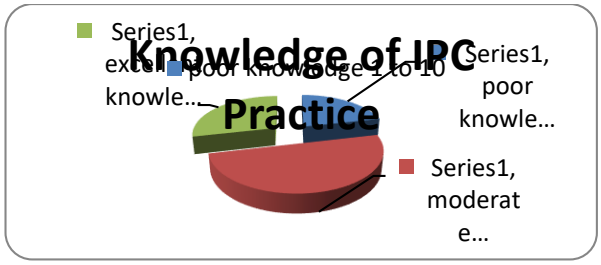

Figure 1: Knowledge of IPC Practice by Respondents (N=140). Source: Author's Research Data, 2018

Fig. 2 below shows that the 31.43% (44) of the respondents had never attended any IPC training workshop and 68.57% (96) had attended the workshop.

Figure 2: IPC Training Workshops attended by Respondents (N=140). Source: Author's Research Data, 2018

Awareness of Infection Prevention Practices among Healthcare workers is presented in Table 2. It was noted that about 99% (139) of participants showed that they have heard about IPC and 68.57% (96) had training in IPC practices. When asked if training programs and awareness campaigns are helpful in preventing infection, 90% of the staff agreed to it. 28.57% (40) of the respondents said contact with blood and body fluids were the commonest mode of transmission while 71.42% (100) indicated needle pricks. Hand washing 40% (56) was a means of prevention while processing of instrument was 60% (84). The general level of awareness on IPC was as follows: the bulk of 60.71% (85) was well-informed with high knowledge; followed by 28.57% (40) who had some awareness and 10.71% (15) had low awareness.

4.4 COMPLIANCE WITH THE DICTATES OF IPC POLICY BY HEALTH WORKERS

Figure 3 below illustrate general level of compliance with IPC policies and procedure, 55% (77) had low compliance level with 45 % (63) had high level of compliance.

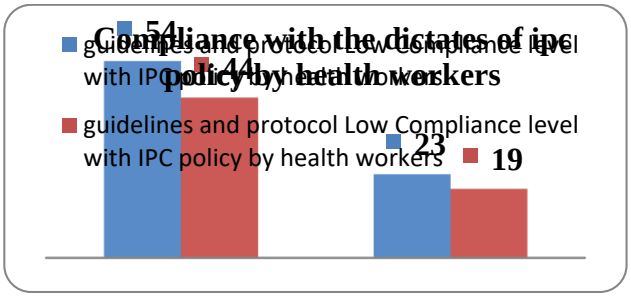

Figure: 3 Level of Compliances with the dictates of IPC policies by Respondents (N=140). Source: Author's Research Data, 2018.

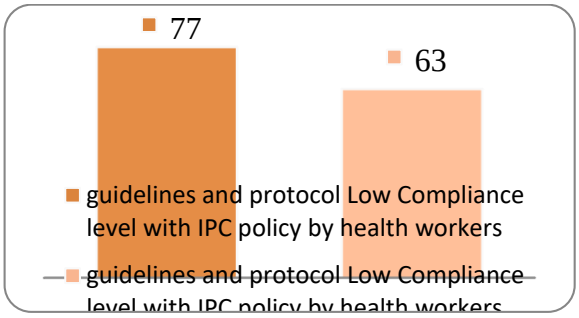

Figure: 4 Low Compliances Level with the dictates of IPC policies by Respondents (N=140). Source: Author's Research Data, 2018.

On the existence of IPC focal persons or/and nurse, it was found that 95.71% (134) of respondents indicated that they were aware of the focal persons or nurse with only 4.29% (6) stated that there was no focal persons or/and nurse. It is worth noting that 100% (98) of the respondent at Bo Government Hospital were aware and that the 4.29% (6) respondent accounted for respondent at Mercy Hospital. When asked if there are any guidelines/ protocols for IPC, 78% said yes, 8% said no and 14% did not know about it. 47% said they frequently follow these while 53% did it only occasionally. Access to IPC principles and procedures at the workplace, 22.14% (31) stated that they had no access to the guideline; with 77.86% (109) showed they had access to the policies. On the frequency of hand washing, 96.42% (135) stated they wash their hands, before and after contact with patients with only 3.58% (5) stated that they rarely washed their hands. Hand hygiene is first line of defense against hospital acquired infection as hands are the most popular vehicle of transmission of organisms. 98.57% (138) staff agreed that hand mediated transmission is the major source of cross infection, according to the questionnaire response 96.42% (135) of the staff said that they follow all five moments of hand hygiene as stated in WHO guidelines, although only 68.57% (96) of the staff actually followed it as per direct observation. 95.71% (134) of them feel hand washing should become an indispensible part of hygienic culture.

Bulk of the respondents indicated they have been using PPE while performing various procedures. The most common used PPE were gloves with 98.4% while the least used were boots with 0.9%. 94.28% (132) of questionnaire respondents believed that Personal Protective Equipment is an effective barrier for infection control but in actual practice only 85% (119) of staff used it. Responding through questionnaire 77.14% (108) of the staff said they always wear fresh gloves before patient examination while only 22.86% (32) said they do it sometimes. While in actual practice as per direct observation only 68.57% (96) of them wore fresh gloves before patient procedures.

57.85% (81) dispose used syringes and needles immediately into safety boxes with, 42.14% (59) put them into receivers before pouring them into sharp containers. Out of the 140 respondents 53.57% (75) said that they frequently dispose waste in a right colour coded dustbin, 44.28% (62) did it sometimes and only 2.14% (3) of the staff members rarely did it.

The staff had mixed views about the quality of sanitation services provided. Only 10% felt it was excellent, 43% thought it

was good, 31% said it's OK and 16% felt it was poor. 72% staff agreed that all the patient care equipments are sterilized properly, 28% did not agree with the above statement.

4.5 BARRIERS TO IPC PRACTICE AMONG HEALTH WORKERS

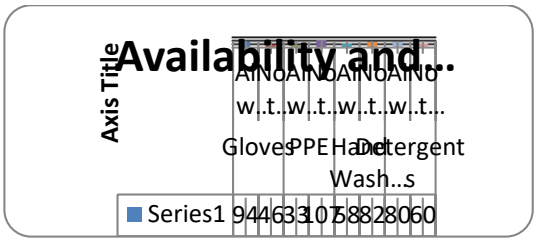

Figure 5: Availability and access to IPC material supplies (N=140). Source: Author's Research Data, 2018.

The ease of use and access to Infection Prevention Control material supplies were examined by supervision; 67.7% of the participants say gloves were available on the ward and 32.3% indicated gloves were not always available on the ward for practices. The availability of personal protective equipment, 76.6% of participants stated that PPE were not always available while (23.4%) stated PPE were available for IPC practices. With regards to hand washing items, (58.3%) indicated that the items were not always accessible and (41.7%) stated that the items were available. Majority, (57.4%) of the respondents indicated that, detergents were always available for decontamination, while (42.6%) stated that detergents were not accessible.

Table 2: Barriers to IPC Practice among Respondents (N=140)

Category	Characteristic	Bo Government Hospital (N=98)	Percentage (70%)	Mercy Hospital Bo (N=42)	Percentage (30%)	Total (N=140)	Total (%=100)
Barriers to IPC practice among health workers	Lack of knowledge	12	12.24	5	11.90	**17**	**12.14**
	Time	36	36.73	22	52.38	**58**	**41.43**
	Equipment	18	18.37	4	9.52	**22**	**15.71**
	Forgetfulness	2	2.04	1	2.38	**3**	**2.14**
	Resources	**30**	30.61	**10**	23.81	**40**	**28.57**
Total		98.00	100.00	42.00	100.00	140.00	100.00

Source: Author's Research Data, 2018

The barriers to infection prevention and control practice amongst nurses, Table 2 shows that Lack of knowledge, time, equipment, Forgetfulness, resources are factors that impeded them from proper infection control practice, lack of knowledge indicated 12.14% (17), lack of time show 41.43% (58), lack of equipment indicated 15.71% (22), forgetfulness as a factor indicated 2.14 % (3) and lack of resources indicated 28.57% (40) as a factor impeding them.

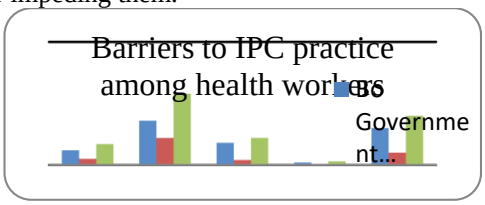

Figure 6: Barriers to IPC Practice among Respondents (N=140). Source: Author's Research Data, 2018.

4.6 DISCUSSION

4.6.1 Demographic Characteristics of the Respondents

140 respondents were incorporated in this study of which 58.57% (82) were female and were in the majority in both hospitals. At the Bo government Hospital the age 36-46 years were in majority which is 36.73% (36) while at Mercy Hospital the age 25-35 years were in the majority 54.76% (23). 49.29%. This shows that mercy hospital has more youth than Bo government hospital. Overall, 14-24 years were 10.71% (15) were in the minority while 25-35 years and 36-46 years were at par 32.14% (45) each which indicate that the average age is 36years. Majority, 88.1% had completed College/University program as their highest educational level for both hospitals which show that professional skills training. The largest professional 71.43% (100) group that participated in this study was nurses this shows that nurses make the greater percentage. The other staff formed the minority with 28.57% (40). Of the 71.43% (100) group that participated in this study that were nurses 12% (12) of the participants were charge nurses, 62% (62) were junior nurses and 26% (26) were senior nurses. About 72.86% (102) work between 15 years in their current positions and 27.14% (38) spent less than 5 years working at the facility.

4.6.2 Knowledge of IPC Practices among Health Workers

This study identified awareness about infection prevention practices among healthcare workers. Awareness of IPC and knowledge of its practices among the respondents were fair 50.0 %. This proportion was relatively low compared with that obtained in a study by Mukwato et al, 2005 in which 63.6% of sampled healthcare workers had training in IPC. This difference in the result may be due to low access to training in IPC. Also, the study location might have influenced the disparity in the result of the two researches.

The majority of the participants are nurses (71.43%) and these are largely junior nurses (43%) and they are the ones with poor knowledge on infection prevention and control. This shows that the health workers' awareness of IPC principles is not enough which concurs with earlier studies by Had (2000) & Smith (2009). To aggravate the problem these junior health workers are the ones doing the nursing care and are not opportune to attend workshops.

A considerable number of nurses 31.43% (44) did not attend IPC training with the majority of these being junior health workers who are always providing day to day nursing care. A good number of those who control to attend IPC workshops and were expected to give react but these are not the case. This poses a great risk of infections as stated in a report by "WHO" (2001). For this reason, there is need for planned periodically training to equip the nurses with awareness on IPC. This is supported by Reid (2001) who recommended that nurses should get in- service training to gain knowledge on IPC

Yet, the maximum reference made to train IPC with the World Health Organization's requirement was suggestive to a more theoretical approach to campaign about infection prevention practices (WHO, 2005). Although there were different levels of awareness on IPC among various ranks of the staff who have heard about IPC, it was inspiring as the highest score was 68.57%. Additionally, the knowledge of the staff on IPC did not prove any statistical association between training in IPC and knowledge in IPC.

4.6.3 Availability and Access to Material for IPC Practices

Non availability and access to materials for IPC practices is known to be one of the barriers to IPC practices (Mukwato et al, 2003). The most available materials for IPC practices on the ward were gloves 67.7%. Although gloves were mostly available on the wards, they are not easily accessible to work with. This disparity may be due to the fact that some ward sisters do not want to issue enough of the materials at a time for the staff to use with the excuse that the nurses are misusing the gloves. This was also observed during the ward observation as some wards were asking patients to provide gloves for to use when their ward in charges were not available.

The materials that were not available for IPC practices on the ward were hand washing stations, 58.3%. Although there were mostly available on some wards, they are not easily accessible to work with. This was due to the fact that water was hard to fetch. Other PPE were not available for IPC practices on the ward, 76.6% say so, although there were mostly available on some wards, maternity units and the theater.

Nonetheless, the most easily to get material was the detergent for decontamination 57.4%. There is difference between the accessibility of the detergents and their correct use. Most wards do not have the protocol for preparing the detergent pasted at where the decontaminants are placed and because of this most staffs were not conversant with the correct strength of the detergent they use on the ward. This situation can affect decontamination of used instruments which can be a cause of spreading of infection.

Additionally, majority of the respondents did not use the IPC manual, either because they did not know about it or it was unavailable. Hence, the IPC nurse should periodically teach the nurses in practice and make available manual in each ward. The nurses should be inducted on the use and importance of the manual. Other factors hindering IPC practices reported are: lack of resources and time which is consistent with what was reported in previous studies by Smith (2009), Dyer (2010), Swanson (2002) & Clark (2011).

4.6.4 Compliance with (IPC) Policies and Protocol

Compliance with IPC practices is base on the access to policies and protocol (Rak, 2010). Access to IPC polices by the health workers was as very low as 47%. This may explain the compliance with IPC practices among health workers. The highest complied practice was hand washing 68.57% (96). This result is contrary to that of (Tiejen, 2003) who mentioned a lower compliance among nurses in his study. Complying with the proper disposal of syringes and needles into safety boxes was 57.85% (81). This was lower than similar study carried out by Mukwato et al, 2005 where compliance with proper disposal of syringes and needles was 62.3% high. This was observed in one hospital where invented containers were used for needles and sharps.

The widely used PPE were gloves with 98.4% during various procedures. This is in agreement with what was obtained by (Tietjen, 2003.) This research seeks to assess the perception of healthcare workers on IPC practices in two hospitals in Bo City in relation to training, the accessibility and access to resources for IPC practices and compliance with regards IPC. The study revealed that compliance varied across different departments and for each hospital. Observable compliance was high at Mercy hospital and for the Bo government hospital in sectors such as Operating Theatre where supplies of materials for IPC were adequate compared to the Medical Ward where supplies were insufficient. About 89% of the participants observed in the Operating Theatre complied with IPC guidelines. However at the Medical and Surgical Wards respondents did not comply with IPC policies.

V. 5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The conclusion and suggestions of the research as related to the objectives. Also, it provides information relevant for strengthening IPC at the facility; assess awareness, availability and access to resources for IPC practices and compliance with IPC guidelines and protocol at the facility to ensure delivery of quality care to patients. They are presented as follows: demographic characteristics of the respondents, knowledge of infection prevention and control practices among health workers, availability and access to material for infection prevention and control practices, compliance with infection prevention and control guidelines and protocol.

5.2 CONCLUSIONS

The study showed low levels of awareness in IPC practices due to lack of information on IPC. It was also found that availability, access to materials for IPC practices and compliance with IPC guidelines were reasonable. Previous studies had shown that it is possible to determine nurses' attitude. (Hu, Zhang et al., 2012), examined the knowledge, attitudes and self-reported behaviour and barriers to compliance with the use of personal protective equipment. The study involved health care workers (HCWs) at Bo government hospital and Mercy hospital Bo.

The study discovered that the bulk of junior nurses lack awareness of infection control principles. Factors impeding nurses from proper infection prevention and control practice which included lack of awareness, forgetfulness, lack of time and lack of resources were identified. Hence, it is needful for guidelines makers and administrators to provide both human and material

resources as well as provide timely and well planned in-service training to the nurses.

Both attitudes towards PPE use and perceived organizational norms have been recognized as predictors of compliance. Hand wash is the single most important intervention to prevent transmission of infection and should be a quality standard in all health institutions. An attitude of not washing hands among individuals involved in the provision of health care can increase the rate of hospital-acquired infections. In a study that was conducted in India, where (Nairet al., 2013) assessed knowledge, attitude and practices of hand washing among medical and nursing students at the health care centre, the majority of students had poor knowledge with regard to hand hygiene. Transmission of blood-borne viruses and other microbial pathogens to patients during routine health care procedures continues to occur due to unsafe and incorrect injection practice, Infusion and medication vial practices being used by health care professionals (Olalekan, et al., 2012).

The negative attitude towards infection prevention and control can promote transmission of infection from one point to another. According to Ward 2012:301306, nursing students generally observed a bad approach towards infection prevention and control from qualified staff, besides IPC was considered to be an added job load as different to a central feature of patient safety and excellent care. Surgical operations provide opportunities for the transmission of infection between patients and health-care workers (HCWs) and between patients. This risk may increase in underdeveloped and developing countries by low compliance with infection control policies and precautions (McGaw et al., 2012). The study concluded that HCWs had sub-optimal 55% (77) had low compliance levels with standard infection control guidelines and 45 % (63) of all participants had high level of compliance with all infection control policies. It is, therefore, important that all health workers strictly adhere to infection control guidelines, especially nurses because they spend more time with the patients. The study showed a raised in the number of subjects in each category scoring good and excellent in the post-education questionnaire.

5.3 RECOMMENDATION

The following actions are recommended for findings of this study:

5.3.1. This study is going to help in designing of the nursing training curriculum. It should include information on infection control so that they can gain in-depth knowledge on infection prevention and control guidelines. In-service education should be provided on infection control on regular basis as a measure to reinforce the knowledge of nurses on infection control. Training in IPC should be part of routine work process for all health facilities. This would improve the understanding of all staff in IPC practices which will lead to delivery of excellence care to patients.

5.3.2. The administration of the facility should ensure access to materials and their ease of use for workers to use for their work. There should also be policy at the facility for all care givers to comply with existing strategy and protocol. Policy makers must also provide enough information on IPC available to the health workers.

5.3.3. The IPC focal nurse should be vigorously functional and assume their monitoring and supervisory roles. The managers should make sure policy manuals are made available to every nurse.

5.3.4 There is need for an development on the nurse patient ratio through staffing of more nurses thus deal with the reason of nurses lacking enough time to practice proper infection prevention and control principles. Resources such as disinfectants should be made available for the nurses to practice proper infection control.

5.3.5 The findings provide basis for other researchers who would want to carry out further investigations on infection prevention and control principles. It is expected that when the above suggestions are put in place, observance with IPC practices will improve to meet the standard recommended by WHO.

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Intelligent Paid Subscription Renewal Prediction System Using Data Mining Techniques

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Abstract- According to Virgo Capital, Typically, good services businesses have renewal rates of more than 80%, while more sticky software renewal rates hit 90% or more. Paid subscription trading websites collect huge amounts of customer's data which, unfortunately, are not "mined" to discover hidden information for effective decision making. Hidden patterns discovery and relationships often go unexploited. This situation can be solved by using advanced data mining techniques. This research has developed a prototype Intelligent Paid Subscription Renewal Prediction System (IPSRPS) using data mining techniques, namely, Decision Trees, Naïve Bayes, and Neural Network. Each technique has its unique strength in realizing the objectives of the defined mining goals, which is shown in results. IPSRPS can answer complex "what if" queries which traditional decision support systems cannot. Using customer profiles such as the number of deals, sealed and un-sealed deals, profile interactions and the total sold amount it can predict the likelihood of customers renewing their subscription or not. It enables significant knowledge, e.g. patterns, relationships between service factors related to customer satisfaction, to be established. IPSRPS is Web-based, user-friendly, scalable, reliable and expandable. It is implemented on the .NET platform.

I. Motivation

Rate of customer renewal is one of the key value questions for any software or services business. Higher renewal rates usually indicate better products and stickier customers, and they directly translate to more predictable revenue and lower selling costs, whether it is measured in dollars, customers, subscriptions, maintenance agreements, or some other metric. Quality service implies getting big deals and administering customer satisfaction effectively. Poor marketing decisions can lead to financial disastrous consequences which are therefore unacceptable. E-marketers must also minimize the average customer's loss rate. These results can be achieved by employing appropriate computer-based information and/or decision support systems.

Most e-marketing companies today employ some sort of customer information systems salesmen to manage their business and customer's data [10]. Huge amounts of data are generated by these systems which take the form of numbers, text, charts and images. Unfortunately, these data are rarely used to support sales decision making.

There is a hidden treasure of information in these data that is largely untapped. So, the important question that raises is: "How can we turn data into useful information that can enable trading experts to make intelligent marketing decisions?" This is the main motivation for this research.

I. Problem statement

"It takes months to find customers, and seconds to lose one". Many online marketing systems are designed to measure customer satisfaction level, customer's revenue/loss management and generation of simple statistics. Some E-marketing websites use decision support systems, but they are largely limited. They can answer simple queries like "What is the average revenue/loss that the customer is achieving comparing to last year?", "How many renewals had done in the last 30 days?", "Identify the count of customers who did not renew their subscriptions, and what is the average retention rate." However, they cannot answer complex queries like "Identify the important preoperative predictors that decrease/increase customers selling", "Given customer trading records, should we offer the renewal with original price, or with a discount?", and "Given customer records, predict the probability of customers renewing their subscriptions."

Customer's loyalty measurements are often made based on salesmen's experience with the customer behaviors rather than on the knowledge-rich data hidden in the database. This practice leads to unwanted biases, errors and excessive financial costs which affects the quality of service provided to customers. Integration of e-marketing decision support with computer-based customer records could reduce customer's loss ratio, enhance customer satisfaction and improve customer's outcome. Data mining, have the potential to generate a knowledge-rich environment which can help to significantly improve the quality of marketing decisions.

II. Research Objects

The core objective of this research is to develop a prototype Intelligent Paid Subscription Renewal Prediction System (IPSRPS) using three data mining modeling techniques, namely, Decision Trees, Naïve Bayes and Neural Network. IPSRPS can discover and extract hidden knowledge (patterns and relationships) associated with customer subscriptions from a historical customer's database. It can answer complex queries for finding customers with no intention to renew and thus assist the company salesmen to make intelligent marketing decisions which traditional decision support systems cannot. By providing better offers, it also helps to reduce customer's loss ratio. It displays the results both in tabular and graphical forms to enhance visualization and ease of interpretation.

III. Data mining review

Although the term "data mining" saw the light for more than two decades now, but the potential of it is only being realized now. Statistical analysis, machine learning and database technology are combined by data mining to extract hidden patterns and relationships from large databases [12]. Fayyad defines data mining as "a process of nontrivial extraction of implicit, previously unknown and potentially useful information from the data stored in a database" [3]. Giudici defines it as "a process of selection, exploration and modelling of large quantities of data to discover regularities or relations that are at first unknown with the aim of obtaining clear and useful results for the owner of database" [4].

There are two data mining strategies: supervised and unsupervised learning. In supervised learning, a training set is used to learn model parameters whereas in unsupervised learning no training set is used (k-means clustering is unsupervised) [10].

Depending on the modelling objective, each data mining technique serves a different purpose. Classification and prediction are the two most common modelling objectives. Categorical labels (discrete, unordered) predicted by classification models while continuous-valued functions predicted by prediction models predict [5]. Decision Trees and Neural Networks use classification algorithms while Regression, Association Rules and Clustering use prediction algorithms [3].

Decision Tree algorithms include CART (Classification and Regression Tree), ID3 (Iterative Dichotomized 3) and C4.5. These algorithms differ in selection of splits, when to stop a node from splitting, and assignment of class to a non-split node [6]. CART uses Gini index to measure the impurity of a partition or set of training tuples [5]. It can handle high dimensional categorical data. Decision Trees can also handle continuous data (as in regression) but they must be converted to categorical data.

Naive Bayes or Bayes' Rule is the basis for many machine-learning and data mining methods [11]. The rule (algorithm) is used to create models with predictive capabilities. It provides new ways of exploring and understanding data. It learns from the "evidence" by calculating the correlation between the target (i.e., dependent) and other (i.e., independent) variables.

Neural Networks consists of three layers: input, hidden and output units (variables). Connection between input units and hidden and output units are based on relevance of the assigned value (weight) of that particular input unit. The higher the weight the more important it is. Neural Network algorithms use Linear and Sigmoid transfer functions. Neural Networks are suitable for training large amounts of data with few inputs. It is used when other techniques are unsatisfactory.

IV. Methodology

CRISP-DM methodology is the methodology we used to build IPSRPS mining models. It has six major phases: business understanding, data understanding, data preparation, modeling, evaluation, and deployment. Business understanding phase focuses on understanding the objectives and requirements from a business perspective, converting this knowledge into a data mining problem definition, and designing a preliminary plan to achieve the objectives. Data understanding phase uses the raw the data and proceeds to understand the data, identify its quality, gain preliminary insights, and detect interesting subsets to form hypotheses for hidden information. Data preparation phase constructs the final dataset that will be fed into the modeling tools. This includes table, record, and attribute selection as well as data cleaning and transformation. The modeling phase selects and applies various techniques, and calibrates their parameters to optimal values. The evaluation phase evaluates the model to ensure that it achieves the business objectives. The deployment phase specifies the tasks that are needed to use the models [2]. Data Mining Extension (DMX), a SQL-style query language for data mining, is used for building and accessing the models' contents. Tabular and graphical visualizations are incorporated to enhance analysis and interpretation of results.

V. Data source

A total of 910 records with 13 trading attributes (factors) were obtained from the Turkish Exporter dataset [1]. Figure 1 lists the attributes. The records were split equally into two datasets: training dataset (455 records) and testing dataset (455 records). The records for each set were selected randomly to avoid bias. For the sake of consistency, only categorical attributes were used for all the three models. All the non-categorical trading attributes were transformed to categorical data. The attribute "Renewal Result" was identified as the predictable attribute with value "1" for customers with previous renew records and value "0" for customers with no renew records (New Customers). The attribute "Customer Id" was used as the key; the rest are input attributes. It is assumed that problems such as missing data, inconsistent data, and duplicate data have all been resolved.

Predictable Attribute:
Renewal Result (Value 0: - no intention to renew subscription; Value 1: willing to renew subscription).
Key Attribute:
Customer Id – Customer's identification number.

Input Attributes:

1. Previous Renewals Count (PRC) (Value = 0: New Subscriber; Value >0: Has Subscription history).
2. Contact Messages Last Year (CMLY) (Value > 50: Good Interaction; Value < 50: Bad Interaction).
3. Contact Messages This Year (CMTY) (Value > 50: Good Interaction; Value < 50: Bad Interaction).
4. Trade Value Last Year (Value, If PRC > 0: This Year Trade Value - Trade Value Average; If PRC = 0: Trade Value – Subscription fees).
5. Trade Value This Year.
6. Retention Rate: (Activity (System Login) in the last period - in the prior period).
7. Total Deals: (Value, If PRC > 0: This Year Deals - Deals Average; If PRC = 0: Deals Count).
8. Closed Leads: (Value, If PRC > 0: Closed Deals Average LY – This Year; If PRC = 0: Closed Deals Count).
9. Sales Per Customer: (Revenue / Number of deals).
10. Satisfied: (Value 0: Not Recommended; Value 1: Not Sure; Value 2: Highly Recommended).

11. Profile Rating: (Value 1-5 stars).

Figure 1. Description of attributes

VI. Mining Models

For model creation, Data Mining Extension (DMX) query language was used, model training, model prediction and model content access. Default setting were set to all parameters except for parameters "Minimum Support = 1" for Decision Tree and "Minimum Dependency Probability = 0.005" for Naïve Bayes [8]. The trained models were evaluated against the test datasets for accuracy and effectiveness before they were deployed in FBMPS. Lift Chart and Classification Matrix were used to validate the models.

VII. Validating model effectiveness

Two models were used for testing and validation the effectiveness of models: Lift Chart and Classification Matrix. The purpose was to determine which model gave the highest percentage of correct predictions for customer's subscriptions renewal.

Lift Chart with predictable value. Columns in the trained model were mapped to columns in the test dataset, to determine if there was sufficient information to learn patterns in response to the predictable attribute. The model, predictable column to chart against, and the state of the column to predict renewal possibilities (predict value = 0) were also selected. Figure 2 shows the Lift Chart output. The percentage of the test dataset used to compare predictions showed on the X-axis, while the percentage of values predicted to the specified state showed on Y-axis. The results for random-guess and ideal model showed on the blue and red lines respectively. Results of Neural Network, Naïve Bayes and Decision Tree models showed on the purple, light-blue and green lines respectively. The top red line shows the ideal model; it captured 100% of the target population for trading values using 22% of the test dataset. The bottom blue line shows the random line which is always a 45-degree line across the chart. 50% of the target population would be captured using 50% of the test dataset if we randomly guess the result for each case. Our three model lines (purple, light-blue and green) fall between the random guess and ideal model lines, which tells us that that all three have sufficient information to learn patterns in response to the predictable state.

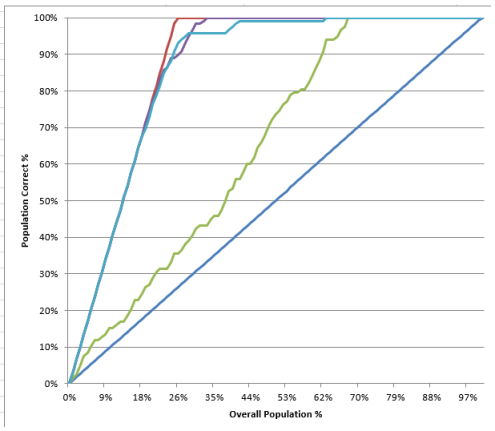

Figure 2. Result of Lift Chart with predictable value

Lift Chart with no predictable value. To produce Lift Chart with no predictable value we use similar steps to the above, except that the state of the predictable column is left blank. No line for the random-guess model included. Figure 3 shows the Lift Chart output. The percentage of test dataset used to compare predictions showed on X-axis, while the percentage of predictions that are correct showed on Y-axis. The ideal, Neural Network, Naïve Bayes and Decision Trees models showed on the red, purple, blue and green lines respectively. The performance of the models across all possible states showed in this chart. The red line which represents the model ideal line, is at 45-degree angle, showing that if 30% of the test dataset is processed, 45% of test dataset is predicted correctly.

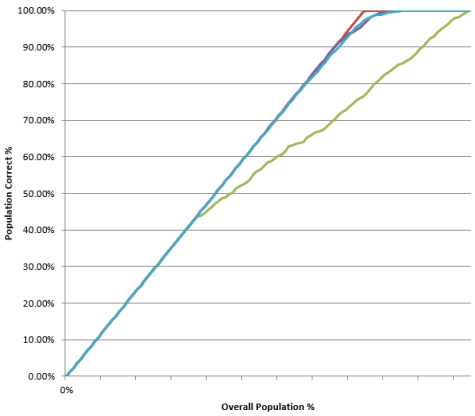

Figure 3. Result of Lift Chart with no predictable value

Neural Network gives the highest percentage of correct predictions (79.23%) followed by Naïve Bayes (70.33%) and Decision Trees (69.85%), if 50% of the population is processed. Naïve Bayes model gives the highest number of correct predictions (86.12%) and appears to perform better than the other two as it followed by Neural Network (85.68%) and Decision Trees (80.4%), If the entire population is processed.

The Lift lines for Neural Network and Naïve Bayes to be always higher than that for Decision Trees, indicating that Neural Network and Naïve Bayes are better at making high percentage of correct predictions than Decision Trees when processing less than 50% of the population causes. The Lift lines for Neural Network and Naïve Bayes overlap along the X-axis, indicating that both models are equally good for predicting correctly. Neural Network

and Naïve Bayes appear to perform better than Decision Trees as they give high percentage of correct predictions when more than 50% of population is processed. The reason is that Lift line for Decision Trees is always below that of Neural Network and Naïve Bayes. Neural Network appears to fare better than Naïve Bayes and vice-versa for some population range.

Classification Matrix. Used to display the frequency of correct and incorrect predictions. Classification Matrix compares the actual values in the test dataset with the predicted values in the trained model. In this example, the test dataset contained 108 customers who have renewed before and 124 customers who have no renewal records. The results of the Classification Matrix for all the three models showed in Figure 4. The rows represent predicted values while the columns represent actual values (1 for customers who will renew, '0' for customers who will not renew). Values predicted by the models showed on the left-most columns. Correct predictions showed on the diagonal values.

Counts for Decition Tree On Customers Group

	False(Actual)	True(Actual)
False	211	53
True	35	156

Counts For Naïve Bayes on Customers Group

	False(Actual)	True(Actual)
False	205	26
True	42	182

Results as Counts for Neural Network on Customers Group

	False(Actual)	True(Actual)
False	205	28
True	42	180

Figure 4. Results of Classification Matrix for all the three models

Figure 5 summarizes the results of all three models. The most effective model appears to be Naïve Bayes as it has the highest percentage of correct predictions (85.05%) for renewal counts, followed by Neural Network (with a difference of less than 1%) and Decision Trees. Decision Trees, however, appears to be most effective for predicting customers who have no intention to renew their subscription (89%) compared to the other two models.

Model Type	Prediction Attributes	No. of Cases	Prediction
Decision Tree	+PRH, +ITR	156	Correct
	-PRH, +ITR	35	Incorrect
	-PRH, -ITR	211	Correct
	+PRH, - ITR	53	Incorrect
Naïve Bayes	+PRH, + ITR	182	Correct
	-PRH, + ITR	42	Incorrect
	-PRH, - ITR	205	Correct
	+PRH, - ITR	26	Incorrect
Neural Network	+PRH, + ITR	180	Correct
	-PRH, + ITR	42	Incorrect
	-PRH, - ITR	205	Correct
	+PRH, - ITR	28	Incorrect

Legend
+PRH: Previous Renew History
-PRH: No Previous Renew History
+ITR: Customers predicted to renew (Intention to Renew).
-ITR: Customers predicted not to renew.

Figure 5. Model results

VIII. Evaluation of Mining Goals

Based on exploration of customers profile dataset and objectives of this research, five mining goals were defined. They were evaluated against the trained models. According to results, all three models had achieved the stated goals, suggesting that they could be used to provide decision support to e-marketers for better customer gain and keep, which will definitely increase the company's profits. The goals are as follows:

Goal 1: Given customers profiles, predict those who are willing to renew their subscription or not. Using singleton query and batch or prediction join query all three models were able to answer this question. The two queries could predict on single and multiple input cases respectively. IPSRPS supports prediction using "what if" scenarios. Users enter values of customer and trading attributes to figure whether the customer will renew his subscription or not. For example, entering values PRC = 2, Retention = 14, Total Deals = 5, Total Closed Deals = 3, Satisfied = 0, Total Trading Value Last Year = 2475 and Total Trading Values This year = 2143 into the models, would produce the output in Figure 6. All three models showed that this customer will likely not to renew his subscription. Decision Trees gives the highest probability (99%) with 450 supporting cases, followed closely by Neural Network (96.49%) with 308 supporting cases and Naïve Bayes (94.93%) with 107 supporting cases. As these values are high, customer-relationship employees could recommend that the customer should be contacted and offered a discount for next subscription for example. Thus performing "what if" scenarios can help prevent a potential customers loss.

Goal 2: Identify the significant influences and relationships in the e-marketing inputs associated with the predictable state – subscription renewal. The Dependency viewer in Decision Trees and Naïve Bayes models shows the results from the most significant to the least significant (weakest) marketing predictors. When there are many predictable attributes, the viewer is especially useful. Figure 7 show that in decision trees model, the most significant factor influencing subscription renewal is "Total Trading Value Past Year vs Paid Subscription Fees (2500)". Other significant factors include Number of Contact Messages, Sealed Deals Count and Previous Renewals Count. Decision Trees model shows 'Retention Rate" as the weakest factor while Naïve Bayes model shows 'Trade Value Growth Rate' as the weakest factor. Naïve Bayes shows the significance of all categorical input attributes so it appears to fare better than Decision Trees. Customer-relationship employees can use this information to further analyze the strengths and weaknesses of the provided customer trading attributes associated with subscription renewal.

Goal 3: Identify the impact and relationship between the customer trading attributes in relation to the predictable state – subscription renewal. Identifying the impact and relationship between the customer trading attributes in relation to subscription renewal is only found in Decision Trees. It gives a high probability

(99.61%) that customers who will renew the subscription are found in the relationship between the attributes (nodes): "Total Closed Deals > 2 and PRC > 0 and Trading Value Growth Rate >= 0% and Satisfied = 1" Customer-relationship employee can use this information to perform customer profile screening on these four attributes instead of on all attributes on customers who are likely to renew their subscription or not. This will reduce customers loss ratio, enhance customer satisfaction and improve customers outcome. Information on least impact (5.88%) is found in the relationship between the attributes: "Total Closed Deals < 2 and PRC = 0". Also given is the relationship between attributes for customers who will not renew the subscription. Results show that the relationship between the attributes: "Closed Deals Perc < 40%, Satisfied = 0 and PRC= 0" has the highest impact (92.58%). The least impact (0.2%) is found in the attributes: "Closed Deals Perc > 40% and PRC > 0 and Trading Value Growth Rate >= 0% and Satisfied = 1". Additional information such as identifying customers' trading profiles based selected nodes can also be obtained by using the drill through function. CRM can use the Decision Tree viewer to perform further analysis.

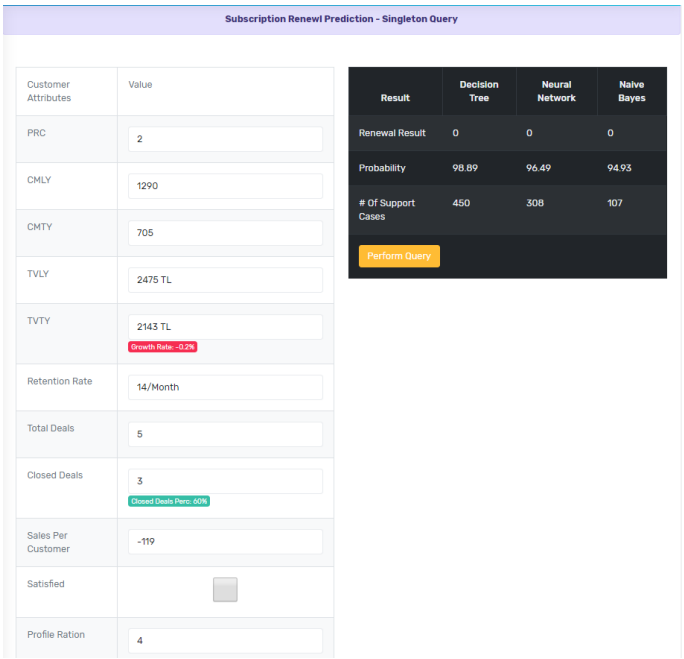

Figure 6. Output for singleton query module

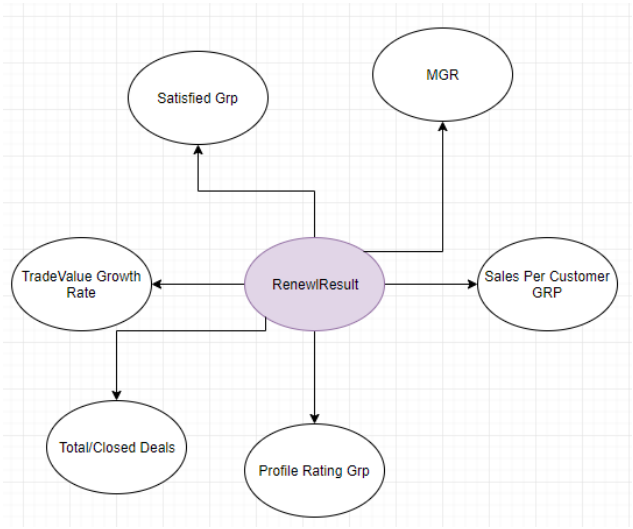

Figure 7. Decision Trees dependency network

Goal 4: Identify characteristics of customers who intend to renew their subscription. Only Naïve Bayes model identifies the characteristics of customers willingness to renew subscription. Naïve Bayes shows the probability of each input attribute for the predictable state. Figure 8 shows that 89.46% of the customers who will renew subscription have renewed two times before (PRC > 0) of which 43% are achieving sales equally or more than last year. Other significant characteristics are: high profile interactive represented by contact messages count, total deals, closed deals, etc. These results can be further analyzed.

Attributes	Values	Probability
PRC	PRC > 0	89.46%
Satisfied	Satisfied = 1	86.18%
Satisfied	Satisfied = 0	83.74%
ClosedDeals_Perc	ClosedDeals_Perc < 40% total deals	80.49%
ClosedDeals_Perc	ClosedDeals_Perc > 40% total deals	79.27%
Trade Value Growth Rate	Trade Value Growth Rate < 0	60.20%
Trade Value Growth Rate	Trade Value Growth Rate > 0	47.32%
PRC	PRC = 0	10.54%

Figure 8. Naïve Bayes Attribute Characteristics Viewer in descending order for Customers to Renew Subscription

Goal 5: Determine the attribute values that differentiate nodes favoring and disfavoring the predictable states: (1) customers who intend to renew subscription (2) customers with no intention to renew subscription. Analyzing the results of attribute discrimination viewer of Naïve Bayes and Neural Network models can be answer this query. Information on the impact of all attribute values that relate to the predictable state is provided by the viewer. Naïve Bayes model (Figure 9) shows the most important attribute favoring customers who intend to renew subscription: "Trading Value >= Paid Subscription Fees" with 158 cases and 56 customers with no renewal history. The input attributes "Satisfied = 1" with 123 (75.00%) customers, "PRC > 1" with 112 (73.68%) customers," Total Closed Deals > 40% total deals" with 138 (66.34%) customers, etc. also favor predictable state. In contrast,

the attributes "Satisfied = 0" with 195 (73.86%) customers, "PRC = 0" with 198 (73.06%) customers, "Total Closed Deals < 40% total deals" with 206 (67.98%), etc. favor predictable state for customers with no intention to renew subscription.

Attribute	Value	Favors True	Favors False
Satisfied	True		
Satisfied	False		
PRC	> 0		
PRC	= 0		
GrowthRate	>= 0		
TotalClosedDeals	< 40 %		

Figure 9. A Tornado Chart for Attribute Discrimination Viewer in descending order for Naïve Bayes

Neural Network model (Figure 10) shows that the most important attribute value that favors customer who intend to renew their subscription is "Growth Rate >= 0" (98%). Other attributes that favor renew subscription include "Deals >= 12", "PRC = 0", "PRC >= 1", etc. Attributes like "Trade Vale This Year <= Trade Value Last Year or < Paid Subscription Fees", "Satisfied = 0" etc. also favor the predictable state for customers with no intention to renew their subscription.

Attribute	Value	Favors True	Favors False
GrowthRate	>=0		
Satisfied	False		
Satisfied	True		
PRC	= 0		
TradeValueThisYear	>= 2500		
TotalClosedDeals	< 40 %		

Figure 10. Attribute Discrimination Viewer in descending order for Neural Network

IX. Benefits and Limitations

IPSRPS can provide decision support to assist CRM to make better marketing decisions or at least provide a "second opinion."

The current version of IPSRPS is based on the 15 attributes listed in Figure 1. This list may need to be expanded to provide a more comprehensive predicting system. Another limitation is that it only uses categorical data. For some cases, the use of continuous data may be necessary. Another limitation is that it only uses three data mining techniques. Additional data mining techniques can be incorporated to provide better results. The size of the dataset used in this research is still quite small. A large dataset would definitely give better results. It is also necessary to test the system extensively with input from users, especially customer relationship employees, before it can be deployed in companies.

X. Conclusion

A prototype customer subscription renewal prediction system is developed using three data mining classification modeling techniques. The system extracts hidden knowledge from a historical customer database. To build and access the models DMX query language and functions are used. A test dataset was used to train and validate the models. Model evaluation and effectiveness measuring done by Lift Chart and Classification Matrix methods. In response to the predictable state, all three models are able to extract patterns. The most effective model to predict customers willingness to renew subscription appears to be Naïve Bayes followed by Neural Network and Decision Trees. Based on business intelligence and data exploration, five mining goals are defined. The goals are evaluated against the trained models. Complex queries can be answered by these three models, each with its own strength with respect to ease of model interpretation, access to detailed information and accuracy. Four out of the five goals answered by Naïve Bayes; Three by Decision Trees; and Two by Neural Network. Although Decision Trees is not the most effective model, but the results are easier to read and interpret. The drill through feature to access detailed customer' profiles is only available in Decision Trees. Naïve Bayes fared better than Decision Trees as it could identify all the significant trading predictors. The attributes relationship produced by Neural Network is more difficult to understand.

IPSRPS can be further enhanced and expanded. For example, it can incorporate other marketing attributes besides the 15 listed in Figure 1. It can also incorporate other data mining techniques, e.g., Time Series, Clustering and Association Rules. Continuous data can also be used instead of just categorical data. Another area is to use Text Mining to mine the vast amount of unstructured data available in customer databases. Another challenge would be to integrate data mining and text mining [13].

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Performance of Broilers Fed with Homemade Ration at Varying Levels of Oil Palm (*Elaeis guineensis* Jacq.) Kernel Meal as Substitute to Copra Meal

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Abstract: Palm Kernel Meal has nutrient and amino acid composition comparable to that of copra meal except for higher lysine and methionine but it has been relatively underutilized and considered as agri-waste by-products. The study was conducted to investigate the potential of palm kernel meal (*Elaeis guineensis*) as a substitute to copra meal fed to broilers. Parameters considered in the study were average initial weight, average final weight, body weight gain, average daily gain, voluntary feed intake, feed conversion ratio, return above feed and chick cost and dressing percentage. Sixty broiler chicks regardless of sex were used as the experimental animal of the study. These birds were randomly distributed into five dietary treatments, replicated three times with four birds per replication. The five dietary treatments were Treatment 1-Homemade Ration without palm kernel meal (control); Treatment 2-Homemade Ration with 3.75 % palm kernel meal; Treatment 3-Homemade Ration with 7.50 % palm kernel meal; Treatment 4-Homemade Ration with 11.25% palm kernel meal and Treatment 5-Homemade Ration with 15% palm kernel meal. Data gathered were subjected to one-way Analysis Of Variance (ANOVA) in a Completely Randomized Design using Statistical Package for Social Science (SPSS) version 17.0 software. Results showed no significant differences in all parameters of the study. However, despite the short term duration of the experiment, the overall result and the return above feed and chick cost (RAFCC) disclosed a bright prospect of PKM substitution for broilers.

Index terms: broilers, copra meal, palm kernel meal, and growth performance

INTRODUCTION

Poultry production had grown rapidly due to its' unlimited demand for protein-rich food. It is one of the most productive and cheapest ways to provide nutritious food for human beings. Livestock and poultry industry in the Philippines is strongest in the agriculture sector of which most of the entrepreneurs dominate the poultry industry (PSA, 2017). Today, poultry raisers are facing a crisis due to the rising cost of feeds, antibiotics, labor, and infrastructure requirements. Birds if not fully supplied with medicines become vulnerable to disease and stress, thus, requiring expensive raising. An attractive alternative for today's mass-produced industrial chicken is broiler chicken (*Gallus gallus domesticus* Linn.). Broiler chicken has been highly selected for high growth rate, breast-meat yield and feed conversion efficiency. Specifically, these are raised for meat production under an intensive system using commercial feed ration. However, broiler production cost has increased significantly in recent years due to the price of feedstuffs (Gofredo *et. al.*, 2018). The same authors cited that the search for inexpensive, locally available and equally nutritive feedstuffs to partly substitute conventional poultry diets has never been more pressing. Broiler chickens require a certain amount of energy daily to satisfy their nutrient requirements, however, slower-growing birds will have greater total energy requirements because it takes longer days for them to hit market weight. This means more maize and soya beans to feed them, more fuel and transport emissions and more manure produced. This is not simply a cost factor, but it has major implications for the sustainability and environmental impact of poultry production as a whole, as demand for chicken continues to increase. (www.chickencheck.in, 2015).

The performance of the bird is dependent on the kind and quality of feed given as well as their water requirements. Feeds provide and satisfy the nutritional requirement while water plays an important role in metabolism, digestion, and thermoregulation of the body of the birds. It is a constant challenge for researchers to find a new locally available and nutritious feed to meet the nutritional requirements of the birds. Some prefer to do mixes into the feeds while others have it by adding and substituting through drinking water as an alternative means but would still satisfy the nutritional requirements. The challenge to solve such a crisis in production is one of the aims of animal producers and nutritionists to seek alternative sources of feedstuff that is effective and enough to meet the growing requirement of the birds with availability and cost as factors to think of. Palm Kernel Meal (PKM), a by-product of Oil Palm (*Elaeis guineensis* Jacq.) is considered to be an agro-industrial waste derived from the extraction process. PKM is widely used as source of protein and energy in various poultry and livestock animals such as laying hens (Chong, *et al.*, 2008), broiler chickens (Mardhati, *et al.* 2011), dairy cows (Carvalho, *et al.*, 2006), rabbit (Orunmuyi, *et al.*, 2006), and pigs. Several studies have been reported on the inclusion of varying levels of PKM in poultry diet and its effects on the performance parameters. In the Philippines, no report on the extensive use of this by-product has been published both in ruminant and non-ruminant, thus this study.

II. METHODOLOGY

Table 1. Composition and calculated analysis of experimental starter ration for broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

Feed Ingredients	Treatments				
	I	II	III	IV	V
	Control	3.75 % PKM	7.50 % PKM	11.50 % PKM	15% PKM
Home-made Ration	100	96.25	92.5	88.75	85
Palm Kernel Meal	0	3.75	7.5	11.25	15
Total	100	100	100	100	100
Price/kg (p)	21.89	21.38	21.08	20.78	20.48
Calculated Nutrient Analysis					
Crude Protein (%)	21.39	21.37	21.36	21.34	21.33
ME Kcal/kg	2747.80	2747.80	2747.80	2747.80	2747.80
Calcium	0.78	0.79	0.79	0.79	0.80
Phosphorus	0.45	0.47	0.49	0.50	0.52
Lysine	1.13	1.21	1.29	1.37	1.46
Fiber	5.60	5.60	5.60	5.60	5.60
Methionine	0.29	0.34	0.39	0.45	0.50
L-Tryptophan	0.19	0.19	0.19	0.19	0.19

2.1 Procurement of Experimental Birds

Sixty (60) day-old broiler chicks regardless of sex were used in the experiment. These day-old broiler chicks were purchased from a reliable source and placed at the Poultry house, College of Agriculture, Sultan Kudarat State University – Lutayan Campus, Brgy. Blingkong, Lutayan, Sultan Kudarat.

2.2 Preparation of Experimental Cages

One week before the arrival of the chicks, facilities were cleaned and disinfected to prevent the possible occurrence of diseases. The brooder pen was made of galvanized iron sheets with a dimension of 2 ft x 4.5 ft x 1.0 ft. This was cleaned and disinfected with commercially available disinfectant before the experimental birds were placed for brooding. After the brooding stage, the broiler chicks were transferred to grower cages with the recommended standard floor space requirement of 1 square foot per bird. The grower cages were constructed in elevated colony type pens and made up of local materials. The walling and flooring were made from bamboo slats. Provisions for proper ventilation and prevention of extreme cold weather conditions were also provided.

2.3 Brooding and Rearing Management

During the whole duration of the brooding period, old newspapers were used as beddings or litter and changed to prevent manure accumulation. Two 50-Watt electric bulbs were provided as a source of artificial heat until the time when they will be able to regulate their body temperature. The chicks were being fed with commercial booster mash during the whole duration of the brooding period (14 days).On the 15th day of brooding, the chicks were transferred to the grower cages and the standard experimental diet for broiler chickens were being followed.

2.4 Feeding and Water Management

The experimental birds were fed *ad libitum* to ensure that they are fed continually. At the brooding stage, the birds were given chick booster mash. However, on the 15th day, the experimental birds are fed with their respective experimental rations until the 35th day. The experimental homemade rations were given to chicks at 6:00 in the morning, 12:00 and 3:00 p.m., fed *ad libitum*. The homemade rations given were weighed and recorded. Separate feed containers were provided for every treatment and feed refuse was collected and weighed. Freshwater was provided throughout the feeding experiment.

2.5 Preparation of Homemade Ration

The homemade ration was prepared after purchasing all the ingredients. The Palm kernel meal was purchased from Kenram Palm Oil Industries Inc., Brgy. Kenram, Isulan, Sultan Kudarat these were dried then hammer milled before adding to the formulation. The maximum inclusion of feedstuff in the ration was considered based on the Philippine Recommends for Poultry and Livestock Feed Formulation.

2.6 Experimental Diet

The experimental treatments were as follows:

T1 - Homemade Ration without PKM (Control)
T2 - Homemade Ration with 11.25% CM and 3.75% PKM
T3 - Homemade Ration with 7.50% CM and 7.50% PKM
T4 - Homemade Ration with 3.75% CM and 11.25% PKM
T5 - Homemade Ration with 15% PKM

2.7 Slaughtering of Birds

A total of 15, 35 days old broiler chicken were dressed after 35 days of rearing and feeding homemade rations with varying levels of palm kernel meal as a substitute to copra meal. These were obtained from 60 broiler chickens raised in a growth performance study. The process included cutting of throat from the outside and near the mandible to cut the jugular vein and facilitate bleeding. With downward pressure, the knife was rolled with the left hand and immersed in the boiling water for 20 seconds, enough to remove the feathers.

III. RESULTS AND DISCUSSION

3.1 Average Final Weight

Presented in Figure 1 is the average final weight of broilers fed with homemade ration at varying levels of Palm Kernel Meal as a substitute to copra meal. Results revealed no significant differences (*p-value* = 0.210) among treatment means. The figure shows that the birds in Treatment 4 had the heaviest final weight of 1254.42 grams; followed by Treatment 2 with 1233.00 grams; Treatment 3 with 1200.25 grams;

Treatment 5 with 1195.17 grams and the lowest in Treatment 1 with 1134.08 grams. This result confirmed to the studies of Osei and Amo (1987) as supported by Onifade and Babatunde (1998) who reported that the addition of palm kernel meal had no significant influence on the body weight of broilers. This is, however, similar to the finding of Garcia *et al.* (1999), which stated that the body weight gain of broilers was slightly (< 0.05) higher when fed palm kernel meal diets at 10% than at 20% and 30% of the dietary rate. The results imply that birds fed with varying levels of PKM show a comparable result in the entire feeding period. Moreover, the use of PKM in the monogastric diet should be limited due to its high fiber content which can reduce the digestive enzyme's action (Ojewola and Ozuo, 2006)

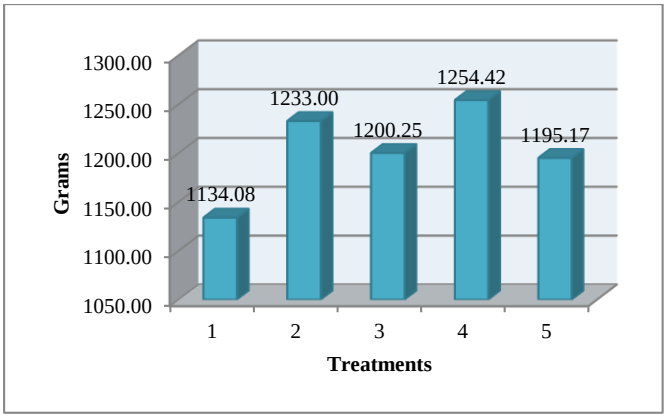

Figure 1. Average final weight (grams) of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.2 Body Weight Gain

Figure 2 presents the average body weight gain of the experimental birds. Results showed no significant difference among treatment means. Treatment 4 had the highest weight gain of 975.42 grams followed by Treatment 2 with 955.83 grams; Treatment 3 with 914.00 grams; Treatment 5 with 910.17 grams and Treatment 1 with the least body weight gain of 839.08 grams. The result of the study agreed with Soltan (2009) who reported that during processing, Palm Kernel Meal may undergo Maillard reaction due to the heat applied and this adversely affects digestibility. This observation is similar to the study of Okuedo, *et al.*, (2006) who observed that dietary supplementation of PKM up to 30 % PKM did not affect the final weight and weight gain in broiler chickens. However, they observed that birds fed 45% above PKM had reduced body weight as shown in Figure 2.

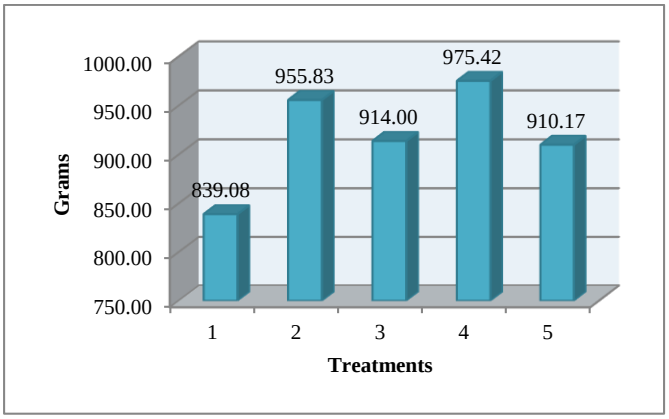

Figure 2. Average body weight gain of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.3 Average Daily Gain

Figure 3 shows the average daily gain (gram) of birds. Treatment 4 had the highest average daily gain of 46.45 grams compared to Treatment 2, Treatment 3, Treatment 5 and Treatment 1 which had 45.52 grams, 43.52 grams, 43.34 grams, and 39.96 grams, respectively. However, no significant differences were observed, indicating that homemade ration at varying levels of palm kernel meal could not affect the average daily gain of broiler chicken. It should be noted that broiler chicken in Treatment 4 fed with homemade ration generally obtained heavier gain in weight compared to the Control (without PKM), with 11.25%. Result confirmed to the study of Armas and Chicco (1977) that the inclusion of palm kernel in the ration can increase the gain in weight and growth performance of the broiler chicken.

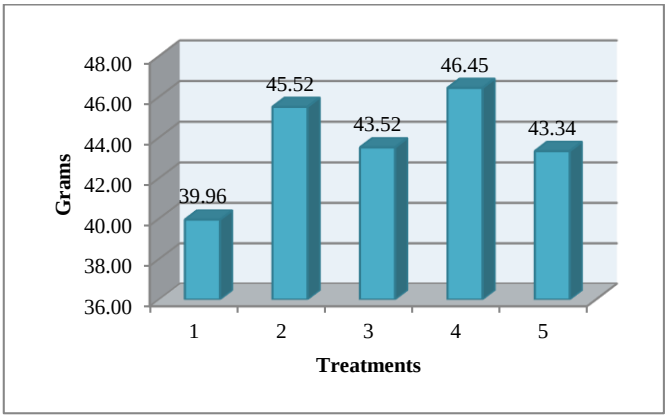

Figure 3. Average daily gain (grams) of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.4 Voluntary Feed Intake

The voluntary feed intake of birds is shown in Figure 4. Results revealed no significant difference among treatment means. Treatment 3 had the highest feed consumption of 2023 .83 grams followed by Treatment 1 with2011.50 grams; Treatment 2 with 1948.50 grams; Treatment 4 with 1900.08 grams and Treatment 5 with the least feed consumption of 1881.92 grams only The result supports with Mateos, *et al.*, (2012) that during the starter period, feed rations containing Palm Kernel Meal had no significant effect on the voluntary feed intake of broiler chicken. Moreover, Walugembe, *et al.*, (2015) indicated that the use of high fiber ingredients in broiler diets does not affect growth performance. It was therefore not surprising that the high level of PKM did not have an adverse effect on the feed intake of broilers.

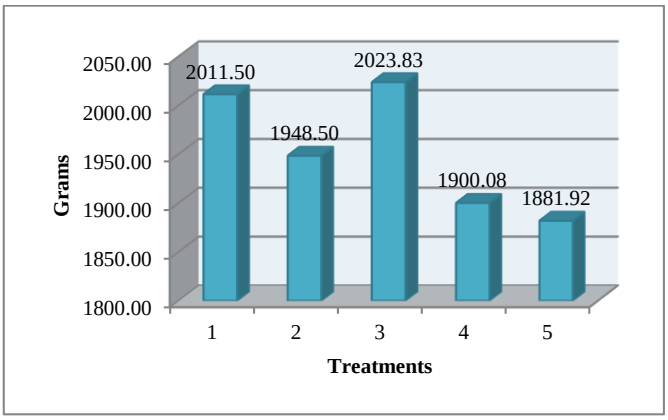

Figure 4. Average voluntary feed intake (grams) of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.5 Feed Conversion Ratio

Feed conversion is the ratio between the total feed consumed over the total weight gained of the birds. The lower the value, the more efficient are the birds in converting feed to live weight. Results showed no significant difference among the treatment means for the feed efficiency of the birds.

Treatment 4 had the highest feed efficiency value of 1.95 kg; Treatment 2 with 2.05 kg; Treatment 5 with 2.09 kg; Treatment 3 with 2.22 kg and Treatment 1 with 2.41 kg. The result agreed to the study of Osei and Amo (1987) who reported that the addition of PKM in the diet did not significantly affect the feed conversion ratio. However, numerically, birds receiving a diet of 20% and 30% PKM diet have slightly better FCR. This observation was not similar to the study of Ojewola and Ozuo (2006) who found that the inclusion of 15% PKM has poor FCR for growing cockerels compared with the Control. This implies that the birds receiving different levels of PKM are more efficient numerically in converting feed into meat since they were not significant.

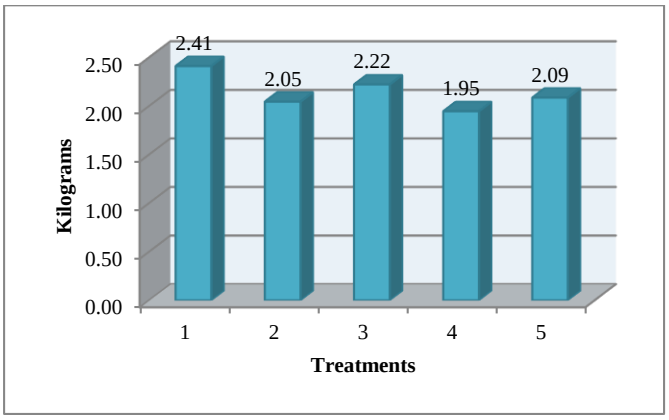

Figure 5. Feed conversion ratio (kilograms) of broilers fed with homemade ration at varying levels of oil palm kernel meal

3.6 Dressing Percentage

Figure 6 shows the results of dressed meat of broilers fed homemade ration which shows no significant difference among treatment means. Treatment 4 had the highest percentage of 71.60%, followed by Treatment 2 with 70.40%, Treatment 3 with 68.00%, Treatment 1 with 67.86% and Treatment 5 with the least dressing percentage with 66.60%. The results confirmed with the study of Okuedo *et al*. (2006) who observed that broiler chicken fed with varying levels of Palm Kernel Meal had higher dressing percentage compared to those at 0% inclusion of PKM in the ration, as presented in figure 6.

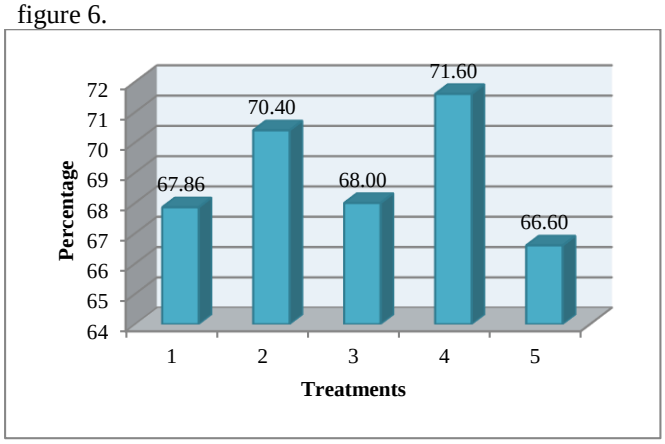

Figure 6. Dressing percentage (%) of broilers fed with homemade ration at varying levels of oil palm kernel meal as a substitute to copra meal

3.7 Return Above Feed and Chick Cost

The return above feed and chick cost refers to the amount gained using the treatment of the study. It shows that the given treatment had a positive or negative impact on profit gaining. Among the five dietary treatments, Treatment 4 with 11.25% PKM had the highest return of Php 81.33. This was followed by Treatment 2 with Php 76.60; Treatment 5 with Php 74.64; Treatment 3 with Php 71.21 and Treatment 1 with Php 61.21. This result supports the study of Osei and Amo (1987) who stated that using PKM considerably.

Table 2. Return above feed and chick cost of broilers fed homemade ration at varying levels of palm (*Elaeis guineensis*) kernel meal as a substitute to copra meal

PARTICULARS	TREATMENT				
	1	2	3	4	5
Final live weight, kg	1.134	1.233	1.200	1.254	1.195
Price/kg LW (Php)	130.00	130.00	130.00	130.00	130.0
Gross return/head (Php)	147.42	160.29	156.00	163.02	155.35
Cost of DOC/head (Php)	30.00	30.00	30.00	30.00	30.00
Feed Consumption (kg/head)					
a.CBM (kg)	0.37	0.37	0.37	0.37	0.37
b.Homemade ration (kg)	2.01	1.94	2.02	1.90	1.88
Price/kg of Feed (kg)					
a. CBM (kg)	33.00	33.00	33.00	33.00	33.00
b. Homemade ration (kg)	21.89	21.38	21.08	20.78	20.48
Total Feed Cost (Php)					
a. CBM (kg)	12.21	12.21	12.21	12.21	12.21
b. Homemade Ration (kg)	44.00	41.48	42.58	39.48	38.50
Total Cost (Php)	56.21	53.69	54.79	51.69	50.71
RAFCC	61.21	76.60	71.21	81.33	74.64

IV CONCLUSION AND RECOMMENDATION

The addition of palm kernel meal in broiler ration had no significant effect on the growth performance of broiler. However, the inclusion of Palm Kernel Meal in the homemade ration gave a higher return of investment in raising broilers. In light of the findings, the researcher recommends the incorporation of PKM in the diet of broilers to obtain higher profit. Likewise, further study on the use of PKM for a long duration of research should be done in ruminant or non-ruminant animals.

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Effects of Fermented Kangkong *(Ipomoea aquatica* Forssk.*)* Juice Supplementation On the Growth Performance of Japanese Quails

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Abstract: Quail raising is said to be the business venture of those with limited capital but who look for high returns in a short period. A feeding trial to assess the growth performance and economic benefits of Japanese quails supplemented with varying levels of fermented kangkong juice through the drinking water was conducted using 120 female Japanese quails at the Department of Animal Science-College of Agriculture and Food Science, Visayas State University, Visca, Baybay City, Leyte, Philippines from January to February 2016. The Japanese quails were randomly assigned to four treatments and replicated three times with ten birds per replication laid out in a Completely Randomized Design set-up. Data gathered were subjected to a one-way analysis of variance (ANOVA) using Statistical Package for Social Science (SPSS) version 17.0 software. Supplementation of fermented kangkong juice (FKJ) into the drinking water of Japanese quails did not significantly affect the growth performance in terms of the results on Bi-monthly weight gain, average daily gain, bi-monthly voluntary feed intake, and cumulative feed conversion ratio. However, the overall result on return above feed and chick cost (RAFCC) disclosed a bright prospect of FKJ supplementation for raising Japanese quails.

Index Terms: Japanese quails, fermented kangkong juice, supplementation, growth performance

I. INTRODUCTION

The Japanese quail (*Coturnix japonica*, Temminck and Schlegel, 1849) locally known as "pugo" is a small and tailless bird that belongs to the order *Galliformes*, family *Phasianidae* and subfamily *Phasianinae* (Karaalp, 2009), and found in many parts of Asia. The rapid multiplication capability of these birds makes their meat and eggs readily available for human consumption. The quail meat is lean, and eggs and meat are low in cholesterol (Tarhyel *et. al.*, 2012). Furthermore, quail meat and eggs are known to be rich in unsaturated fatty acids, phospholipids, vitamins, and essential amino acids. Quail meat is usually boiled or roast with less fats and calories and is a perfect food for health-conscious consumers. Both quail meat and eggs can be included in the diets of children, pregnant mothers, geriatric and convalescent patients. Also, there is no known serious quail disease except for some respiratory problems which do not spread quickly and quails are more resistant and less susceptible to bacterial diseases. Capitan (2003) cited that some quail raisers claimed an ROI of P41 to P66 profit for every P100 invested in the business and that quail enterprise may have a payback period of 6 months.

One of the major problems in quail raising is the high price of feeds that constitute 70-80% of the total operational cost and specific rations for quails are not commonly available in the market (Bitancor, 2008). Thus, quail raisers tend to use broiler feeds despite much higher protein requirement of quails compared with chicken (BAR, 2012). Moreover, the cost of feeds, vitamin-mineral supplements, drugs and biologics cannot be offset because most quail raisers operate on a small-scale basis (Capitan, 2003). Although some reports mentioned that quails are more immune and less prone to bacterial diseases as compared to chicken, still there is a need to boost their immune system. The use of fermented plant juice in the drinking water has been reported to increase microbial activities in gastrointestinal tracts, better absorption of nutrients and hasten manure decomposition when sprayed to animal beddings. In the Philippines, Water Spinach (*Ipomoea aquatica* Forssk.) which is abundantly growing in stagnant streams, fresh water swamps, and pools have been cited as a good source of protein, vitamins and minerals. It is also commonly reported to contain carotenoids, β-sitosterol and glycosides (Chitrajit and Pinak, 2015), hypolipidemic, antimicrobial, purgative, anthelmintic, anti-inflammatory, antiepileptic, CNS depressant, diuretic, and antidiabetic properties. Anadon *et al.*, (2005) reported that fermented plant juice with the aide of live microorganisms has a role in promoting growth rates by improving feed efficiency and speed up manure decomposition when sprayed to poultry and livestock beddings. Hence, this study investigates the potential of fermented kangkong juice supplementation in the drinking water of quails.

II. METHODOLOGY

2.1 Preparation of Experimental Cages

One week before the arrival of chicks, all facilities were cleaned and disinfected to prevent the possible occurrence of diseases. The brooder pen was made of galvanized iron sheets with a dimension of 2 ft x 4.5 ft x 1.0 ft. This was cleaned and disinfected with a commercially available disinfectant before putting the experimental quails for brooding.

After the brooding stage, the quails were transferred to grower-layer cages with recommended standard floor space requirement of 16 inches per bird (Capitan, 2003). The grower-layer cages were made of steel and constructed with slightly inclined flooring so that clean eggs will roll out of the pen for easy collection. Shallow feeders and waterers measuring 91.44

cm (3ft) long, 10.16 cm (4 inches) wide, and 5.08 cm (2 inches) in height were constructed from the PVC water pipe. Provisions for proper ventilation and prevention of extreme cold weather conditions were also provided.

2.2 Brooding and Rearing Management

Upon the arrival of the day-old quail chicks, these were placed in the brooding pen. During the whole duration of the brooding period, old newspapers were used as beddings or litter that were regularly changed for a dry and clean pen. Two 50watt electric bulbs were provided as a source of artificial heat until the time when they were able to regulate their body temperature. The chicks were fed with commercial booster mash during the whole duration of the brooding period (14 days).

On the 15th day of brooding, the chicks were transferred to the grower-layer cages, and the standard feeding program for quails was followed. From day 15 to 35, 17 grams per head per day starter mash was given, and from Day 36 until the end of the experiment, 23 grams per head per day laying mash was provided (BAR, 2012). The daily feed allowance was given 6:00 in the morning and 3:00 in the afternoon.

The experimental drinking water was started on Day 15, and given twice a day to ensure freshness during the whole duration of the study. Proper sanitation, cleanliness and daily removal of dung to get rid of flies and foul odor were regularly practiced.

2.3 Preparation of Fermented Kangkong Juice (FKJ)

Fresh kangkong leaves and stems were used as plant material for the fermented kangkong juice. For every three (3) kilos of chopped Kangkong, one (1) kilogram molasses was added based on the formula cited by Miller (2003). The molasses serve as a source of food for the microbial population that performs the fermentation process and the weak alcohol produced during fermentation extracts chlorophyll and other plant components. Chopped kangkong stem and leaves were mixed with molasses and placed into a clean clay pot to about ¾ full. All containers were properly labeled, covered and stored in a cool and dry area for seven (7) days to allow anaerobic fermentation process. After fermentation, this was strained using a net bag to separate plant residues from the liquid juice. The juice was placed in a clean, sterilized and covered glass bottle to prevent unwanted contamination. The fermented kangkong juice was added at various levels and mixed properly to the drinking water at various levels and mixed thoroughly before giving to the experimental birds.

2.4 Experimental Treatments

The experimental treatments were as follows:

T_0 - 1000 ml Drinking water (Control)
T_1-1000 ml Drinking Water+10 ml Fermented Kangkong Juice
T_2- 1000 ml Drinking water + 20 ml Fermented Kangkong Juice
T_3- 1000 ml Drinking water + 30 ml Fermented Kangkong Juice

Table 1. The nutritional value of fermented kangkong juice

NUTRIENTS	UNIT	VALUE
Crude Protein	%	15.94
Phosphorus	%	0.654
Potassium	%	2.248
Calcium	%	0.390
Cupper	mg/kg	13.5
Zinc	g/kg	38.900
Iron	mg/kg	304.400

2.5 Data Analysis

The data gathered was subjected to a one-way analysis of variance (ANOVA) using the software version 17.0 of the Statistical Package for Social Sciences (SPSS).

III. RESULTS AND DISCUSSION

3.1 Weight Gain

Results revealed no significant difference in bi-monthly weight gains of quails at weeks 2 and 4. Although not significant, weight gain at week 2 and 4 was highest in quails supplemented with 30 ml FKJ (51.10 and 79.97 g) followed by 10 ml FKJ (46.6 and 75.53 g), 20 ml FKJ (45.87 and 74.70 g) and Control without FKJ (44.63 and 71.5 g), respectively. It should be noted that quails supplemented with FKJ in the drinking water generally obtained heavier gain in weight compared to the Control or without FKJ probably attributed to the additional crude protein supplied by FKJ supplementation. Moreover, FKJ contained 15.94% crude protein. Result confirmed with Anadon *et al.* (2005) and Abela (2007) who cited that live microorganisms in fermented juices and probiotics can aide for the better utilization of feed nutrients.

Table 2. The cumulative bi-monthly weight gain (g)

Treatment	Week	
	2	4
T_0 (Drinking water, control)	44.63	71.50
T_1 (Drinking water + 10 ml FKJ)	46.60	75.53
T_2 (Drinking water + 20 ml FKJ)	45.87	74.70
T_3 (Drinking water + 30 ml FKJ)	51.10	79.97
p-value	0.409^{ns}	0.128^{ns}

^{ns} *Column means are not significant*

3.2 Average Daily Gain

The cumulative bi-monthly average daily gain (ADG) of Japanese quails was not significantly affected by varying levels of fermented kangkong juice (FKJ) in the drinking water. Although not significant, ADG at week 2 and 4 were highest in quails supplemented with 30 ml FKJ (3.65 and 5.71g) followed by 10 ml FKJ (3.33 and 5.40g), 20 ml FKJ (3.28 and 5.34g) and Control or without FKJ (3.19 and 5.11g), respectively. Despite the short duration of the experiment, results manifested generally heavier ADG in quails supplemented with FKJ in the drinking water compared with the Control or without FKJ. Results are consistent with the findings of Richter *et al.* (2000), Cmiljanic *et al.* (2001), Banday and Risam (2002), and Raceviciute-Stupeliene *et al.* (2007) that showed significantly higher weight gain in birds with live microorganisms in drinking water compared to 100% pure drinking water.

Table 3. The cumulative bi-monthly average daily gain (g)

Treatment	Week	
	2	4
T_0 (Drinking water, control)	3.19	5.11
T_1 (Drinking water + 10 ml FKJ)	3.33	5.40
T_2 (Drinking water + 20 ml FKJ)	3.28	5.34
T_3 (Drinking water + 30 ml FKJ)	3.65	5.71
p-value	0.409^{ns}	0.125^{ns}

^{ns} Column means are not significant

3.3 Voluntary Feed Intake

Supplementation of fermented kangkong juice in the drinking water did not significantly affect the cumulative bi-monthly voluntary feed intake of quails at weeks 2 and 4. However, slightly higher voluntary feed intake was observed in the Control or without fermented kangkong juice (234.03g and 499.53g and this were followed by 30 ml FKJ (233.37g and 496.0g), 20 ml FKJ (233.2 and 496.57g), and 10 ml FKJ (233.13 and 489.37g), respectively. Supplementation with FKJ in the drinking water of quails demonstrated an increasing trend in voluntary feed intake with an increasing level of FKJ, however still quails without supplementation tend to consume more feeds.

Table 4. The cumulative bi-monthly voluntary feed intake (g)

Treatment	Week	
	2	4
(Drinking water, control)	234.03	499.53
(Drinking water + 10 ml FKJ)	233.13	489.37
(Drinking water + 20 ml FKJ)	233.20	496.57
(Drinking water + 30 ml FKJ)	233.37	496.00
p-value	0.911^{ns}	0.717^{ns}

^{ns} Column means are not significant

3.4 Feed Conversion Ratio

Supplementing fermented kangkong juice (FKJ) in the drinking water of Japanese quails did not significantly affect the feed conversion ratio at weeks 2 and 4. Although not significant, Japanese quails supplemented with FKJ showed better FCR compared with the Control in the drinking water. Results indicated slightly better FCR 4.58 and 6.21 with quails given 30 ml FKJ in the water and quails under Control or without FKJ (5.33 and 7.01) showed the least FCR. The FKJ supplementation perhaps contributed to the better utilization of feed nutrients. Raymane (2000) and Cavit (2003) confirmed that live microorganisms promote growth rates by improving feed efficiency with subsequent animal health improvements (Philips and Philips, 1996). Likewise, live microorganisms have positive effects on the physiological functions of the gastrointestinal tract that reflected better digestion, nutrient absorption, and metabolism.

Table 5. The cumulative feed conversion ratio

Treatment	Week	
	2	4
T_0 (Drinking water, control)	5.33	7.01
T_1 (Drinking water + 10 ml FKJ)	5.03	6.48
T_2 (Drinking water + 20 ml FKJ)	5.10	6.65
T_3 (Drinking water + 30 ml FKJ)	4.58	6.21
p-value	0.427^{ns}	0.089^{ns}

^{ns} Column means are not significant

3.5 Return Above Feed and Chick Costs

Results indicated highest RAFCC in quails supplemented with 10 ml FKJ (17.92 PhP) followed by the Control or without FKJ (17.74 PhP), 30 ml FKJ (17.70 PhP) and 20 ml FKJ (17.25). Despite the short term duration of the experiment, the overall result on RAFCC of raising Japanese quails supplemented disclosed a bright prospect of FKJ supplementation.

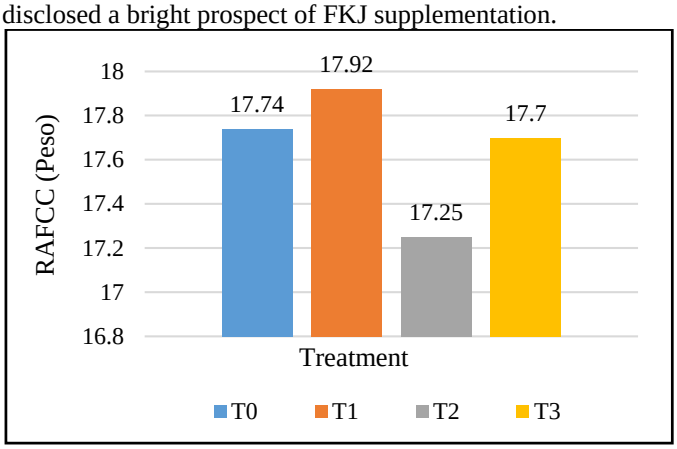

Figure 1. Return above feed and chick cost (Php) of Japanese quails supplemented with varying levels of FKJ

IV. CONCLUSION AND RECOMMENDATION

Supplementation of fermented kangkong juice into the drinking water did not significantly affect the growth performance of the Japanese quails. However, the overall result on return above feed and chick cost disclosed a bright prospect of FKJ. A similar study should be conducted to assess the long-term effects of FKJ supplementation and establish the optimum level of FKJ incorporation into the drinking water of quails.

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"Patients' Belief on the causes of Mental Illness among Adult in Kebbi State, Nigeria.

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Abstract- The purpose of this study was to explore the patient's belief on the causes of mental illness in Nigeria. An exploratory-descriptive design within the qualitative paradigm was used. In-depth one-on-one interview with thirteen (13) participants between the ages of 30-54 years old. All participants consented to participate and they were used purposively sampled. No form of coercion was used to attract or retain them. The interviews were audio taped and transcribed verbatim after which content analysis was done to identify themes and categories. A key finding in this study was that patient's belief on the causes of mental illness indicated that patients believed Thoughts/thinking, feelings, and emotions as the causes of their illness. Other findings included: witchcraft, emotional experience, resources, occupations, and family/homes. It was recommended that health care providers should create an avenue to enlighten their patients on mental illness.

Index Terms- Mental Illness, Patient, Causes, Belief.

I. Introduction

Mental illnesses are universal phenomena in the world affecting every society, but beliefs about causation vary across cultures. It has been reported that people living in western countries focus mainly on biological and social risk factors such as genetic vulnerability, disease of the brain, infection or stressful social conditions or personal weakness (Furnham & Chan, 2004; Magliano, Fiorillo, De Rosa, Malangone, & Maj, 2004; Nakane, et al., 2005), but the predominant views held by people living in non-western countries focus mainly on supernatural and religious factors (Saravanan, Jacob, Deepak, Martin, David, & Bhugra, 2008).

More than 450 million people across the globe suffer from mental illnesses. Among these, 90 million are drug or alcohol dependent, 25 million suffer from schizophrenia, and 150 million have depression (WHO, 2010).Schizophrenia, depression, epilepsy with psychosis, dementia, alcohol dependence and other mental, neurological and substance-use disorders make up 13% of the global disease burden, surpassing both cancer and cardiovascular diseases (National Institute of Mental Health, 2011). It has been projected that by the year 2030, depression will be the second highest cause of disease burden in middle-income countries and the third highest in low-income countries (WHO, 2010). In the United States, people with severe mental illness die 25 years earlier than the general population on average. In Denmark, the life expectancy gap has been shown to be as high as 18.7 years with certain disorders (Kessler, Foster, Saunders, & Stang, 2013).

In a cross-cultural study, infection, allergies and genetic diseases were the most commonly attributed causes of mental illness in Australia; whereas, nervousness and perceived constitutional weakness were more often reported in Japan. (Nakane et al., 2005).Another comparative study of young adults in Hong Kong and England found that, Hong Kong youths believed that social factors were the likely cause of schizophrenia, while the English youths were more likely to report genetic factors as a cause of schizophrenia (Furnham & Chan., 2004). Similarly, in reports from Germany and Italy, lay people held a predominantly biological view of the cause of schizophrenia (Angermeyer & Matschinger, 2006; Magliano et al., 2004; Nakane et al., 2005).

A report from Turkey showed about 60% of a rural population held the view that personal weakness might be a cause of schizophrenia (Taskin, Sen, Aydemir, Demet, Ozmen, & Icelli, 2003). In contrast to this, in Indonesia, the majority of patients held the belief that schizophrenia was caused by supernatural causes, such as witchcraft or disturbance by spirits (Kurihara, Kato, Reverger, & Tirta, 2006). Similarly, a study exploring the belief system surrounding causes of mental illness in a primary care setting in Saudi Arabia reported that patients attributed their symptoms to religious and supernatural factors, saying that it could be the result of punishment from Allah (Kuriharaet al., 2006). Despite these seemingly dichotomous views regarding attribution about the causes of mental illness, a significant proportion of people living in western countries still endorse the spiritual and magical views. For instance, a study done in Italy reported that 4% of the participants including lay people, professionals, and relatives, believed that magic, spirit possession and spells as causes of schizophrenia (Magliano et al, 2004).

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Cultural beliefs play a major role in determining perceptions of the meaning and causes of mental illness (Marsella & Yamada, 2000). However, relatively little attention has been paid to exploring beliefs among Hispanics about the factors that cause mental illness, and, in particular, the population of Mexican Americans along the U.S./Mexico border (Urdaneta, Saldaña, & Winkler, 1995). This is troublesome especially since Mexican Americans as a population exhibit strong mental health care disparities in the U.S. (Alegría et al., 2008; Blanco et al., 2007; Cook, McGuire, & Miranda, 2007; Guarnaccia, Martinez, & Acosta, 2005).

In Nigeria, religio-magical views of causation have been found to be more associated with negative perception of mental illness and stigmatizing attitudes to the mentally ill persons as compared with biological explanations (Gureje, Olley, Olusola, & Kola, 2005). Spiritual explanations have also been found for mental states due to physical illness such as delirium (Ola et al., 2010). These beliefs may also explain why many cases of mental illness in Sub-Saharan Africa are treated punitively or outside modern health care systems. For example, the psychiatric patients are treated via traditional or faith healers (Olaet al., 2010). Also a report from Nigeria showed that the majority of people preferred indigenous treatment over the modern health care system which was consistent with their predominant belief about the causes of mental illnesses (Kabir, Iliyasu, Abubakar, & Aliyu, 2004).

Many patients believe that mental illness is rare, something that only happens to people with life situations very different from their own, and that it will never affect them. Studies of the epidemiology of mental illness indicate that this belief is far from accurate. Most of the patient's believed in demons as the cause of mental health problems which is well-known phenomenon in many cultures of the world (Pfeifer, 1994).

Another research also revealed that war was also mentioned as a cause of mental disturbance, fear from crossing flooding river [during rainy season] were also mentioned to be causes for mental disturbance. Although stress might be an important factor here, these incidents are believed to involve some bad spiritual interference as well. So, it combines both psychosocial stressor and spiritual influence (Teferra & Shibre, 2011).

In Western countries depression and schizophrenia are most often seen by the public as caused by the social environment, particularly recent stressors (McKeon & Carrick, 2001; Matschinger & Angermeyer, 2001). While psychiatric epidemiologists would concur about the importance of stressful life events in depression, in schizophrenia life events are more of a trigger than a cause. Biological factors are seen by the public as less important than environmental ones (McKeon &Carrick, 2001; Matschinger & Angermeyer, 2001; Link *et al*, 2004), although relatives of people with schizophrenia are more likely to see biological factors as important (Angermeyer & Matschinger, 2006).

A research conducted in Germany shows that patients usually looks to biological factors when searching for the cause of schizophrenia, while the general public tends to cite psychosocial factors, especially stress-related factors, in order to explain the development of this illness (Angermeyer, & Matschinger, 2006).
In some non-Western cultures, supernatural phenomena, such as witchcraft and possession by evil spirits, are seen as important causes of mental disorders (Razali *et al*, 2006), although this is uncommon in the West (Angermeyer & Matschinger, 2009). Beliefs about causes may alter patterns of help-seeking and response to treatment. For example, in Malaysia belief by psychiatric patients in supernatural causes was associated with greater use of traditional healers and poorer compliance with medication (Razali *et al*, 2006). In a US controlled trial of psychotherapy for depression, belief in relationship causes was associated with a better outcome in behavioural therapy, while belief in existential causes was associated with a better outcome in cognitive therapy (Addis & Jacobson, 2010).

Another research conducted on public beliefs about causes and risk factors for mental disorders shows that the major changes were an increase in belief in genetic causes of both depression and schizophrenia, increases in beliefs about problems from childhood and the death of someone close as causes of depression, and a decrease in the belief that "weakness of character" is a cause of schizophrenia (Jorm et, al., 2005).

In India beliefs about the causation of schizophrenia indicates that supernatural cause was named by only 12% of the families and as the only cause by 5% participants. Psychosocial stress was most commonly cited cause, followed by personality defect and heredity. A small number of families (14%) could not name any cause and 39% named more than one cause. Patient gender and education, duration of illness and the key relative's education and the nature of relationship were related to the type of causal attributions made (Srinivasan & Thara, 2001).

In Malaysia, about 53% of the patients attributed their beliefs to supernatural agents. Witchcraft and possession by evil spirits were regarded as common causes of illness. The number of patients who believed in supernatural causes of their mental illness was significantly higher among those who had consulted bomohs (Malay traditional healers) than among those who had not consulted them. The belief that mental illness is caused by supernatural agents is firmly held by bomohs, who reinforce this notion in those who seek their advice. Belief in supernatural causes of mental illness was not significantly associated with age, gender, level of education or occupation of the patients. Patients

who believed in supernatural causes of mental illness were also found to show poor drug compliance, and the number of such patients at 6 months follow-up was significantly lower than the corresponding figure for those who did not believe in supernatural causes (Razali, Khan & Hasanah, 2006).

Several reports from other non-western countries also showed the diversity of opinion held by people living in non-western countries. For instance, a study done in Nigeria involving a large community survey found that as many as one third of the respondents suggested that possession by evil spirits could be a cause of mental illness, but in this same study the majority held the biopsychosocial causes such as drug and alcohol misuse, traumatic event/shock, accumulation of stress, physical abuse and genetic inheritance as the causes of mental illness (Gureje et, al., 2005). In south-western region of Nigeria, 90 % of psychiatric patients are of the belief that, the cause of their illness are contrast supernatural cause, only few patients admitted that financial distress or poverty was a possible cause of mental disorder (Adebowale & Ogunlesi, 1999).

II. METHOD

An exploratory descriptive qualitative design was used for the study. The reason for choosing this design was that very little has been done in this area in northern part of Nigeria and that has motivated the researcher to investigate the patients' belief on the causes of mental illness among adults in northern Nigeria.

This research design adopted a qualitative approach. A qualitative approach allows the researcher to use naturalistic methods. Hence, the overall purpose is to gain insight into the patients' belief on the causes of mental illness. Accordingly, this study employs qualitative techniques in both the collection and analysis of data (Field & Morse, 1985). The research was conducted at the Zauro General Hospital, Kebbi State Nigeria.

III. PARTICIPANT

The population for this study were ten (13) participants between the ages of 30-54 years old and in lucid interval were selected for this study. A lucid interval is recognized in law as meaning an insane person has had sufficient remission of his mental condition to render him temporary capable of making a will or transaction business or knowing the difference between right and wrong i.e the psychiatric symptoms have abated and can now function like any other human being (NIMH, 2011) at the Zauro General Hospital. The participants were recruited through the nurse working at outpatient department (O.P.D).

Purposive sampling technique was used to select the participants at the out-patients department (OPD) of Zauro General Hospital in this study. Purposive sampling is a non-probability method in which the researcher selects study participants on basis of personal judgment about which ones will be most appropriate to generate the required data (Polit, Beck &Hungler, 2001).

The recruitment of participants was done by the nurse at the O.P.D in Zauro General Hospital after thorough explanation regarding the study had been done at the psychiatric unit at the Zauro General Hospital. Patients in their lucid interval were identified by the psychiatric nurse in-charge of OPD.

IV. DATA COLLECTION

Semi-structured interview guide was used to discuss with the participants. The researcher used open ended questions during an interview which was conducted in Hausa. An audiotape was used to collect and capture the narrations of the patients. Field notes were also taken consisting of observations that were made during the interview.

Permission was sought by the researcher from relevant authorities of the Zauro General Hospital where the study was done after making available to them a permission letter and Ethical Clearance Certificate from Noguchi Memorial Institute for Medical Research, University of Ghana. Each interview lasted up to 30-45 minutes. Probing questions were asked to follow-up on participants' comments. Interviews were audio taped later translated and transcribed in English focusing on the meaning of comments. The transcripts were discussed with an expert in Hausa and participants to ensure that their views were accurately captured. Back translation was not done because of financial and time constraints in the study. The interviews focused on their perceptions about the causes of mental illness. The participants were approached by the researcher through the nurse at O.P.D to ask if they would participate. Once a person agreed to consider participating, he/she was briefed on the research topic, objectives, and the purpose of the study using information sheet. The participant was then asked if he/she had any questions for clarification. Once all questions and concerns were addressed, he/she was given the consent form and asked to sign or thumb print which indicates that the informed consent was understood.

V. DATA ANALYSIS

All aspects of the data including interviews, field notes and diary entries were analysed to provide the rich information from the patient's perceptions on the causes of mental illness. Data analysis occurred concurrently and principles of content analysis was followed systematically (Elo & Kyngas, 2008; Hsieh & Shannon, 2005). The sequence of the analysis followed a complete transcription of each interview, which was verified and supplemented by field. The researcher, after listening carefully repeatedly to the tapes, transcribed each interview into a document. Whilst listening to the interviews and transcribing, the researcher submerged into the data to familiarize himself with what the data is saying. This familiarisation was followed by coding. The codes that are similar were clustered around common domains and categories. To ensure that the findings (themes) fit the reality of participants, constant comparison of data was done. That is, the researcher made sense of data by carrying out analysis of each interview to identify the themes before going on to the next one and then compared themes emerging across the interviews.

VI. RESULT

The characteristic of the sample obtained included the patients at lucid interval sex, age, marital status, religion, tribe, occupation and place of residence. Interviewees were between the ages of 30-54 years old. Nine of the participants did not have any formal education and three (3) out of these nine were house wives, three (3) were farmers and three (3) were petty traders. Two (2) were secondary school graduates and one (1) is a butcher whilst one were teacher. And finally One (1) have higher National Diploma and working with Kebbi state Government.

All participants were interviewed in Hausa because they understood Hausa than English. In all nine (9) women, and four (4) men were interviewed. All the participants were either living in the community where the hospital is located (Zauro) or within the neighbouring towns such as Ambursa, Gwadangwaji, Birnin Kebbi and Asarara among others.

One of the major themes identified in exploring the patient's belief on the causes of mental illness was psychosocial aspect as a cause of mental illness. Thought/thinking, feelings, emotions and spirituals was mentioned by some participants as causative agents. The four (4) subthemes are:

Thoughts/thinking

Some participants spoke about the role of one's thoughts in causing mental illness. They expressed that too much thinking on negative issues can affect an individual's sleep pattern making them depressed.

Participant narrated that:

"I believe that dwelling or concentrating too much on the negative aspect of life or the things that are happening around can lead to poor mental health".

(Participant 1)

Too much or negative thinking can affect sleeping pattern thereby causing excessive bad mood:

"Someone worrying about something a lot to where it affects their sleep or can cause bad mood that would cause you to feel tired in the morning; maybe you did not accomplish thinking it out, whatever problem was bothering you. So, I think you would be a little still emotional on whatever you were thinking about and that would affect you throughout the day . . ."

(Participant 2)

Participants believed that depression from too much thinking can results in mental illness:

"Maybe some thoughts can cause. . .depression. So you would have a lot of circumstances where you become depressed and can lead to madness".

(Participant 3)

Negative thoughts can alter someone minds leading to mental illness:

"What they think, what is going through their minds . . .When you always have negative thought in your mind that you think can hinder your progress in life that can contribute to the cause of mental Illness".

(Participant 4)

Feelings

Some participants commented that feelings in the course of their life pattern affect them psychologically. The major problems that demoralized them were too much stress, shocking news and frustration by someone.

Too much distress affects feelings which can lead to mental illness:

"I connect distress with feelings, basically. When your mom . . . is always asking for money and you don't have it . . ." laugh! I have a friend whose father always ask him for money when he does not have, and that really touches him much to the extent that he have to isolate himself so as not to see his father that affects his feeling, so I have to calm him down with the words of support".

(Participant 5)

Participants perceived that, frustration by someone or shocking news can result to mental illness:

"[It is caused by] a lot of stress, . . .shock frustration, anger." When you are frustrated by someone be it family members, friends or any other person that can cause madness. Shocking news too, when you receive a news that you lost your father, mother, child or any of the closest person this will affect your feelings and make you go mad".

(Participant 6)

Loneliness was connected to madness:

"Sometimes if you're lonely, when you are alone you have nobody to chat with, nobody to share your problems or complaint to, not to even think of getting support or solutions to your problems. If you are alone a lot of things will come into your life that will affect your feelings thereby making you to become depressed."

(Participant 7)

Participants expressed unwanted circumstances as a causative agent of madness:

"Well, in reality, you don't want to face what life brings to you. Well, get over it. You want to be in denial that it isn't happening to you but you failed to do so, it affects your feelings".

(Participant 8)

Thinking about failure in life such as failure in exam or where to get money for school fees can results to depression:

"Oh! Thinking about a test, because I am a college student; how and where to get money for feeding and school fees too, failure on exam too because can depressed someone, this happened when I was in college one of our student failed his final exam so he was withdrawn from the school and this affected his feelings so since then that boy hasn't gone back home and ran mad".

(Participant 9)

Failure to achieve something good in life and if your conscious is not clear about your deeds can lead to mental illness:

"If you are doing something wrong and you know is against your culture, norms and religion that will affect your feelings.

Disconnection with real life, if you are hindered from achieving or attaining something in life".

(Participant 10)

Emotions

Many participants discussed emotions as contributing factors. In addition, the emotional experience of loss, abusive background, too much worry or thinking and raped was considered by many participants to be a cause of mental illness.

Participant believed that abusive background can trigger depression:

"If you come from an abusive background . . . as a child your parents were very abusive with you mentally, physically, emotionally that . . . can have a lot to do with the way you become as an adult. A lot of people that are depressed and stuff like that usually have had a pretty . . . bad upbringing or have had some kind of like abuse and that . . . can also trigger someone who's an adult to have like major depression."

(Participant 11)

The same participant expressed raped can result in madness especially to women:

"Maybe when they were raped.....and like I said, when women were raped they may even commit suicide, I remembered one news caster that hang herself because she was raped, so they were physically, mentally, emotionally disturbed."

(Participant 12)

Another participant expressed too much worry or loses will affect someone emotions resulting to madness:

"*Worry comes from 'thinking too much'. I heard about someone who is very wealthy but when he lose that wealth, he was worried and that makes him start throwing off his clothes and walks naked. It could be man or woman; people take a different path away from him."*

(Participant 13)

Spiritual e.g. Witchcraft

Participant mentioned spiritual problems such as curse by spiritual leaders and charm as a possible cause and had this to say:

"..... Well spiritual leaders may curse someone and this may make him mad. If someone takes [steals] someone else's money or material, the person who lost the money or material may do something like charm in retaliation which makes the person who steals mad. Everyday problems; financial, emotional, uhh spiritual, I guess, also when someone come out at mid-night with no shirt he may get mad because evil spirit will get into him hence that person will become mad and he cannot become normal again"

(Participant 10)

Participants believed that charm can result to madness:

"If you are dating a girl that many men are chasing her and you happened to be the one she loves much, some of these people may just decide to charm you so that you can run mad. Even in working place if you are not lucky your co-workers can do anything especially if you are heading an office your subordinate can charm you so they can overtake you".

(Participant 9)

Another participant stated emphasised on charm as a causative agent in the cause of madness:

"Hhmm! This is very common among women who are rivals, this one happened among our family, my uncle have three wives, the first wife is innocent but the second one was very wicked and she don't like the third one, so she tried by all means to see that the husband divorce that third one but she couldn't. Later she felt the only way out is to charm that girl and so she did, so in the night when everyone is sleeping all of a sudden that third wife start shouting……"yeeeeeeee"she pulled out all her cloth so when everyone came out they met her naked. Oh my God, it is a pity and up to now that woman never come back to her normal sense".

(Participant 6)

Participants mentioned witchcraft as a causal factor and had this to say:

Participant two (2) believed that, when someone is bewitched it can result to madness:

"Well, at times, a person could say, well, maybe you're bewitched, or maybe someone put a curse on you. That's why you're that way . . ."

The same participant also added that:

"If you have problem with someone, and if that is wicked he may do some witchcraft on him which may make him mad. For example I have a friend and that my friend has a step mum so, the step mum is very wicked to the extent she charmed his own mum and she become mad".

(Participant 3)

Participant also relates charm to be by witchcraft which can result to madness:

"Gosh! Witchcraft is terrible; someone can easily charm you especially now that we are in political era. Most of these politicians you are seeing are devils they can do anything just to achieve their desire. This is very common because they know even if you get better nobody will vote for since you have history of mental illness".

(Participant 11)

VII. DISCUSSION

One of the major finding that accounted for the patients believed about the causes of mental illness was psychosocial causes of mental illness was been divided into thought/thinking, feelings, emotions and spirituals. Findings of this study showed that patients believed psychological aspects as the causes of mental illness. Their beliefs on psychological causes include: Thought/thinking, feelings, spirituals, and emotions.

Thoughts/thinking

Findings of the present study revealed the role of thoughts as the cause of mental illness. They believed that too much thinking on the negative aspect of life can lead to poor mental health. This finding is consistent with the findings of Garcia and Saewye (2007) who reported that Mexican-American adolescent's believed lack of positive emotions and thought patterns as contributing factor of mental illness which may lead to suicide. This study also support the findings of Chakraborty et, al., (2013) from their study on perceptions and about the cause of psychiatric disorders and subsequent help seeking patterns among psychiatric outpatients in a tertiary care centre in Eastern India, who reported that participants gave highly variable responses to the question that assessed their opinion about the cause of psychiatric disorders. The majority (80%) of respondents with obsessive compulsive disorders (OCD) and anxiety disorders viewed the problem arising out of too much thinking. In same research majority (61.5%) of the respondents viewed that somatization and dissociative disorders is developed because of too much worrying/thinking.

Moreover, the finding shows that patients believed sleep impairment as result of too much thinking which can affect the mood of individuals and subsequently leading to mental illness. This finding is similar to the findings of Kabir and colleague (2004) on the perception and belief about the causes of mental illness among young adults in Northern Nigeria, who reported that participants believed lack of adequate sleep as a result of mood disturbances as the major cause of mental illness. This belief is true because excessive thinking interferes with sleep pattern which may lead to psychological disturbances. When it persist can lead to mental disorders like anxiety or depression (Teferra & Shibre, 2011).

Feelings

Majority of participants believed that feelings are attributed to the cause of their mental illness. Patients believed that too much distress as a result of struggling for life survival affects feeling which can lead to mental illness. This echo with the previous findings of Arbona et al., (2010) which revealed that, distress as a result of failure to meet life expectancy can lead to mental distress for Latinos which may subsequently lead to mental disability.

The findings of this study also revealed that frustration and excessive anger are believed as the causes of mental illness among psychiatric patients. This finding is in lined with the findings of Angermeyer and Dietrich (2006) among psychiatric patients in Germany who reported that excessive anger and frustration are believed by psychiatric patients as the cause of mental illness. This is a correct belief because frustration, and anger can lead to anxiety disorders (Zissi, 2006).

Furthermore, the findings show that loneliness, unwanted circumstances and failures are believed by patients to the factors that causes mental illness. They believed that when loneliness, unwanted pregnancy, examination failure for students and disappointment in life can make one to have suicidal tendencies which may lead to mental disorder. This findings of Lener et al., (2004), Khan et al., (2009) and Tanaka et al., (2005) who reported patients and the public believed loneliness, frustrations, failure to achieved life expectations and unwanted circumstance are the significant cause of mental disorders.

Emotions

Many participants attributed emotional experiences as contributing factors to the causes of mental illness. Some named childhood experiences, indicating *life experiences as a child, how people were raised*, and *the way they've been treated at home* as causes. Abuse was also designated as a cause by some respondents. Some specifically talked about childhood abuse, listing physical, sexual, emotional and psychological abuse as causes. Some participants generally mentioned abuse or psychological abuse as a cause, one linking it to family but not to a particular time in life. In addition, the emotional experience of loss was considered by many participants to be a cause of mental distress. The most frequently mentioned type of loss was *the death of a family member or loved one*. The second most frequently mentioned type of loss that caused mental distress according to participants was loss of a job. Participant also indicated loss of a home. Finally, traumatic events were another type of emotional experience stipulated by participants as causing mental distress. These findings support the findings of Edwards, Holden, Felitti, & Anda (2003), Shattell et al., (2008) & Addis and Jacobson (2010), who reported both an emotionally abusive family environment and the interaction of an emotionally abusive family environment with various maltreatment types [such as sexual abuse, physical abuse, and seeing one's mother being beaten] had a significant effect on mental health scores. They also reported that rape has been found to be the cause of severe depression in many patients.

Spiritual e.g. Witchcraft

Findings of this study revealed that most participants considered their mental illness to be caused by spirituality. Patients believed that mental illness are caused by spirit following a curse by leaders, charms by other people in the struggle for power, wife or tittle. This findings support the findings of Adewuya & Makanjuloa (2008) on their study done in Nigeria in which participants most frequently believed that mental illness is caused by evil spirits. This also goes in line with the study done in Bali, Indonesia, where the majority of the patients held the belief that schizophrenia was caused by spirits disturbance (Kurihara et al., 2006). The finding also support the findings of Teferra, & Shibre (2011) on the study done on the perceptions and beliefs causes of severe mental disturbance and preferred interventions in Southern Ethiopia where majority of the participants attributed evil spirit such as witchcraft as the cause of their illness. The beliefs of patients that mental illness is cause by spirit is a wrong belief because it contradicts the modern theories of psychiatric illness. This beliefs may lead the patients to seek for alternative treatment before coming to the hospital for treatment (Kabir et al., 2004).

Findings of this study showed that several participants mentioned witchcraft as a causal factor of mental illness. Participants believed that mental illness can be cause by witchcraft as a result of wickedness of some people. This finding is in line with the study done in Nigeria by Adewuya and Makanjuloa (2008), where most of the participants frequently believed that mental illness was caused by witchcraft. Furthermore, Solomon and Teshome (2004) on Perceived cause of severe mental disturbance and preferred interventions by the Borana semi-nomadic population in southern Ethiopia: shows that, majority of respondents perceived that, witchcraft were said to be the causes

of mental disturbance. The finding also concur the study done in Nigeria by Kabir et al. (2004) where eighteen percent (18%) of the participants believed that mental illness is caused by witchcraft. However, the finding also goes in line with non-western cultures and supernatural phenomena where witchcraft is seen as important causes of mental illness (Razali et al, 1996). On the contrary, the finding of Ganesh (2010) reveals that, eighty six percent (86%) of the participant did not believe that mental illness could cause mental illness. This perception that mental illness is cause by witchcraft is wrong and contradicts the modern theories about the causes of psychiatric diseases.

VIII. CONCLUSION

The study investigated the patient's belief on the causes of mental illness among adult in Kebbi State, Nigeria. The findings of this study indicated that participants reported thought/thinking as well as emotion as a causal agents of the causes of their illness. They pressed that mental illness can be occur as a result of feelings, spirituals such as witchcraft were mentioned by a lot of participant's. However, the findings of the study showed a lack of knowledge about the actual causes of mental illness. Therefore, it is highly recommended that further research be done on the patient's belief on the causes of mental illness. Also, since the study was done in the hospital and the sample size was small, it was recommended that another study be done in a wider perspective involving psychiatric hospitals and in other part of the state so as to be able to generalize the findings.

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Preparation of Orange Wine and Comparison of Some Physical Parameters of Different Wines

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Abstract- This research concerns with production of orange wine and some physical parameters of different wines were studied. The orange sample was purchased from Myoma market, Kyaing Tong in Eastern Shan State. The orange wine was produced by fermentation method. Some physical parameters of the orange wine and different wine such as pH, specific gravity and percent alcohol by volume (ABV) were examined. The pH of mature of orange wine and different wines such as grape, strawberry, pear, damson and apple (after the fermentation period of two week interval at the end of period) had found to be (3.4, 3.6, 3.6, 3.2, 3.3 and 3.5) respectively. The specific gravity of orange wine and different wines were (1.010 g cm^{-3}, 1.050 g cm^{-3},1.015 g cm^{-3}, 1.020 g cm^{-3} , 1.005 g cm^{-3} and 1.025 g cm^{-3}). The percent alcohol of orange wine and different wines were (20.38 %, 13.58 %, 21.05 %, 19.70 %, 23.77 % and 17.66 %). The preliminary phytochemical investigation revealed the presence of phenolic compound, carbohydrate, reducing sugar, glycoside, steroid and protein by using the standard methods. In addition, some nutritional values like moisture (86 %), ash (0.11 %), fibre (0.8 %), fat (0.01 %), protein (0.1 %) and carbohydrate (12.98 %) content were determined by official analytical methods.

Index terms- Orange wine, specific gravity, percent alcohol, phytochemical test, nutritional values

I. Introduction

Oranges are one of the most popular fruits around the world. While they are enjoyable as a snack or as a recipe ingredient, its juice is highly associated with good health which acts as an integral part of a healthy breakfast. Oranges are round citrus fruits with finely-textured skins that are orange in color just like their pulpy flesh. The size of the fruit ranges from about three inches in diameter. Oranges are classified into two general categories sweet and bitter. The word orange is derived from the Sanskrit 'naranga" which means orange tree. Usually, ripe oranges consist of 40 % - 55 % juice by weight, depending on their variety. Like other citrus fruits, its rind contains essential oils which are used in cooking and perfumery. Sweet oranges are divided into five or six main categories. Common sweet oranges, blood, navel, acidless, bitter and mandarin, are available at different times of year (lglesias *et al*, 2007).

The orange types basically belong to two different species and are classified according to the acid concentration, color of pulp and presence of reproductive orange. One species, the Citrus sinesis, produces sweet oranges. The ripe fruits contain high percentage of water (85-90%) and many constituents; carbohydrates, organic acids, vitamin C, minerals and small amount of lipids, proteins, carotenoids, flavonoids and volatile compounds (Okafor, 2007). The consumption of citrus fruits like orange and lemon singly and especially when combined offer significant protection against various cancers, diabetes, Parkinsons disease and inflammatory bowel disease (Csiro, 2003). The fruit of Citrus sinensis is called sweet orange to distinguish it from Citrus urantium, the bitter orange. The name is though numerous intermediate languages. In a number of languages, it is known as a "Chinese apple", (Idise, 2012).

Orange wine is a type of white wine made by leaving the grape skins and seeds in contact with the juice, creating a deep orange-hued finished product. Orange wine is a complex concept-in terms both definition and sensorial analysis (sight, bouquet, taste). The same as whites, it is made of white grape varieties. This is also the only thing these two types of wine have in common. The main characteristic of orange wine is (obviously) its color that can vary from golden to copper nuances obtained. These include substrate related factors such as cultivar types, cultivation conditions, conditions at harvest and post- harvest handling (Kourkoutas *et al*, 2005). Yeast species are used in many industrial fermentation processes including alcoholic beverages production (Kunkee, 1984). Yeast fermentation of orange juice shows at once, which has been no destructive effect on vitamin C result in harmony with the observations, the contrary, the activity of vitamin C persisted for a very long time-being retained for 51 days (Lepkovsky *et al*, 1925. Wine has been enormous health benefits similar to those of fruits from which they are derived (Jacob, 2001). e.g almonds have been found to be more effective in reducing bloods levels of low density lipoprotein cholestrol when combined with other foods known to independently lower cholestrol (Ramachandra *et al*, 2005)

Figure 1 Photographs of orange plants and orange fruits

1.1 Botanical Description

Family name	-	Rutaceae
Genus	-	Citrus
Species	-	Aurantium
Botanical name	-	*Citrus aurantium*
Scientific name	-	Citrus sinensis
English name	-	Orange
Myanmar name	-	Pyar lain maw
Part used	-	Fruit

II. Materials and Methods

2.1 Collection of Sample

Fresh orange were collected from Myoma market in Kyaing Tong Township. The orange used in this fermentation studies were purchased from Myoma market in Kyaing Tong Township, Eastern Shan State. The *Citrus aurantium* were identified at Botany Department, Kyaing Tong University, Eastern Shan State.

2.2 Phytochemical Investigation in Orange Fruit

Orange fruits were subjected to phytochemical test in order to find out the types of phyto-organic constituents such as phenolics, carbohydrates, reducing sugars, glycoside, tannins, saponins, alkaloids, steroids and flavonoids.

2.3 Preparation of Orange Wine

The collected orange fruits were washed, crushed with blender and diluted with 100 mL water in the blender. The crushed fruit 1.5 kg were obtained. And then 1500 mL brown sugar solution, the mixture of yeast solution and sodium metabisulphite, ammonium phosphate solution were added and stirred continuously, and filtered the solution. This solution was poured in brown bottle and closed with stopper and not permitted to contact with air (anaerobic region). Fermentation was allowed to continue for 86 days at the dark place.

2.4Determination of pH

pH meter was rinsed with deionized water and the pH electrode was dried by using tissue paper. It was adjusted with pH 7.00 buffer solution and 30 mL of wine sample was placed into 50 m beaker. Then pH of wine was measured by using pH meter. After measuring pH, meter was rinsed by deionized water.

2.5Determination of Percent Alcohol in Orange Wine and Different Wines

Before using the hydrometer both the hydrometer and sample jar were clean with water surely. The liquid was poured into the hydrometer jar to avoid the formation of air bubbles by stirring the liquid gently. The hydrometer was inserted into the liquid, holding it at the top of the stem, and released it when it was approximately at its position of equilibrium. The liquid specific gravity was read and recorded it. Above procedure was carried out for the original specific gravity and final specific gravity of orange wine. The percent alcohol of orange wine was calculated as percent alcohol of alcohol by volume. Similarly, the percent alcohol of different wines such as grape, strawberry, pear, damson and apple were also calculated as percent alcohol of alcohol by volume.

Alcohol by Volume (ABV) For Wine C.J.J Berry Method

$$\text{ABV} = \frac{OriginalSG - FinalSG}{7.36}$$

Original SG = 1.160, Final SG = 1.010

$$\text{ABV} = \frac{1.160 - 1.010}{7.26}$$

$$= 20.38\%$$

Note : To calculate the final strength of the wine, write down (omitting the decimal point) the SG.

2.6 Determination of Nutritional Values of Orange Wine

The moisture content of the orange wine sample was determined by Dean and Stark's distillation apparatus (A.O.C.S., 1950). The ash content and the crude fibre content in the orange wine sample were determined by the method given in "The Chemical Analysis of Foods" (Joslyn, 1970). The fat content was determined by the Soxhlet extraction method (Peason, 1970 & 1976). The crude protein content of the sample was determined by Macro-kjeldahl method (Steyermart, 1961; Willainn, 1984). The total carbohydrate content of orange wine sample can be obtained as the difference between 100 and the sum of the percentages of ash, fibre, moisture and protein. The total carbohydrate content of orange wine can be obtained as the difference between 100 and the sum of the percentages of ash, fibre, moisture and protein.

$$\text{Moisture (\%)} = \frac{Volumeofwater(mL)}{Weightofsample(g)} \times 100$$

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of dried powder (g)}} \times 100$$

$$\text{Fibre (\%)} = \frac{\text{Weight of fibre}}{\text{Weight of original sample}} \times 100$$

$$\text{Fat (\%)} = \frac{\text{Weight of extracted fat (g)}}{\text{Weight of powdered sample (g)}} \times 100$$

$$\text{Protein (\%)} = \frac{(V_2 - V_1) \times 0.01401 \times M \times 100}{W} \times 6.25$$

V_1= volume in mL of standard acid for blank titration
V_2 = volume in mL of standard acid for sample solution
M = molarity of standard acid solution in $moldm^{-3}$
W = weight in grams of the sample used for the digestion procedure

III. RESULTS AND DISCUSSION

3.1 Physical Parameters of Orange Wine

Some physical parameters of orange wine such as pH, specific gravity and percent alcohol were determined. These experiments were carried out by two weeks interval. The results were shown in Table 1 and Figures 2,3 and 4. The pH of wine was found to be 3.4 to 3.9. Specific gravity of orange

wine indicated that the range of 1.010 to 1.035 g cm^{-3}. Alcohol percent (ABV) of orange wine was found to be range of 16.98 % to 20.38 %. It was observed that decreased the pH value and specific gravity with increased the time. Percent alcohol was increased with time increased. After three months of fermentation, pH value, specific gravity, alcohol percent (ABV), of orange wine and some physical parameters of different wines such as grape, apple, pear, strawberry and damson were shown in Table 2 and Figures 5, 6 and 7.

Comparison of orange wine and the different wines were observed that pH values of orange and apple wine were nearly the same. The pH values of grape and strawberry wine were greater than orange wine. But pH values of pear and damson wine were smaller than orange wine. The specific gravity of grape wine was the highest and regularly decreased in apple, pear, strawberry, orange and damson wine. The alcohol percent (ABV) of strawberry and damson wine were greater than orange wine and then pear, apple and grape wine were smaller than orange wine.

The pH value of wine was found to be 3.4. The pH of wine was variable in the major taste of sourness. The clarity of wine was affected by pH. For table wines, preferred pH levels were 3.1 to 3.4 for white wines and 3.3 - 3.6 for red wines. This value (pH 3.4) was agreed with literature value. So, orange wine was the white wine.

Table 1. Physical Characteristics of Orange wine for Two Interval Weeks

No	Interval weeks	Parameters		
		pH	Specific gravity (g cm^{-3})	Alcohol percent (ABV) (%)
1	21.6.2017	3.9	1.035	16.98
2	5.7.2017	3.8	1.030	17.66
3	19.7.2017	3.7	1.025	18.34
4	2.8.2017	3.6	1.020	18.34
5	16.8.2017	3.5	1.015	19.02
6	30.8.2017	3.4	1.010	19.70
7	6.9.2017	3.4	1.010	20.38

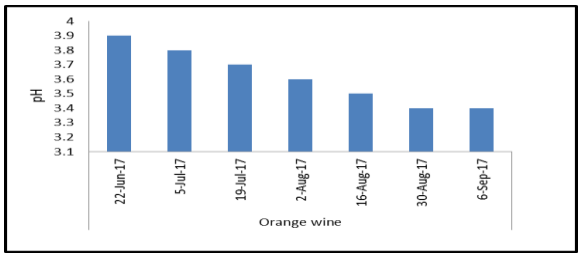

Figure 2. pH of orange wine

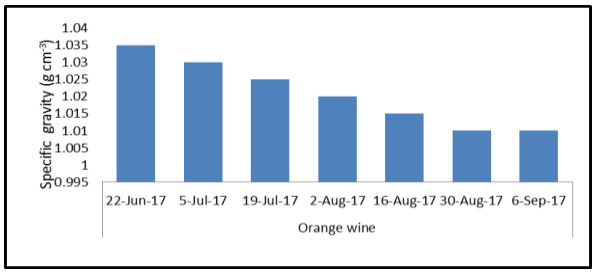

Figure 3. Specific gravity of orange wine

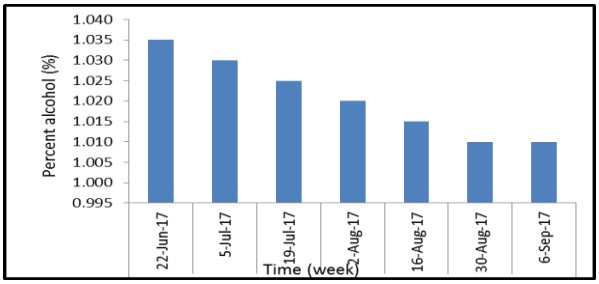

Figure 4. Percent alcohol of orange wine

Table 2. Some Physical Parameters of Orange Wine and Different Wines

No	Samples	Parameters		
		pH	Specific gravity (g cm^{-3})	Alcohol percent (ABV) (%)
1	Orange wine	3.4	1.010	20.38
2	Grape wine	3.6	1.050	13.58
3	Strawberry wine	3.6	1.015	21.05
4	Pear wine	3.2	1.020	19.70
5	Damson wine	3.3	1.005	23.77
6	Apple wine	3.5	1.025	17.66

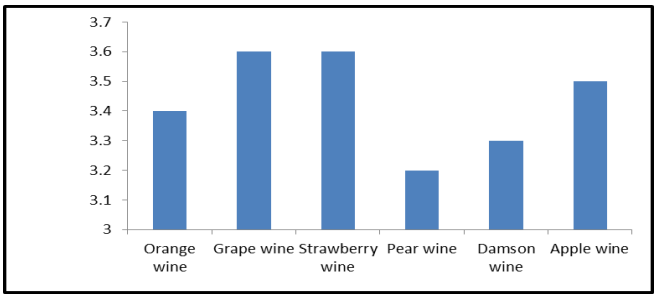

Figure 5. Comparison of pH of orange wine and different wines

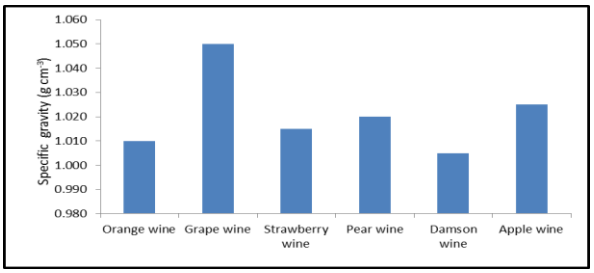

Figure 6. Comparison of specific gravity of orange wine and different wines

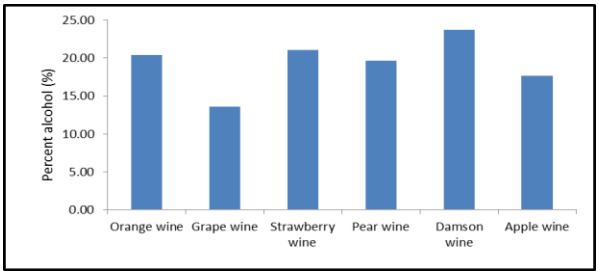

Figure 7. Comparison of percent alcohol of orange wine and different wines

IV. CONCLUSION

From the overall assessments of the present research work, the following inferences could be drawn. According to the preliminary phytochemical investigation, it was found that phenolic compound, carbohydrate, reducing sugar, glycoside, steroid and protein by using the standard method. Orange wine was prepared by fermentation method. The physical parameters of orange wine and different wines were examined. Some nutritional values such as moisture, ash, fibre, fat, protein and carbohydrate contents were determined from the orange wine. The energy value was found to be 81 kcal/100g. Orange wine is a type of white wine which is lower in carbohydrate. White wine provides of our daily nutritional needs 3 % magnesium, 3 % vitamin B_6 , 3 % vitamin B_2 , 3 % Niacin,1 % Riboflavin along with trace elements iron, calcium, potassium, Phosphorus and zinc. It can be concluded that people should drink the orange wine regularly and moderately than the different wines. Nowadays, orange wine has been popping up on the influential wine lists across the world. In the summer, the London Ritz added five orange wines to its highly traditional 800 wine list, while wine sellers in New York are also catering for a spike in its popularity, according to Bloomberg.

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The Appropriate Foundation System for Supporting The Load of Stage House in The Tidal Area (A Case Study in Kemijen Village, Semarang, Indonesia)

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Abstract- Kemijen is a village in the northern part of Semarang Timur District which is affected by tide. When there is a tide or flood, the residents do land-taking to elevate their houses. Stage house is a suitable house for tidal / flood areas because the floor of the houses becomes higher compared to ordinary houses, without being buried and the floor of the houses will remain dry.
The stage houses that had been tried in Kemijen Village use lightweight building materials considering the carrying capacity of the lands in the tidal or flooded area, so the foundations used are not too large in dimensions.
Concerning the economic conditions of the residents of Kemijen Village with low income, it is necessary to build a cheap but strong and durable foundation. Strong foundation is a foundation that cannot be subsided due to the load to support and must be balanced when subsided. Durable foundation is a foundation that can last a long time in its use in spite of weather impact in dry and wet conditions and potential tidal waves.
Based on the needs above, an appropriate foundation system is needed in the form of raft foundations with bamboo sticks because bamboo sticks can improve poor soil conditions. In addition, raft foundation placed on the top of the bamboo serves as a weight support for stage houses.

Index Terms- Tide, Stage House, Raft Foundation, Foundation System,

I. INTRODUCTION

KEmijen village is one of the villages in the northern part of Semarang Timur sub-district which is affected by tide and experiences a decrease in environmental quality.

Tidal floods and land subsidence has made residents who live in the area to backfill in an effort to avoid flooding in their houses. For the residents with sufficiently established economic capacity, they can raise their houses. However, this did not help much because almost every 3 to 5 years they still had to repeatedly raise their houses (Listiati, Etty E, et al, 2017).

One effort to overcome the problem of tide and land subsidence with the approach of "raising the house - without filling the ground" is to make a stage house. Stage house is a house with the floors made higher than the ground level by putting up poles. According to Frick (2006), stage houses are usually built on the poles of 60-300 cm high.

In the first year of the research (Listiati, Etty E, et al, 2017), a house concept and design model adapting to tidal floods in Kemijen Village had been built in the form of hydraulic stage house. In the second year of the research (Listiati, Etty E, et al, 2018), a house model that was adaptive to tide in the form of hydraulic house was built. The stage houses can be raised by raising the columns supporting the stage houses using hydraulic jack.

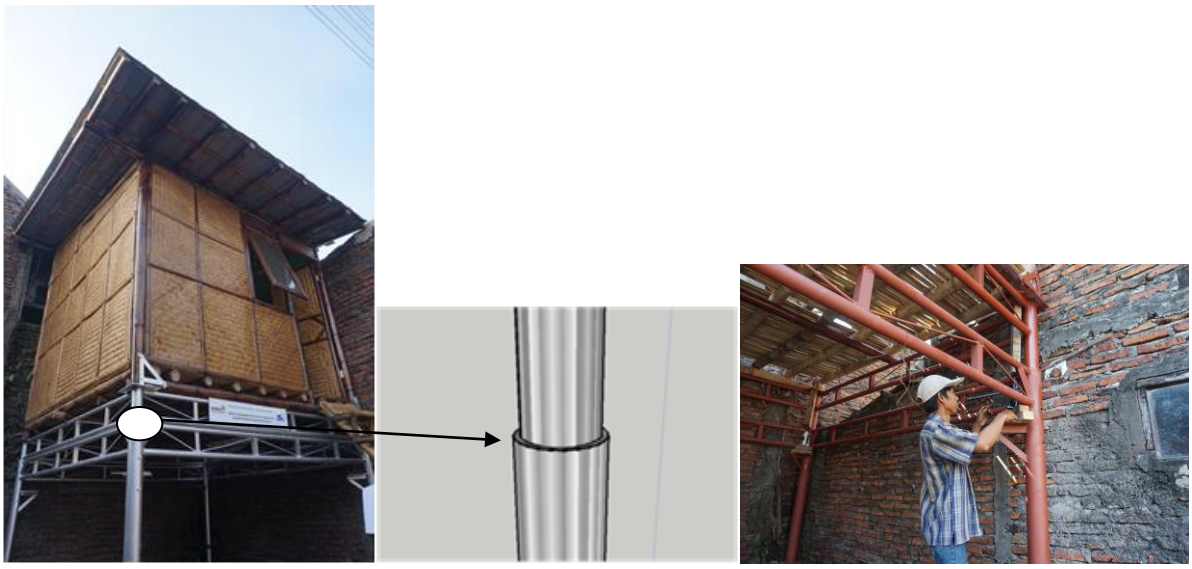

Figure 1: A stage house as a research result that can be raised with a hydraulic system. The design was built on the land owned by Mr. Heriyanto (a resident of RT 02, RW 04 Kemijen Village) which was always flooded

Figure 2: the land of Mr. Heriyanto's house before it was built (Left) and a hydraulic stage house that had already been finished (Right)

In making this stage house, foundation is the most important part to consider because it is located in an area with soft soil condition. The type of foundation used was raft foundation. Considering the condition of soil submerged by tidal water which is very soft soil, bamboo must be installed to provide additional land carrying capacity at the building site.

According to Wahyudi (2015), foundation is a structure on the surface or in a layer of land that functions as a base and also channels the loads originating from the super-structure into the soil.

Planning the lower structure for a building construction is absolutely necessary to be able to maintain the stability of the supported construction. Errors in the calculation of lower structure will cause a sturdy building in the upper structure to collapse and be fatal for its users.

Considering that a stage houses must be raised hydraulically and in order to avoid a subsidence in the house construction, the construction of stage house should be relatively light. To achieve lightweight construction, lightweight wall, floor and roof building materials and appropriate foundation choices were selected.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

In several journals related to this research, one of them states that the structural system components which bear the load of stage house must be easy to implement and safe / strong in carrying the load on it and durable for a certain period of time [5].
In another journal that discusses piles, it is concluded that gelam pile is potentially used as a pile foundation material for swampy areas [6]. Meanwhile, according to Suroso and colleagues, they state that the use of pile on soft clay soils can increase the carrying capacity of soft clay [7]. From the increase in carrying capacity, it shows that the bottom of the pile contributes a significant contribution to soft clay. In their research, the contribution reached 2.2 times stronger than the carrying capacity of soft clay without any pile. The greater the diameter of the overall pile, the higher the effective increase in carrying capacity.
Tjandrawibawa states that many piles are used to reduce the subsidence that will occur [8]. To find out the behavior of the foundation with the pile, a research was carried out in the form of a loading test on a foundation model using "biting" bamboo as a pile. Three types of mounting pile of upright, tilt and upright and tilt combination were carried out in the test. The loading results showed an increase in the carrying capacity of the soil by 60% for sloping pile, 37% for upright pile and 33% when using upright sloping combination. Regarding the selection of raft foundation, the results of Dharmayasa's research state that each raft foundation should be checked for its supporting capacity centrically (the column is right in the middle of plate foundation) and eccentric (the column is not right in the middle of plate foundation). When the results of the plate calculation are mutually close together or even overlapping each other, a continuous plate foundation equipped with beams can be used [9].

III. RESULT AND DISCUSSION

A. Methodology

This study used applied research method; a research that aims to solve existing problems in society (M. Nasir, 1988). The main objective was to provide solutions to problems so that the research results can be used for the benefit of the community. In this approach, a holistic understanding is needed to be able to get a real picture.

To obtain a comprehensive understanding of tidal problem, in this study, interviews and in-depth discussions with the local community through FGD (Forum Group Discussion) were conducted. In addition, location observation also completed the understanding of the existing problems in the community, including the potential (both social potentials and the potential of the availability of materials) that can be used to build hydraulic stage house.

B. Analysis and Discussion

There are numbers of software available which can mimic the process involved in your research work and can produce the possible The foundation system used in the stage house in Kemijen Village consists of three components, i.e.:

1. Bamboo *cerucuk* (local term for bamboo pile raft system)
2. Raft foundation
3. Sloof beam

These three components have their respective functions as follows:

1. **Bamboo *cerucuk***

Bamboo can increase the carrying capacity of lower soil in the form of muddy swamp soil and waterlogging continuously. The efforts to improve the carrying capacity of the soil and to determine the shape of the foundation suitable for the condition of the soil were required.

The efforts to repair poor soils can be made by knowing the thickness of the soil layer and the balancing force on the working foundation load. If the soil layer is poorly thin, generally the soil layer is peeled and replaced with better soil (usually with sand graded soil). If the poor soil layer is deep enough, various efforts can be made such as chemical stability (temporary), mechanical

stability by accelerating consolidation (temporary loading, vertical drainage) or by modifying the type of foundation.

The type of bamboo used for bamboo shoots is *petung* bamboo, which is generally the strongest with short segments are short, and the diameter is 8 to 13 cm with a stem length of 10 to 18 meters. It was cut into one and a half meters long, with the tip taper, so it was easily plugged into the ground. Stored *petung* bamboo was strived to always be in the water or under the lowest water level even during drought.

Before the erection of the bamboo, it was preceded by cleaning and *uitzet* or measurement and bouwplank work so that the spacing of columns or building boundaries to be carried out is really precise and truly in right angle.

Figure 3: Work preparation (site clearing) (left) and *Uitzet* (measurement) building boundaries and bouwplank (right)

Figure 5: Stacking of bamboo pile at the stage house

Figure 6: Preparation of bamboo immersion in tidal water (left) and Immersion for bamboo preservation in the location of the stage house (right)

For bamboo, preservation was carried out in order to prevent pest and fungus attacks. Bamboo contains flour which is preferred by termites. For this reason, all parts of bamboo stems need to be immersed first in water so that the flour can dissolve and ultimately not be liked by termites. Soaking bamboo for preservation was done at the location of the stage house

2. Raft Foundation

After the foundation had been strengthened by the installation of bamboo *cerucuk*, the foundation could be placed directly on the base. The base of foundation must lie under the surface so that it can resist the forces to the sides.

For stage house foundation, due to relatively light / small building, it was sufficient to use a shallow foundation, which is also known as a direct foundation (spread footing) by widening the bottom of the column or wall so that the building load is spread into smaller pressures with the allowable carrying capacity of the land. The base dimensions of the raft foundation are based on the allowable building load and land carrying capacity.
The size of the raft foundation carried out was 60 cm x 60 cm with a thickness of 20 cm on the edges and 35 cm on the part adjacent to the column. Then, the reinforcement used consists of the reinforcement of the foundation raft and column. The reinforcement of the foundation raft used concrete steel with a diameter of 12 mm, with a distance of 20cm

The placement of raft foundation can adjust the environmental conditions where a stage house is built. Raft foundation column does not have to be in the middle, but it can be alongside or at the end of the foundation. In the implementation of its construction, the placement of one raft foundation was placed against the other one as well as different position of the column position so that the building of the stage house can be 'tight' / directly adjacent to the building next to it. The load of this stage house was not too large, so it did not have much effect on the number of reinforcements to the Raft Foundation installed.

Figure 7: Casting of the raft foundation (left) and Ironing of the column (right)

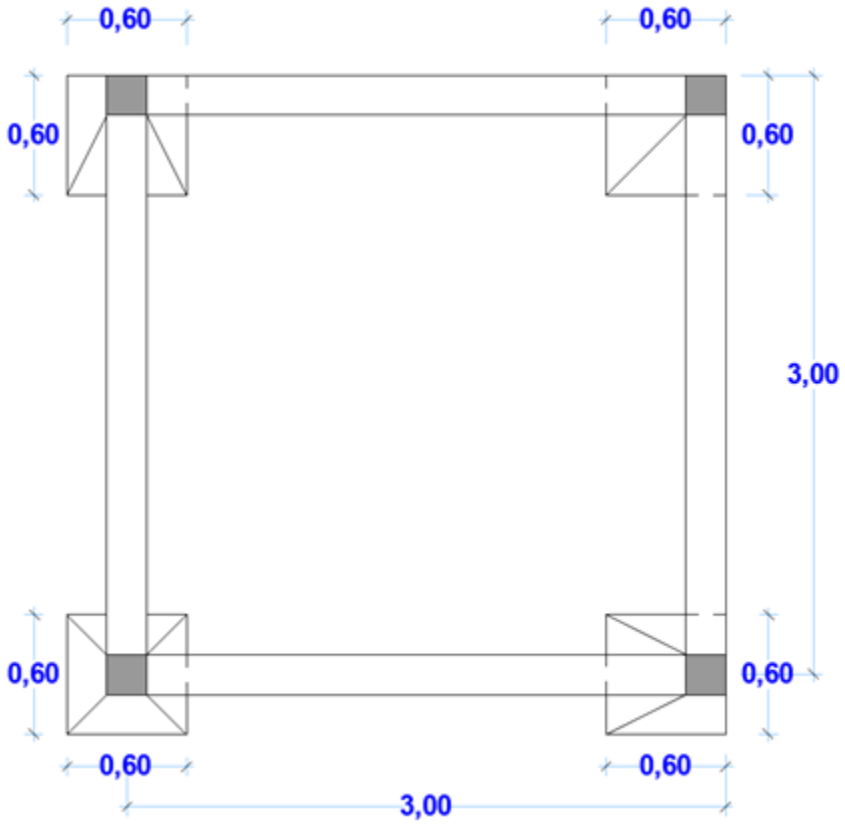

Figure 8: Different column positions in each raft foundation

In the soil layers affected by standing water or tidal disasters, they are usually rather soft or less dense due to the insistence of building foundations on the soil so that it will show a significant subsidence. When this subsidence occurs together at the same time as different subsidence level, problems will arise. The installation of sloof beams that connect the foot of the foundation to one another reduces the significant difference in subsidence.

3. Sloof beam

The sloof beam of the stage houses was made of reinforced concrete with a cross section size of 15 x 25 cm with a reinforcement of 6 Ø 12 and a brace of Ø 8-15 which functions as a binding beam of the raft foundations. These can occur simultaneously.

Figure 9: Casting of sloof beam and raft foundation column (left) and finished casting of sloof beam and raft foundation column (right)

Sloof beams can carry the loads of different foundation subsidence. As a result of this subsidence, the sloof beam has a moment. In addition, it also bears the axial force load of 10% of the column load that works in conjunction with the moment force. This axial force works back and forth as a normal force on the sloof beam so that the calculation can be made like a column calculation. Moments may occur due to the load of upper structure.

There are various types of shallow foundation systems that can be used in the construction of stage houses such as raft foundations, continuous foundations, and raft foundations which are reinforced with bamboo cerucuk. Each type of foundation has advantages and disadvantages, so it must be chosen which one is the most appropriate for an area.
The sloof beams cast on the four sides are be able to reinforce the existing foundation system so that one raft foundations and another are completely bound. Likewise, when a stage house will be extended towards the side and the front, the sloof beam will be added in each column of the raft foundation forming a mutually binding network.

The concrete used for casting raft foundation and its columns, along with the sloof beams, must have a good mixture quality, by making a mixture at a planned weight (mixture of 1 Cement: 2 Sand: 3 gravel). Cylindrical specimens are made for the concrete mixture to determine the quality of the planned concrete mixture of K250

Figure 10: Mixing a concrete stir for a concrete cylinder test (left) and making a concrete test specimen (right)

IV. CONCLUSION

- Raft foundation is the most appropriate foundation used in stage houses because it is economical and far more capable of supporting relatively light stage house.
- Plate foundation is used for the adjacent raft foundations, so a continuous plate foundation is more practical to use
- Stage house foundation system with the use of bamboo *cerucuk* and sloof beams will have more convincing ability to reduce land subsidence and uniformly distributed load.
- Sloof beam in stage house foundation system will strengthen the connection between one raft foundation to another one
- The bamboo *cerucuk* used in this study were *petung* bamboo, with perpendicular erection direction, because the location did not allow to be tilted (adjacent to the surrounding walls)

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Pricing a European Put Option by Numerical Methods

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Abstract
This paper aims at introducing the concept of pricing options by applying numerical methods. In particular we focus on the pricing of a European Put Option by two numerical techniques, that is, the Monte-Carlo simulation and the Crank-Nicolson finite difference method. In the Monte-Carlo simulation method, the concept of a random walk is used in the simulation of the path followed by the underlying stock price. The Black-Scholes partial differential equation is approximated by using the Crank-Nicolson algorithm to obtain the Put Option price. The explicit price of the European Put Option is known, thus we will at the end of the exercise, compare the numerical prices obtained using these two techniques to the closed form price.

Keywords
Black-Scholes model, Stochastic Differential Equation, Options pricing, Monte-Carlo simulation, Crank-Nicholson algorithm

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1. Introduction

Numerical methods play an important role in the pricing of options, especially when there is no closed form solution or when the problem itself is too complicated to be solved analytically [1]. In this paper, we will discuss two crucial techniques used in option pricing: the Crank-Nicolson finite difference method and Monte-Carlo simulation. There are other forms of finite difference methods, for example the implicit and explicit methods, but the Crank-Nicolson method is considered because it is more accurate, unconditionally stable and converges to the solution faster [2].

According to [3], an option on a stock is a contract in which the owner is granted the right but not the obligation to trade on a given number of shares of a common stock at a fixed price K, called strike price, and at a predetermined date T, called the expiry. The holder will then have to decide whether to exercise the right or not, depending on the market price of the stock at that time as compared to the strike price K, and to the type of the option. The writer, who is the person selling the option contract, will then have no choice but to honour the agreement when the holder of the option decides to exercise the right.

Other examples of options include the American, Asian, Barrier and Bermudan Options. Each of them can be categorised as a Call or a Put Option. A call option is a financial contract in which the holder has the right but not the obligation to buy a certain number of shares of a stock at a predetermined price K, whereas a Put Option gives the holder the right but not the obligation to sell a certain amount of shares of stock at a price K. The main difference between the European and the American option is in the exercising period. The holder of a European option has to wait until maturity of the option in order to exercise the right, while the American option holder has the privilege of exercising the contract at any time up to the maturity date. The payoff for a European Put Option is

$$P(S,t) = \max(K - S_T, 0) \tag{1}$$

where S_T is the asset price at the expiry date T and K is the strike price. The strike price, also known as the exercise price, is the price at which the two parties on an option contract agree upon, such that the holder of the option will either buy or sell an underlying asset on the expiry date T at that price. The payoff diagram for a Put Option is given in figure 1 below.

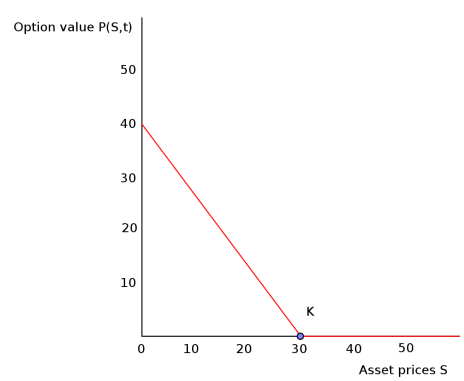

Figure 1. Payoff for a Put Option.

To enable the reader obtain a clear understanding of the objective of this paper, the work is organized as follows:

In Chapter 2, the reader is introduced to the Black-Scholes model, which plays a crucial role in the pricing of options. We also deal with the derivation of the Black-Scholes linear parabolic partial differential equation and we then state the Black-Scholes equation used for evaluating the explicit solution for the option.

Chapter 3 deals with pricing of a European Put Option by numerical methods. This is the central point of this paper, as the reader is taken through the derivation of the Crank-Nicolson scheme, discussion about Monte-Carlo simulation and the implementation of both schemes.

The comparison of the solutions obtained by the numerical methods to the closed form solution is shown in Chapter 4. Finally in Chapter 5 we present a brief conclusion and future problems.

2. Preliminaries

Here we present some key terms and mathematical definitions used in the construction of financial models.

2.1 Definition: σ-algebra

Let Ω be a non-empty set and let $\mathscr{F}$ be a collection of subsets of Ω. Then $\mathscr{F}$ is said to be a σ-algebra if ;

i) $\emptyset \in \mathscr{F}$,

ii) given that a set $A \in \mathscr{F}$ then the complement of A i.e $A^c \in \mathscr{F}$,

iii) whenever the sequence $\{A_i\} \in \mathscr{F}$ for $i = 1, 2, \cdots$, then $\cup_{n=1}^{\infty} A_n \in \mathscr{F}$. [4]

2.2 Definition: Probability measure

Let Ω be a non-empty set and let $\mathscr{F}$ be a σ-algebra of subsets of Ω. Then a function that assigns every set $A \in \mathscr{F}$ to a number in $[0,1]$ is called a probability measure $\mathbb{P}$. For this case we denote by $\mathbb{P}(A)$ the probability of A and it is such that ;

i) $\mathbb{P}(\Omega) = 1$,

ii) if $A_1, A_2, \cdots$ is a sequence of disjoint sets in $\mathscr{F}$ then

$$\mathbb{P}(\cup_{n=1}^{\infty} A_n) = \sum_{n=1}^{\infty} \mathbb{P}(A_n) .$$

The pair $(\Omega, \mathscr{F})$ is called a measurable space while the triple $(\Omega, \mathscr{F}, \mathbb{P})$ is called a probability space. [4]

2.3 Definition: Filtration

Let Ω be a non-empty set and T be a fixed positive number and assume that for each $t \in [0,T]$ there is a $\sigma-$algebra $\mathscr{F}(t)$. Suppose $s \leq t$ then every set $\mathscr{F}(s)$ is also in $\mathscr{F}(t)$. A filtration is a collection of $\sigma-$algebras $\mathscr{F}(t)$ for $0 < t < T$. [4]

2.4 Definition: Adapted Process

Let ω be a non-empty sample space equipped with a filtration $\mathscr{F}(t)$, $0 < t < T$. Let $X(t)$ be a collection of random variable indexed by $t \in [0,T]$. Then given that for each t, the random variable $X(t)$ is $\mathscr{F}$-measurable, then the collection of these random variables is said to be an adapted stochastic process. [4]

2.5 Theorem: Girsanov Theorem

Let $B(t)$ where $0 < t < T$ be a Brownian motion on a probability space $(\Omega, \mathscr{F}, \mathbb{P})$ where $\mathscr{F}(t)$, is assumed to be the filtration for this Brownian motion. Let $\mathscr{A}(t)$ be an adapted process. Define

$$Z(t) = \exp\left(-\int_0^t \mathscr{A}(u)\mathrm{d}B(u) - \frac{1}{2}\int_0^t \mathscr{A}^2(u)\mathrm{d}u \right) ,$$

$$\tilde{B}(t) = B(t) + \int_0^t \mathscr{A}(u)\mathrm{d}u ,$$

and assume that

$$\mathbb{E}\int_0^T \mathscr{A}^2(u)Z^2(u)\mathrm{d}u < \infty .$$

Set $Z = Z(t)$. Then $\mathbb{E}(Z) = 1$ and under the probability measure $\tilde{\mathbb{P}}$, where,

$$\tilde{\mathbb{P}}(A) = \int_A Z(\omega)\mathrm{d}\mathbb{P}(\omega), \ \forall A \in \mathscr{F} ,$$

the process $\tilde{B}(t)$, $0 < t < T$ is a Brownian motion on a new probability space $(\Omega, \mathscr{F}, \tilde{\mathbb{P}})$. [4]

2.6 Definition: Stochastic Process

A stochastic process $\{X(t)\}_{t\in[0,T]}$ is a family of random variables parametrized by time t, i.e, $X(t)$ is a random variable for each $t \in [0,T]$. [5]

2.7 Definition: Martingale

Let $(\Omega, \mathscr{F}, \mathbb{P})$ be a probability space, let T be a positive fixed number and let $\mathscr{F}(t)$, $0 \leq t \leq T$ be a filtration of sub-σ-algebra of $\mathscr{F}$. Then an adapted stochastic process $M(t)$, $0 \leq t \leq T$ is called a martingale process if

$$\mathbb{E}\Big[M(t)|\mathscr{F}(s)\Big] = M(s)$$

for all $0 \leq s \leq t \leq T$. [4]

2.8 Definition: Brownian Motion/Wiener process

Let $(\Omega, \mathscr{F}, \mathbb{P})$ be a probability space where $\mathbb{P}$ is the probability measure, $\mathscr{F}$ is a collection of sets whose probabilities are influenced by the measure $\mathbb{P}$ and Ω the sample space. Then $W(t)$ $t \geq 0$ is a standard Brownian motion or Wiener process if the following conditions are satisfied ;

i) $W(t)$ is a continuous function.

ii) $W(0) = 0$.

iii) The increments $W(t_1)-W(t_0), W(t_2)-W(t_1), \cdots, W(t_n)-W(t_{n-1})$ are independent for all $0=t_0<t_1<\cdots<t_n$.

iv) $W(t_{k+1})-W(t_k) \sim N(0, t_{k+1}-t_k)$. [4]

Figure 2 below demonstrates the sample path followed by Brownian motion of stock prices.

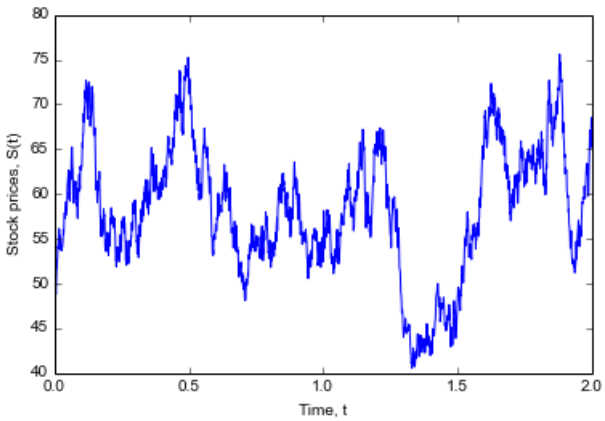

Figure 2. Brownian motion.

2.9 Definition: Geometric Brownian Motion

A geometric brownian motion is a stochastic process $S(t)$ which satisfies the stochastic differential equation (SDE)

$$\mathrm{d}S_t = \mu S_t \mathrm{d}t + \sigma S_t \mathrm{d}W_t \ ,$$

where W_t is the Wiener process, μ and σ are constant parameters called the drift and rate of volatility respectively. Given that $S(0)=S_0$, the solution of the SDE above is

$$S_t = S_0 \exp\left((\mu - \frac{\sigma^2}{2})t + \sigma W_t\right) \ ,$$

where W_t is the Wiener increment. [6]

2.10 Definition: Arbitrage

Arbitrage is the process where an investor has the possibility of gaining profit from zero investment without taking any risk. [5]

2.11 Definition: Normal Distribution

A random variable X is said to be normally distributed with mean μ and variance σ^2 if it's probability density function is

$$f_X(x) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left(\frac{-(x-\mu)^2}{2\sigma^2}\right), \ -\infty < x < \infty \ .$$

[7]

2.12 Theorem: The Central Limit Theorem

Let $X_1, X_2, \cdots$ be a sequence of independent identically distributed random variables each with mean $\mu < \infty$ and variance $\sigma^2 < \infty$. Let $S_n = \sum_{i=1}^{n} X_i$. Then as $n \to \infty$, $S_n \sim N(n\mu, n\sigma^2)$. Hence for any x we have that

$$P\left(\frac{S_n - n\mu}{\sigma\sqrt{n}} \leq x\right) \sim \Phi(x) \text{ as } n \to \infty \ .$$

[8]

2.13 Definition: Log-normal Distribution

A random variable X is said to be log-normally distributed if $\log(X)$ is normally distributed and the probability density function of the random variable X is given by

$$f_X(x) = \frac{1}{\sqrt{2\pi}x\sigma} \exp\left(\frac{-(\log(x)-\mu)^2}{2\sigma^2}\right), \ x > 0 \ .$$

[9]

2.14 Definition: European Put Option

This is a type of financial contract giving the holder the right but not the obligation to sell an underlying asset at a predetermined strike price K at the expiry time T. [10]

3. The Black-Scholes Model

The greatest success achieved in the pricing of European stock options was made in the early 1970's by Fisher Black, Myron Scholes and Robert Merton. This then led to the development of what is now famously known as the Black-Scholes-Merton (Black-Scholes) model which has greatly assisted traders in the pricing and hedging of derivatives. Their work led to their acknowledgement by the award of the Nobel Prize for Economics in 1997 [11].

Let us now derive the Black-Scholes partial differential equation and state the Black-Scholes formula for the pricing of European options.

3.1 Stochastic Differential Equation

A stochastic differential equation (SDE) is a differential equation in which one of the terms in the equation follows a random process.

Consider the following geometric Brownian motion which represents the price dynamics of a non-dividend paying stock

$$\mathrm{d}S(t) = S(t)\left(\mu \mathrm{d}t + \sigma \mathrm{d}B(t)\right) \ , \tag{2}$$

where S is the asset value, μ is the appreciation rate (drift), which is a measure of the average rate of the growth of the asset price and σ is the volatility coefficient which is a measure of standard deviation of the returns. The price is defined on a probability space $(\Omega, \mathscr{F}, \mathbb{P})$. The term $B(t)$ is a standard Brownian motion with respect to $\mathbb{P}$. We now apply the

concept of Girsanov change of probability measure, which is described in [12], to obtain a new probability distribution $\widehat{\mathbb{P}}$ which is an equivalent martingale measure.

The drift component in equation (2) above can be split into its risk-free component r and $(\mu - r)$, therefore we have

$$\frac{\mathrm{d}S(t)}{S(t)} = r\mathrm{d}t + (\mu - r)\mathrm{d}t + \sigma \mathrm{d}B(t) \ . \tag{3}$$

Hence applying the Girsanov transformation we have

$$\sigma\widehat{B}(t) = (\mu - r)t + \sigma B(t) \ ,$$
$$\mathrm{d}\widehat{B}(t) = \frac{(\mu - r)}{\sigma}\mathrm{d}t + \mathrm{d}B(t) \ ,$$

and substituting this into equation (3) we have

$$\begin{aligned}\frac{\mathrm{d}S(t)}{S(t)} &= r\mathrm{d}t + (\mu - r)\mathrm{d}t + \sigma\left(\frac{\sigma\mathrm{d}\widehat{B}(t) - (\mu - r)\mathrm{d}t}{\sigma}\right) \ , \\ &= r\mathrm{d}t + (\mu - r)\mathrm{d}t + \sigma\mathrm{d}\widehat{B}(t) - (\mu - r)\mathrm{d}t \ .\end{aligned}$$

This results in the driftless stochastic differential equation

$$\mathrm{d}S(t) = S(t)\left(r\mathrm{d}t + \sigma\mathrm{d}\widehat{B}(t)\right) \ . \tag{4}$$

3.2 Itô's Process

An Itô process is a stochastic process $\{X_t, t \geq 0\}$ given by

$$X_t = X_0 + \int_0^t a(\tau,\omega)\mathrm{d}\tau + \int_0^t b(\tau,\omega)\mathrm{d}B_\tau \ .$$

The corresponding SDE is given by

$$\mathrm{d}X_t = a\mathrm{d}\tau + b\mathrm{d}B_t \ ,$$

where $a(\tau,\omega)$ and $b(\tau,\omega)$ are adapted random functions. [13]

3.3 Itô's Lemma

[13] Let $f(S,t)$ be a twice continuously differentiable function on $[0,\infty) \times \mathbb{R}$ and let S_t be an Itô process

$$\mathrm{d}S_t = a_t\mathrm{d}t + b_t\mathrm{d}B_t \ , t \geq 0 \ .$$

Taking the Taylor series expansion of f we have

$$\begin{aligned}\mathrm{d}f_t &= \frac{\partial f}{\partial S_t}\mathrm{d}S_t + \frac{\partial f}{\partial t}\mathrm{d}t + \frac{1}{2}\frac{\partial^2 F}{\partial S_t^2}(\mathrm{d}S_t)^2 \\ &\quad + \text{higher order terms} \ .\end{aligned}$$

Hence ignoring higher order terms and substituting for $\mathrm{d}S_t$ we obtain

$$\mathrm{d}f_t = \frac{\partial f}{\partial S_t}(a_t\mathrm{d}t + b_t\mathrm{d}B_t) + \tag{5}$$
$$\frac{\partial f}{\partial t}\mathrm{d}t + \frac{1}{2}\frac{\partial^2 f}{\partial S_t^2}(a_t\mathrm{d}t + b_t\mathrm{d}B_t)^2 \ ,$$
$$= \frac{\partial f}{\partial S_t}(a_t\mathrm{d}t + b_t\mathrm{d}B_t) + \frac{\partial f}{\partial t}\mathrm{d}t + \frac{1}{2}\frac{\partial^2 f}{\partial S_t^2}b_t^2\mathrm{d}t \ , \tag{6}$$
$$= \left(\frac{\partial f}{\partial S_t}a_t + \frac{\partial f}{\partial t} + \frac{1}{2}\frac{\partial^2 f}{\partial S_t^2}b_t^2\right)\mathrm{d}t + \frac{\partial f}{\partial S_t}b_t\mathrm{d}B_t \ . \tag{7}$$

This is the Itô's formula, where we have used the relation $\mathrm{d}t \cdot \mathrm{d}t = \mathrm{d}B_t \cdot \mathrm{d}t = \mathrm{d}t \cdot \mathrm{d}B_t = 0$ and $\mathrm{d}B_t \cdot \mathrm{d}B_t = \mathrm{d}t$. Equation (7) plays a very important role in the field of mathematical modelling in finance and specifically in the pricing of derivatives as it is used in the derivation of the Black-Scholes PDE. When this PDE is solved, the value of f will represent the price of the derivative.

We conclude that f_t follows the Itô's process and the drift rate is given by

$$\mu = \left[\frac{\partial f}{\partial S_t}a_t + \frac{\partial f}{\partial t} + \frac{1}{2}\frac{\partial^2 f}{\partial S_t^2}b_t^2\right] \ ,$$

and the variance is

$$\sigma^2 = \frac{\partial^2 f}{\partial S_t^2}b_t^2 \ .$$

Given that the variable $S(t)$, representing stock price, follows a geometric Brownian motion, then it follows the stochastic differential equation (2). Therefore, for a general function $F(S,t)$, Itô's lemma will give

$$\mathrm{d}F = \left[\mu S\frac{\partial F}{\partial S} + \frac{\partial F}{\partial t} + \frac{1}{2}\sigma^2 S^2\frac{\partial^2 F}{\partial S^2}\right]\mathrm{d}t + \sigma S\frac{\partial F}{\partial S}\mathrm{d}B_t \ , \tag{8}$$

where μ and σ are constants representing the drift rate and the rate of volatility respectively.

Example

Consider a stock price S which follows the random process

$$\mathrm{d}S(t) = S(t)\Big(\mu\mathrm{d}t + \sigma\mathrm{d}B(t)\Big) \ .$$

Let $F(S,t) = \log S$ then,

$$\frac{\partial F}{\partial S} = \frac{1}{S}, \ \frac{\partial^2 F}{\partial S^2} = \frac{-1}{S^2} \text{ and } \frac{\partial F}{\partial t} = 0 \ .$$

Substituting these values into (8) we obtain

$$\mathrm{d}(\log S) = (\mu - \frac{\sigma^2}{2})\mathrm{d}t + \sigma\mathrm{d}B_t \ .$$

This result implies that $\log S$ is a Brownian motion whose drift parameter is $(\mu - \frac{\sigma^2}{2})$ and variance is σ^2. Taking the integral from 0 to T we have

$$\int_0^T \mathrm{d}(\log S) = \int_0^T (\mu - \frac{\sigma^2}{2})\mathrm{d}t + \sigma\int_0^T \mathrm{d}B_t \ ,$$
$$\log S_T - \log S_0 = (\mu - \frac{\sigma^2}{2})T + \sigma(B(T) - B(0)) \ ,$$
$$S_T = S_0 \exp\left((\mu - \frac{\sigma^2}{2})T + \sigma Z\sqrt{T}\right) \ ,$$

where $Z \sim N(0,1)$. This clearly shows that stock prices obeys the log-normal distributions [6].

3.4 Black-Scholes Partial Differential Equation

To obtain the Black-Scholes partial differential equation we follow the process described in [14] and consider the SDE (2). The term $B(t)$ is a random variable which follows a normal distribution whose mean is 0 and variance is $\mathrm{d}t$. Therefore we can write

$$dB(t) = Z\sqrt{dt}\ ,$$

where Z is a standardised normal distribution, i.e, $Z \sim N(0,1)$ with probability density function given by

$$f(Z) = \frac{1}{\sqrt{2}}\exp(-\frac{1}{2}Z^2)\ ,$$

for $-\infty < Z < \infty$. The expectation can be defined for any function F by

$$\mathbb{E}[F(\cdot)] = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} F(Z)\exp(-\frac{1}{2}Z^2)\mathrm{d}Z\ .$$

Hence we have that

$$\mathbb{E}[Z] = 0\ ,$$
$$\mathbb{E}[Z^2] = 1\ .$$

If there is no uncertainty about the price, that is when $\sigma = 0$, and μ is a constant, then we get an ODE. When solved we obtain an exponential growth in the value of the asset, i.e,

$$\frac{\mathrm{d}S}{S} = \mu\mathrm{d}t\ ,$$
$$\implies S = S_0\exp^{\mu(t-t_0)}\ ,$$

where S_0 is the value of the asset at $t = t_0$. This means that when $\sigma = 0$, the asset price is totally deterministic and thus the future price can be predicted.

To obtain the Black-Scholes PDE, let $f(S)$ be a smooth function of the asset price S and let us assume that S is not stochastic. Taking the Taylors series expansion we have

$$\begin{aligned}
\mathrm{d}f &= \frac{\mathrm{d}f}{\mathrm{d}S}\mathrm{d}S + \frac{1}{2}\frac{\mathrm{d}^2 f}{\mathrm{d}S^2}\mathrm{d}S^2 + \text{ higher order terms}\ ,\\
&= \frac{\mathrm{d}f}{\mathrm{d}S}(\sigma S\mathrm{d}B(t) + \mu S\mathrm{d}t) + \frac{1}{2}\frac{\mathrm{d}^2 f}{\mathrm{d}S^2}(\sigma S\mathrm{d}B(t) + \mu S\mathrm{d}t)^2,\\
&= \frac{\mathrm{d}f}{\mathrm{d}S}(\sigma S\mathrm{d}B(t) + \mu S\mathrm{d}t)\\
&+ \frac{1}{2}\frac{\mathrm{d}^2 f}{\mathrm{d}S^2}(\sigma^2 S^2\mathrm{d}B(t)^2 + 2\mu\sigma S^2\mathrm{d}t\ \mathrm{d}B(t) + \mu^2 S^2\mathrm{d}t^2)\ ,\\
&= \frac{\mathrm{d}f}{\mathrm{d}S}(\sigma S\mathrm{d}B(t) + \mu S\mathrm{d}t) + \frac{1}{2}\frac{\mathrm{d}^2 f}{\mathrm{d}S^2}(\sigma^2 S^2\mathrm{d}t), \qquad (9)\\
&\text{since } \mathrm{d}B(t)^2 \longrightarrow \mathrm{d}t \ \text{ as } \ \mathrm{d}t \longrightarrow 0 \text{ (Itô's lemma)}\\
&= \sigma S\frac{\mathrm{d}f}{\mathrm{d}s}\mathrm{d}B(t) + (\mu S\frac{\mathrm{d}f}{\mathrm{d}S} + \frac{1}{2}\sigma^2 S^2\frac{\mathrm{d}^2 f}{\mathrm{d}S^2})\mathrm{d}t\ . \qquad (10)
\end{aligned}$$

The general case for equation (10) above is obtained by considering a function $F(S,t)$ of the random variable S and time t. Since S and t are independent variables we will use partial derivatives in the expansion. Therefore taking the expansion of $F(S+dS, t+dt)$ in Taylor series about (S,t) we have

$$\mathrm{d}F = \frac{\partial F}{\partial S}dS + \frac{\partial F}{\partial t}\mathrm{d}t + \frac{1}{2}\frac{\partial^2 F}{\partial S^2}\mathrm{d}S^2 + \cdots\ . \qquad (11)$$

By neglecting the remainder terms and using the *Itô's lemma* and the SDE (2), we can write equation (11) above as

$$\mathrm{d}F(S,t) = \sigma S\frac{\partial F}{\partial S}\mathrm{d}B(t) + \left(\mu S\frac{\partial F}{\partial S} + \frac{\partial F}{\partial t} + \frac{1}{2}\sigma^2 S^2\frac{\partial^2 F}{\partial S^2}\right)\mathrm{d}t\ . \qquad (12)$$

Here we determine a portfolio π consisting of one option F and a number $-\Delta$ of the underlying asset [14]. Therefore this portfolio would have value

$$\pi = F - \Delta S\ , \qquad (13)$$

hence we have

$$\mathrm{d}\pi = \mathrm{d}F - \Delta\mathrm{d}S\ . \qquad (14)$$

Substituting equations (2) and (12) into (14) above we find that the portfolio π follows the random walk

$$\begin{aligned}
\mathrm{d}\pi &= \sigma S\frac{\partial F}{\partial S}\mathrm{d}B(t) + \left(\mu S\frac{\partial F}{\partial S} + \frac{\partial F}{\partial t} + \frac{1}{2}\sigma^2 S^2\frac{\partial^2 F}{\partial S^2}\right)\mathrm{d}t\\
&- \Delta(\mu S\mathrm{d}t + \sigma S\mathrm{d}B(t))\ , \qquad (15)\\
&= \sigma S\left(\frac{\partial F}{\partial S} - \Delta\right)\mathrm{d}B(t) +\\
&\left(\mu S\frac{\partial F}{\partial S} + \frac{1}{2}\sigma^2 S^2\frac{\partial^2 F}{\partial S^2} + \frac{\partial F}{\partial t} - \mu S\Delta\right)\mathrm{d}t\ . \qquad (16)
\end{aligned}$$

We choose Δ to eliminate the random component $B(t)$ in this random walk. Hence

$$\Delta = \frac{\partial F}{\partial S}\ , \qquad (17)$$

which represents the rate of change of the value of our option with respect to S. The portfolio now, no longer follows a random walk and we have

$$\mathrm{d}\pi = \left(\frac{\partial F}{\partial t} + \frac{1}{2}\sigma^2 S^2\frac{\partial^2 F}{\partial S^2}\right)\mathrm{d}t\ . \qquad (18)$$

This implies that the increment in this portfolio is wholly deterministic.

Black and Scholes then considered the no-arbitrage principle which simply states that the value of a portfolio must be equal (on average) to the value of the portfolio at a risk-free interest rate, r. If this was not the case then some individuals, knowledgeable about the market would risklessly profit. Thus the return on an amount π invested in a riskless asset would yield a growth of $r\pi\mathrm{d}t$ in time $\mathrm{d}t$.

Hence we have that

$$r\pi \mathrm{d}t = \left(\frac{\partial F}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 F}{\partial S^2}\right) \mathrm{d}t \ . \tag{19}$$

Substituting equations (13) and (17) into (19) and dividing through by dt we obtain

$$\frac{\partial F}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 F}{\partial S^2} + rS\frac{\partial F}{\partial S} - rF = 0 \ . \tag{20}$$

This is the Black-scholes partial differential equation. We note that this PDE is a parabolic equation and it does not contain the growth parameter μ, meaning that the value of an option is independent of the nature of the growth of the asset.

3.5 The Black-Scholes Equation

The Black-Scholes PDE, equation (20) has an infinite number of solutions. Therefore to obtain a unique solution, hence avoiding the possibilities of arbitrage, boundary conditions must be imposed. These boundary conditions specify how the solution of the problem behaves in some region of the solution domain. We note that the highest derivative with respect to S is a second order derivative and the highest derivative with respect to t is a first order derivative. Hence we impose two conditions about the behaviour of the solution in S and one in t [14].

Let us now introduce the boundary conditions of the PDE as described in [14] for a European Put Option whose payoff is denoted by $P(S,t)$. The final condition for the option, that is, the value at the terminal point where time $t = T$, is given by

$$\begin{aligned} P(S,T) &= (K-S)^+ \ , \\ &= \max(K-S,0) \ , \end{aligned}$$

where K is the strike price and S is the asset value.

Now suppose that the value of the asset is zero. Then the payoff for the option will automatically be K and the present value of the option received at time T is

$$P(0,t) = Ke^{-r(T-t)} \ .$$

Finally, we consider the case when the asset value is large enough. Therefore as S increases, the option value tend to be worthless,

$$P(S,t) = 0 \quad \text{as } S \to \infty \ .$$

The closed form solution for the European Put Option problem (20) together with the boundary conditions described above is fully explained in [10] where the following assumptions were made in deriving the solution equation ;

i) The risk free interest rate r, and asset volatility are constant.

ii) The underlying asset prices follow a lognormal random walk.

iii) There are no arbitrage opportunities hence all portfolios would earn equal returns.

iv) During delta hedging of a portfolio, no transaction costs are incurred.

v) The short selling of securities is allowed and the assets are divisible.

vi) No dividends are paid during the entire period of the contract.

vii) There is continuous trading of the underlying assets.

Therefore the explicit solution for the European Put Option is given by

$$P(S,t) = Ke^{-r(T-t)}N(-d_2) - SN(-d_1) \ ,$$

where

$$\begin{aligned} d_1 &= \frac{\log(S/K) + (r + \frac{1}{2}\sigma^2)(T-t)}{\sigma\sqrt{T-t}} \ , \\ d_2 &= \frac{\log(S/K) + (r - \frac{1}{2}\sigma^2)(T-t)}{\sigma\sqrt{T-t}} \ . \end{aligned}$$

The value of d_2 can also be approximated as $d_2 \approx d_1 - \sigma\sqrt{T-t}$.

The parameter $N(\cdot)$ is the cumulative probability distribution function for a standardised normal random variable

$$N(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}y^2} dy \ . \tag{21}$$

To obtain the value of $N(x)$ we use the idea described in [15], and we proceed to compute the error function as

$$erf(x) = \frac{1}{\sqrt{\pi}} \int_{-x}^{x} e^{-y^2} dy \ ,$$

which simplifies equation (21) to

$$N(x) = \frac{1}{2}\left(1 + erf(\frac{x}{\sqrt{2}})\right) \ .$$

4. Pricing The European Put Option

4.1 Finite-Difference Methods

The concept of finite difference methods as described in [11] has major applications in the valuation of derivatives. This method aims at solving the differential equation satisfying the underlying derivative. For this case, we attempt to obtain the numerical solution of the Black-Scholes PDE by converting it into a set of difference algebraic equations which can then be solved iteratively.

The most common forms of finite difference methods used in the computation of this PDE are the implicit method, the explicit method and the Crank-Nicolson scheme. The three methods are similar in computation and implementation,

they only differ in the accuracy, stability and execution speed. In this paper, we consider the Crank-Nicolson method in pricing a European Put Option because it is more accurate to $O\Big((\Delta t)^2, (\Delta S)^2\Big)$, unconditionally stable and converges faster than the other two methods of finite difference [2].

Therefore to achieve this objective, the main things to consider in the formulation of the partial differential equation problem are ;

i) the PDE,

ii) the region of space-time to which the PDE is defined,

iii) the ancillary boundary and initial conditions to be met.

This means that the solution of this problem is defined on the (S,t) plane.

Equation Discretization

The PDE and the boundary conditions need to be discretized either by using forward or backward forms of approximations. The option value is a function of two independent variables S and t and thus we discretize the equation with respect to S and t.

Now according to [11] we suppose that the option will mature after time T. We then divide this time into N equally spaced intervals each of length Δt. Thus we have $N+1$ points

$$0, \Delta t, 2\Delta t, \cdots, N\Delta t \ ,$$

where $\Delta t = \frac{T}{N}$.

Similarly we need to discretize the stock price. Assume that the highest price of the stock is $S_{\max}$, at which point, the Put Option becomes worthless. We also know that the stock prices cannot go below zero and and since we need the highest stock price to be large enough, we assume that $S_{\max} = 2S_0$ [1]. Dividing $S_{\max}$ into M equally spaced intervals of length ΔS, we have $M+1$ points,

$$0, \Delta S, 2\Delta S, \cdots, M\Delta S \ ,$$

where $\Delta S = \frac{S_{\max}}{M}$. The (S,t) plane will have the axis ranges $(0,\ S_{\max})$ and $(0,\ T)$ and thus the grid will have $(M+1)\times(N+1)$ points.
The (S,t) plane is shown in figure 3 below [11].

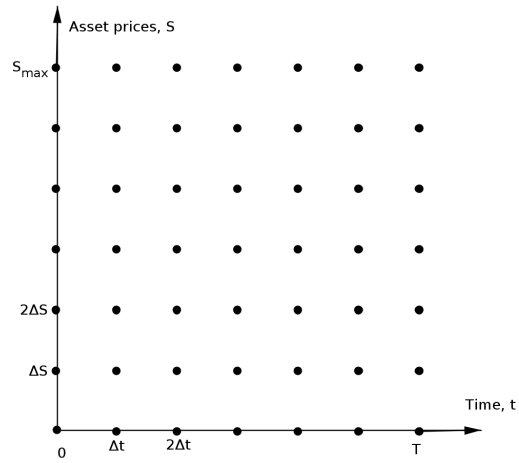

Figure 3. The (S,t) plane.

The point (n,m) on the grid corresponds to the stock price $m\Delta S$ where $m = 0,1,2,\cdots,M$, at time $n\Delta t$ where $n = 0,1,2,\cdots,N$. Therefore in this method we denote by $F_{n,m}$ the value of the option at time t_n when the asset price is S_m. That is,

$$F_{n,m} = F(n\Delta t, m\Delta S) = F(t_n, S_m) \ .$$

From the Black-Scholes PDE, we need to replace the partial derivatives by approximations based on the Taylor series expansion about points of interest. Therefore we need to obtain the approximation for the first order partial derivative with respect to t and S and the second order partial derivative with respect to S. By considering the Taylor series expansions we end up with the relevant finite difference approximations.

The expansion of $F(t, S+\Delta S)$ in Taylor series gives

$$F(t,S+\Delta S) = F(t,S) + F_S(t,S)\Delta S + \frac{1}{2}F_{SS}(t,S)(\Delta S)^2 + O\Big((\Delta S)^3\Big) \ , \tag{22}$$

and thus the first partial derivative is

$$F_S(t,S) = \frac{F(t,S+\Delta S) - F(t,S)}{\Delta S} + O(\Delta S) \ , \approx \frac{F_{n,m+1} - F_{n,m}}{\Delta S} \ . \tag{23}$$

This is the forward difference approximation.

Similarly the expansion of $F(t, S-\Delta S)$ is given by

$$F(t,S-\Delta S) = F(t,S) - F_S(t,S)\Delta S + \frac{1}{2}F_{SS}(t,S)(\Delta S)^2 - O\Big((\Delta S)^3\Big) \ , \tag{24}$$

this implies that the first partial derivative is

$$F_S(t,S) = \frac{F(t,S) - F(t,S-\Delta S)}{\Delta S} + O(\Delta S) \ , \approx \frac{F_{n,m} - F_{n,m-1}}{\Delta S} \ . \tag{25}$$

This results to backward difference form of approximation. Subtracting equation (24) from equation (22) and taking the first order partial derivative we obtain the central difference approximation

$$F_S(t,S) = \frac{F(t,S+\Delta S) - F(t,S-\Delta S)}{2\Delta S} + O\Big((\Delta S)^2\Big) , \approx \frac{F_{n,m+1} - F_{n,m-1}}{2\Delta S} . \quad (26)$$

To obtain the approximation of the second order partial derivative of the stock price, we add equations (22) and (24) thereby obtaining

$$F_{SS}(t,S) = \frac{F(t,S+\Delta S) - 2F(t,S) + F(t,S-\Delta S)}{\Delta^2 S} + O\Big((\Delta S)^2\Big) , \approx \frac{F_{n,m+1} - 2F_{n,m} + F_{n,m-1}}{(\Delta S)^2} . \quad (27)$$

For the time derivatives we have the approximations

$$F(t+\Delta t,S) = F(t,S) + \Delta t F_t(t,S) + (\Delta t)^2 F_{tt}(t,S) + O\Big((\Delta t)^3\Big) . \quad (28)$$

Hence the forward difference derivative

$$F_t(t,S) = \frac{F(t+\Delta t,S) - F(t,S)}{\Delta t} + O(\Delta t) , \approx \frac{F_{n+1,m} - F_{n,m}}{\Delta t} . \quad (29)$$

Similarly for backward difference in time we have

$$F(t-\Delta t,S) = F(t,S) - \Delta t F_t(t,S) + (\Delta t)^2 F_{tt}(t,S) - O\Big((\Delta t)^3\Big) , \quad (30)$$

and therefore we have

$$F_t(t,S) = \frac{F(t,S) - F(t-\Delta t,S)}{\Delta t} + O(\Delta t) , \quad F_t(t,S) \approx \frac{F_{n,m} - F_{n-1,m}}{\Delta t} . \quad (31)$$

Substituting these approximations into the PDE yields a difference equation which will be used in obtaining the approximation for the option value $F(t,S)$.

5. Boundary Conditions

The Black-Scholes PDE has an infinite number of solutions. Therefore since the price of the European option whose payoff is given by $\max(K - S_T, 0)$ must be unique, then we need to impose some boundary and initial conditions.

It is clear that when the stock value is zero, the Put Option will be worth the strike price K at time T, and discounting to time $t = 0$ we have

$$F_{n,0} = Ke^{-r(N-n)\Delta t} \quad \text{for } n = 0,1,2,\cdots,N . \quad (32)$$

We can also see that the value of the option will tend to zero if the value of the underlying asset increases. If we take the maximum value of the underlying asset $S_{max} = S_M$, then

$$F_{n,M} = 0 \quad \text{for} \quad n = 0,1,2,\cdots,N . \quad (33)$$

Since the value of the Put Option at time T is known, we can impose the initial condition

$$F_{N,m} = \max(K - m\Delta S, 0) \quad \text{for} \quad m = 0,1,2,\cdots,M . \quad (34)$$

The initial condition gives us the value of the option F at the maturity time T and not at the beginning. Therefore we need to discount to the initial time zero. The price of the option at time $t = 0$ for the initial price S_0 is given by $F_{0,\frac{M}{2}}$ and $F_{0,\frac{M+1}{2}}$ when the number of steps M is even and odd respectively [1]. This is because we took the assumption that $S_{\max} = 2S_0$.

6. Explicit Method

The explicit method is obtained by taking the backward difference approximation in time, that is, equation (31) and together with equations (26) and (27), substitute into the PDE taking note that $S = m\Delta S$. Therefore we have

$$\frac{F_{n,m} - F_{n-1,m}}{\Delta t} + rm\Delta S \frac{F_{n,m+1} - F_{n,m-1}}{2\Delta S} + \frac{1}{2}\sigma^2 m^2 (\Delta S)^2 \frac{F_{n,m+1} - 2F_{n,m} + F_{n,m-1}}{(\Delta S)^2} - rF_{n,m} = 0 . \quad (35)$$

We can rewrite this so that the present values of the underlying asset depends on the future values. Hence we have

$$F_{n-1,m} = aF_{n,m-1} + bF_{n,m} + cF_{n,m+1} ,$$

where

$$a = \frac{\Delta t}{2}(\sigma^2 m^2 - rm) ,$$
$$b = 1 - \Delta t(\sigma^2 m^2 + r) ,$$
$$c = \frac{\Delta t}{2}(rm + \sigma^2 m^2) ,$$

for $n = N-1, N-2, \cdots, 1, 0$ and $m = 1, 2, \cdots M-1$.

If we assume that the values of $\frac{\partial F}{\partial S}$ and $\frac{\partial^2 F}{\partial S^2}$ at points (n,m) are the same as at point $(n+1,m)$, then equations (26) and (27) respectively become

$$F_S(t,S) \approx \frac{F_{n+1,m+1} - F_{n+1,m-1}}{2\Delta S} , \quad (36)$$

$$F_{SS}(t,S) \approx \frac{F_{n+1,m+1} - 2F_{n+1,m} + F_{n+1,m-1}}{\Delta^2 S} . \quad (37)$$

Therefore substituting (36), (37) and (29) into the PDE (20) we have

$$\frac{F_{n+1,m}-F_{n,m}}{\Delta t}+rm\Delta S\frac{F_{n+1,m+1}-F_{n+1,m-1}}{2\Delta S}-rF_{n,m}$$
$$+\frac{1}{2}\sigma^2m^2(\Delta S)^2\frac{F_{n+1,m+1}-2F_{n+1,m}+F_{n+1,m-1}}{(\Delta S)^2}=0\,. \tag{38}$$

We can rearrange this as

$$F_{n,m}=\frac{1}{1+r\Delta t}\Big(a_mF_{n+1,m-1}+b_mF_{n+1,m}+c_mF_{n+1,m+1}\Big)\,, \tag{39}$$

where the coefficients

$$a_m=\frac{\sigma^2m^2\Delta t}{2}-\frac{rm\Delta t}{2}\,,$$
$$b_m=1-\sigma^2m^2\Delta t\,,$$
$$c_m=\frac{rm\Delta t}{2}+\frac{\sigma^2m^2\Delta t}{2}\,,$$

for $n=N-1,N-2,\cdots,1,0$ and $m=1,2,\cdots M-1$. This is the explicit method which is accurate to $O\Big(\Delta t,(\Delta S)^2\Big)$. The coefficients above represent the risk neutral probabilities of the asset prices $S+\Delta S, S$ and $S-\Delta S$ at time $t+\Delta t$ and their sum is 1. If they are all non-negative, then they represent the probability that the underlying asset prices increases, decreases or remain constant. However at times these coefficients are negative. This brings numerical instability hence the results never converge to the required solution of the differential equation. They are negative when $m^2\sigma^2\Delta t>1$ and $m<\frac{r}{\sigma^2}$. [16]. Figure 4 below describes the Explicit method [11].

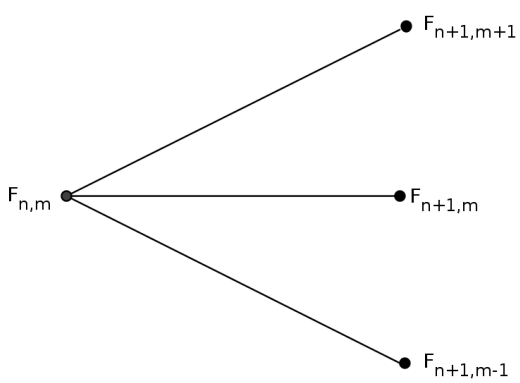

Figure 4. Explicit finite difference.

7. Implicit Method

We have seen that the problem with the explicit method is its instability condition. The implicit method tries to overcome this challenge. It aims at approximating the future prices of the underlying asset using the present values. It is obtained by substituting the forward difference approximation of the time derivative, equation (29), and the first and second order partial derivatives of the stock price given by equations (26) and (27) into the Black-Scholes PDE. Taking note that $S=m\Delta S$ we have

$$\frac{F_{n+1,m}-F_{n,m}}{\Delta t}+rm\Delta S\frac{F_{n,m+1}-F_{n,m-1}}{2\Delta S}$$
$$+\frac{1}{2}\sigma^2m^2(\Delta S)^2\frac{F_{n,m+1}-2F_{n,m}+F_{n,m-1}}{(\Delta S)^2}-rF_{n,m}=0\,. \tag{40}$$

This can be represented as

$$F_{n+1,m}=a^*F_{i,j-1}+b^*F_{i,j}+c^*F_{i,j+1}\,,$$

where

$$a^*=\frac{\Delta t}{2}(rj-\sigma^2m^2)\,,$$
$$b^*=1+\Delta t(\sigma^2m^2+r)\,,$$
$$c^*=\frac{-\Delta t}{2}(rj+\sigma^2m^2)\,,$$

for $n=N-1,N-2,\cdots,1,0$ and $m=1,2,\cdots M-1$.

This is the **implicit finite difference method** which is accurate to $O\Big(\Delta t,(\Delta S)^2\Big)$. The Implicit method is shown in figure 5 below [11].

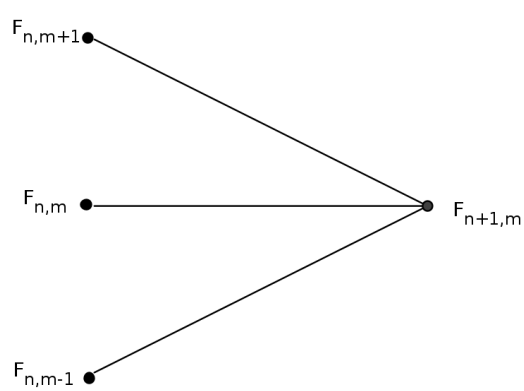

Figure 5. Implicit finite difference.

8. Crank-Nicolson Method

The Crank-Nicolson method is the average of the explicit and implicit methods .Therefore we have

$$\frac{1}{2}\Bigg(\frac{F_{n+1,m}-F_{n,m}}{\Delta t}+rm\Delta S\frac{F_{n+1,m+1}-F_{n+1,m-1}}{2\Delta S} + \frac{1}{2}\sigma^2m^2(\Delta S)^2\frac{F_{n+1,m+1}-2F_{n+1,m}+F_{n+1,m-1}}{(\Delta S)^2} - rF_{n+1,m}+\frac{F_{n+1,m}-F_{n,m}}{\Delta t}+rm\Delta S\frac{F_{n,m+1}-F_{n,m-1}}{2\Delta S} + \frac{1}{2}\sigma^2m^2(\Delta S)^2\frac{F_{n,m+1}-2F_{n,m}+F_{n,m-1}}{(\Delta S)^2}-rF_{n,m}\Bigg)=0\,. \tag{41}$$

This can be written as

$$F_{n+1,m}-F_{n,m} = \frac{-rm\Delta t}{4}\Big(F_{n,m+1}-F_{n,m-1}+F_{n+1,m+1}-F_{n+1,m-1}\Big) + \frac{r\Delta t}{2}(F_{n,m}+F_{n+1,m})-\frac{\sigma^2m^2\Delta t}{4}\Big(F_{n,m+1}-2F_{n,m} + F_{n,m-1}+F_{n+1,m+1}-2F_{n+1,m}+F_{n+1,m-1}\Big)\,.$$

Rearranging the result is

$$-\left(\frac{\sigma^2m^2\Delta t}{4}-\frac{rm\Delta t}{4}\right)F_{n,m-1} + \left(1+\frac{\sigma^2m^2\delta t}{2}+\frac{r\Delta t}{2}\right)F_{n,m} - \left(\frac{\sigma^2m^2\Delta t}{4}+\frac{rm\Delta t}{4}\right)F_{n,m+1} = \left(\frac{\sigma^2m^2\Delta t}{4}-\frac{rm\Delta t}{4}\right)F_{n+1,m-1} + \left(1-\frac{\sigma^2m^2\Delta t}{2}-\frac{r\Delta t}{2}\right)F_{n+1,m} + \left(\frac{\sigma^2m^2\Delta t}{4}+\frac{rm\Delta t}{4}\right)F_{n+1,m+1}\,. \tag{42}$$

We can rewrite equation (42) as

$$-\alpha_mF_{n,m-1}+(1-\beta_m)F_{n,m}-\gamma_mF_{n,m+1} = \alpha_mF_{n+1,m-1}+(1+\beta_m)F_{n+1,m}+\gamma_mF_{n+1,m+1}\,, \tag{43}$$

where

$$\alpha_m=\frac{\Delta t}{4}(\sigma^2m^2-rm)\,,$$
$$\beta_m=\frac{-\Delta t}{2}(\sigma^2m^2+r)\,,$$
$$\gamma_m=\frac{\Delta t}{4}(\sigma^2m^2+rm)\,,$$

for $n=N-1,N-2,\cdots,1,0$ and $m=1,2,\cdots M-1$. This equation can be represented in a tri-diagonal matrix as

$$\begin{pmatrix}(1-\beta_1) & -\gamma_1 & 0 & \cdots & 0\\ -\alpha_2 & (1-\beta_2) & -\gamma_2 & \cdots & 0\\ 0 & -\alpha_3 & (1-\beta_3) & \ddots & 0\\ \vdots & \vdots & \ddots & \ddots & -\gamma_{M-2}\\ 0 & 0 & 0 & -\alpha_{M-1} & (1-\beta_{M-1})\end{pmatrix} \times\begin{pmatrix}f_{n,1}\\ f_{n,2}\\ f_{n,3}\\ \vdots\\ f_{n,M-1}\end{pmatrix} = \begin{pmatrix}(1+\beta_1) & \gamma_1 & 0 & \cdots & 0\\ \alpha_2 & (1+\beta_2) & \gamma_2 & \cdots & 0\\ 0 & \alpha_3 & (1+\beta_3) & \ddots & 0\\ \vdots & \vdots & \ddots & \ddots & \gamma_{M-2}\\ 0 & 0 & 0 & \alpha_{M-1} & (1+\beta_{M-1})\end{pmatrix} \times\begin{pmatrix}F_{n+1,1}\\ F_{n+1,2}\\ F_{n+1,3}\\ \vdots\\ F_{n+1,M-1}\end{pmatrix}+d$$

where d is given by

$$d=[\alpha_1(F_{n,0}+F_{n+1,0}),0,\cdots,\gamma_{M-1}(F_{n,M}+F_{n+1,M})]^T\,.$$

The diagram for a Crank-Nicolson method is shown in figure 6 below [2].

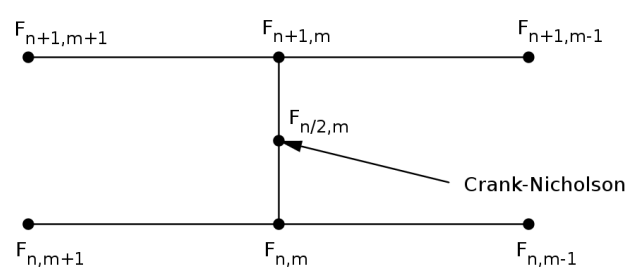

Figure 6. Crank-Nicolson finite difference.

8.1 Accuracy of the Crank-Nicolson Method

The accuracy of the three methods is mainly affected by the truncation errors arising from the finite difference approximation in the Taylor series expansions. The Crank-Nicolson approximation is more accurate than either the implicit or explicit finite difference approximations. It is accurate up to $O\Big((\Delta t)^2,(\Delta S)^2\Big)$ thus it has faster convergence than the other two methods. As described in [17], it can be shown that by equating the central difference and the symmetric central difference at

$$F_{n+\frac{1}{2},m} \equiv F(t+\frac{\Delta t}{2},S)\ ,$$

one would end up with the Crank-Nicolson method with an accuracy of $O\Big((\Delta t)^2,(\Delta S)^2\Big)$.

9. Monte-Carlo Simulation

The Monte Carlo simulation, as discussed in [11], is another important approach used in the valuation of derivatives. Under the risk-neutral assumption, the value of the option is obtained by calculating the average of the option payoff then discounting it to the present value under a risk-free interest rate, r .

Therefore Monte Carlo simulation is a process by which we generate a large sample of random asset paths which follow the SDE from equation (4). The option payoff for each path is computed and the arithmetic mean is evaluated, then the value is discounted under a risk-free interest rate to obtain an approximation of the option value.

The mean is obtained by using the concept of the law of large numbers. It states that if $X_1,X_2,\cdots,X_n$ are independent identically distributed sequences of random variables with finite expectation having similar distribution as the random variable X, then as $n\to\infty$,

$$\overline{X_n} \equiv \frac{1}{n}(X_1+X_2+\cdots,X_n) \to E(X)\ .$$

We also note that $\overline{X_n}$ is itself a random variable [16].

In this section, we follow the concepts discussed in [11]. Therefore, in order to simulate the path followed by S, under risk-neutral measure, we subdivide the life of S into N equal intervals of Δt. Thus the SDE from equation (4), that is,

$$\mathrm{d}S(t) = S(t)\Big(r\mathrm{d}t+\sigma d\widehat{B}(t)\Big)\ , \tag{44}$$

becomes

$$S(t+\Delta t)-S(t) = rS(t)\Delta t+\sigma S(t)Z\sqrt{\Delta t}\ . \tag{45}$$

Here $S(t)$ is the price of S at time t and $Z\sim N(0,1)$. Therefore from this, the value of S at time Δt is obtained using the initial value of S, the value of S at $2\Delta t$ is obtained using the value of S at Δt and so on. The path followed by S is then simulated using the M random sample from a normal distribution.

We simulate $\ln S$, because it is more accurate than simulating S, thus from Itô's lemma, the process followed by $\ln S$ is given by

$$\begin{aligned}\ln S &= (r-\frac{\sigma^2}{2})\Delta t+\sigma d\widehat{B}(t)\ ,\\ \implies \ln S(t+\Delta t)-\ln S(t) &= (r-\frac{\sigma^2}{2})\Delta t+\sigma Z\sqrt{\Delta t}\ ,\\ S(t+\Delta t) &= S(t)\exp\left((r-\frac{\sigma^2}{2})\Delta t+\sigma Z\sqrt{\Delta t}\right)\ .\end{aligned} \tag{46}$$

Equation (46) is the equation used in constructing the path of S.

Since r and σ are constants, then

$$\ln S(T)-\ln S(0) = (r-\frac{\sigma^2}{2})\Delta t+\sigma Z\sqrt{\Delta t}\ , \tag{47}$$

$$\therefore\quad S(T) = S(0)\exp\left((r-\frac{\sigma^2}{2})T+\sigma Z\sqrt{T}\right)\ . \tag{48}$$

The accuracy of the option value obtained using the Monte Carlo simulation depends on the number of sample paths, M. The higher the number of trials, the more accurate the results obtained. Therefore as $M\to\infty$, the option value converges to the known value of the Black-Scholes equation.

The mean μ which is the estimate of the of value of the derivative and the standard deviation β is calculated from the discounted payoff. From the central limit theorem, the standard error of the approximation, which is itself a random variable is given by

$$\frac{\beta}{\sqrt{M}}\ .$$

Thus a 95% confidence interval for the option price f is given by

$$\mu-\frac{1.96\beta}{\sqrt{M}} < f < \mu+\frac{1.96\beta}{\sqrt{M}}\ . \tag{49}$$

One of the advantages of the Monte Carlo simulation is that it is easy to implement. It is also good in computing the price of a derivative where the payoff depends on the path followed by the asset price.

The key disadvantages of the method is that it takes more computational time in implementation. It is also not efficient in pricing of American options where early exercise is permitted [11].

10. Results

In this chapter, we present the results obtained in the calculation of the European Put Option by using a Monte-Carlo simulation and the Crank-Nicolson method. These results are then compared to the closed form solution, that is, the solution obtained from the Black-Scholes formula. These numerical solutions were obtained by implementing an R program written for both methods [18].

10.1 Solutions by Monte Carlo Simulation

In using Monte Carlo simulation, the results tend to approach the explicit solution as we increase the number of simulation paths. The main steps followed in the Monte carlo simulation are ;

i) Generate a path for the underlying asset prices by a random walk under a risk-neutral world.

ii) Evaluate the payoff.

iii) Repeat the steps above several times to obtain more sample values for the payoff.

iv) Evaluate the average of these payoffs to obtain an estimate of the expected payoff.

v) The expected payoff is then discounted at a risk-free rate to get the required present value of the option.

Example 1: Monte-Carlo simulation

Consider the pricing of a European Put Option with $S_0 = 30,\ K = 60,\ r = 0.1,\ \sigma = 0.2$ and $T = \frac{3}{2}$. The option price obtained by the Black-Scholes equation is **21.68705**. Therefore when using the Monte-Carlo simulation method, as the number of simulations $M \to \infty$ the results become more accurate. The problem with this is that it takes more computational time when M is very large.

The table 1 below compares the accuracy with increasing the number of Monte-Carlo trials.

Number of simulations M	European Put value
100	21.54301
1000	21.77054
10000	21.66821
100000	21.69118
1000000	21.6794
10000000	**21.68596**

Table 1. Monte-Carlo simulation.

11. Solutions by Crank-Nicolson Method

Example 2: Crank-Nicolson method We need to compute the European Put value for a non-dividend paying stock whose initial price $S_0 = 50,\ K = 60,\ r = 0.1,\ \sigma = 0.2$ and $T = \frac{3}{2}$. Here we assume $S\max = 100$. The Black-Scholes price for the Put Option is 5.817974. The solution set for the European Put Option is shown in figure 7 below.

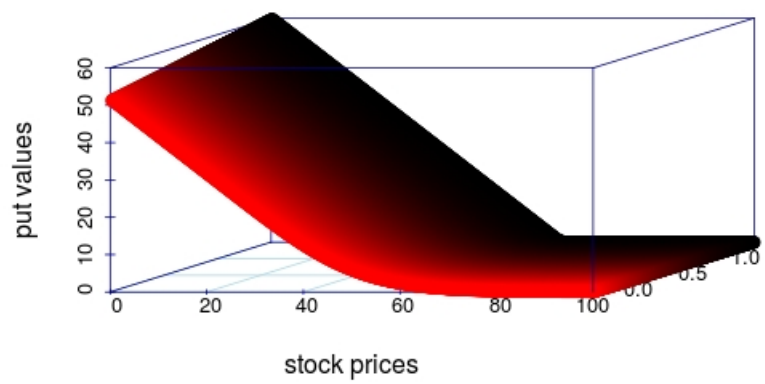

Figure 7. The price of a European Put Option by Crank-Nicolson Algorithm.

Consider the value of the European Put Option when $S = 0$. This is on the boundary condition. From the diagram above, the option will be worth the strike price at terminal time $t = T$, that is, $P(0,t) = 60$ where $t = 1.5$. To obtain the present value of the option, that is, the value at time $t = 0$ we have

$$\begin{aligned} P(0,t) &= K\exp(-r(T-t)) \ , \\ &= 60 * \exp(-0.1 * 1.5) \ , \\ &= 51.64248 \ . \end{aligned}$$

This value is shown on the diagram when $t = 0$.

Similarly, one can easily approximate the value of the Put Option on the diagram for different asset prices between 0 and S_{max} at any time from t_0 to T.

Example 2.1: Crank-Nicolson method with $M = N$

Considering example 2 above, it is clear that as we increase the number of the step sizes for both time and stock, that is, $M, N \to \infty$, the value obtained approaches the Black-Scholes price. However, it will take more computational time when the values of M and N are large $(M, N > 500)$.

Table 2 below shows the results obtained.

N = M	European Put
20	5.74192
50	5.805766
80	5.813204
100	5.814921
200	5.817209
300	5.817633
400	5.817782
500	5.81785
700	5.81791
1000	5.817942

Table 2. Option values when M=N.

Example 2.2: Crank-Nicolson method with $M \neq N$

Using example 2 above, we now compute the Put Option price when $M \neq N$. Similarly, we observe that as we increase the step sizes the results obtained tend to be accurate (approaches the Black-Scholes price). It will also take more time for the computer program to compute for bigger values of M and N.

The results obtained are shown in table 3 below, and it can be seen that the solution converges faster when $M \neq N$ than when we use $M = N$ [17].

N	M	European Put
20	40	5.798591
40	80	5.813127
60	120	5.815819
80	160	5.816761
100	200	5.817197
200	400	5.817779
300	600	5.817886
400	800	5.817924
500	1000	5.817941

Table 3. Option values when $M \neq N$.

12. Comparison of the results to the closed form solution

Example 3: Comparison

In this example we make the comparison of the European Put prices obtained by using the Black-Scholes formula, Monte-Carlo simulation and the Crank-Nicolson algorithm. Consider example 2 above where we have the parameters $K = 60$,$r = 0.1$,$\sigma = 0.2$,$T = \frac{3}{2}$. We will vary the stock prices and evaluate the corresponding put price and in the case of Crank-Nicolson algorithm we assume that $S\max = 2S_0$. We take the step sizes for the time and stock as $N = 200$ and $M = 400$ respectively.

The values obtained are shown in the table 4 below.

S	Black-Scholes	Monte carlo	Crank-Nicolson
20	31.64258	31.64224	31.37008
30	21.68705	21.68596	21.66453
40	12.49253	12.4918	12.4924
50	5.817974	5.817048	5.817779
60	2.244794	2.244683	2.244479
70	0.7541777	0.754244	0.7541207
80	0.2309951	0.2310311	0.2308693
90	0.06678	0.06691529	0.06678432
100	0.0186759	0.01874987	0.01866138

Table 4. Comparison of solutions.

13. Conclusion

The pricing of derivatives has been made easier by the development of the Black-Scholes model as discussed in this paper. The implementation of the Monte Carlo simulation and the Crank-Nicolson method made it easier to make a comparison of the results obtained by these numerical methods to the explicit solution obtained by using the Black-Scholes formula. We observed that the results obtained were approximately equal to the explicit solution.

These results were obtained by implementing the numerical schemes in R. The R codes for both numerical schemes are provided in [18]. However we only focused on the case where the asset is non-dividend paying. Therefore future work, the pricing of options where the underlying stock yields dividends will be incorporated.

14. Recommendation

The Black-Scholes model assumes that the underlying asset follows a normal distribution. In reality, asset returns are known to follow heavy-tailed distributions. Therefore for future work, we will consider the use of models which will incorporate the heavy-tailedness for example the variance gamma processes.

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CSMA/CD using Network Priority Queue and Scheduling/Aging Techniques

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Abstract- CSMA/CD suffers from drawbacks like packet starvation and wastage of bandwidth due to un-utilized periods of the channel. Its performance can be enhanced greatly by modifying the protocol after taking all these factors into consideration.
The proposed protocol make use of a network queue in addition with a priority counter to overcome the problems of the existing MAC protocol. It ensures that whenever there is congestion and high probability of collision and therefore also wastage of bandwidth, another alternative protocol is initiated. This increases its efficiency and also provides the regular protocol as a back-up option in case of queue failure. It also provides a mechanism for real-time video transmission assuming that this feature is not required often.

Index Terms- Aging, CSMA/CD, Collision, Scheduling

I. Introduction to CSMA/CD and its drawbacks

Ethernet currently employs the CSMA/CD protocol also known as the IEEE Standard 802.3 for media access resolution in the data link layer. CSMA/CD or Carrier sense multiple access with collision detection adds on to the CSMA algorithm to define the procedure in case there is a collision.
CSMA was based on the idea that if the channel can be sensed before it is tried to accessed, the number of collisions could be drastically reduced. However, it takes a while for the nodes to receive the bits already being transmitted by another node as a result of propagation delay. This implies that a node might determine the channel is idle and start transmitting before it learns that the channel was already in use. This leads to a collision. CSMA/CD determines how the stations should proceed in this eventually.
In CSMA/CD, the transmission and collision detection is a continuous and simultaneous process that means that the node transmits and receives using two different ports. Though one port, it transmits while through the other it monitors the channel. If the transmission is completed the process is terminated. If a collision is detected, the process is still terminated and the collision procedure is initiated another attempt at transmission.
The node that detects a collision sends out a short jamming signal through usually 48bits long to let the other nodes know about it and inform them that all the frames involved have either been destroyed or modified so that they can be discarded. The nodes involved in a collision then have to wait a random amount of time before they can try to transmit again, the waiting time period is decided using the binary exponential back-off algorithm(BEB) and referred to as the back-off time. If the frame to be transmitted has already suffered K collisions then the node will pick a value R from among {0,1,2,2^k -1} randomly and wait R.TFR , where T FR is average transmission time for a frame before incrementing the counter K and trying again. Eventually, it will pick a value of R small enough to start transmitting before all the other nodes who want to transmit. Now, if there were no restrictions it could mean that the value of R becomes unreasonably large so we will limit the value of R at 1023, i.e., at the most a data frame would have to wait 1023. T FR time. There is also a possibility that the node tries to access the channel but is deterred every time by a collision. This only increases the possibility of collision in a congested network. To overcome this the highest value that K can take is limited to 15,allowing a total of 16 retransmission[2].K max is set at 15.If the value of K exceeds this it is automatically reset to 0 before it enters the process again.
This protocol is efficient when there is low to medium network traffic. However when the network is busy it creates problems.

II. Analysing the problem more and the appoximate solution for it

The probability that a particular manages to get to the channel depends on its waiting period.
The first time a node tries to transmit the value of the counter ‘n’ is set to zero. In the scenario that it finds the channel to be busy it increments the counter to 1 and picks a value of R from among{0,1} to decide its waiting time. This implies that the first time a node tries to transmit after encountering a collision it has a 50% chance of success. The second time it will have to choose a value of R from among a larger set {0,1,2,3} which will decrease the chance of success to 25%. This value will go on decreasing with increase in the value f K or the number of attempted transmissions for a frame.
This leads to the conclusion that a node with a fresh frame to send has a higher chance of acquiring the channel than a node that has been waiting longer.
Also, some node that has just sent its frame and now has a new frame to send out can access the channel more easily than a node which has been waiting its allotted time because the transmission

probability for a new frame if it senses the channel to be idle is 100%. It can do this again and again and unfairly hold the network. This is often referred to as ethernet capture.
Also, since the entire process is randomized there is a possibility that even though many nodes have data to send they are all waiting. This leaves the channel unoccupied and wastes resources while also increasing the probability of collision.

Approximate Solution

If we see our through are CSMA/CD ,if a collision occurs between 2 nodes or frames they are K value is incremented and then they are made to wait for a random amount of time. Now again during the 2nd transmission if a collision occurs with the same frame ,then again its K value is incremented and its made to wait for a longer period. This can go on till a maximum value of 15 or 16 times in total .But now instead of this I would prefer that we can have a priority counter and a priority queue during such situations. So the counter will decide the priority for the for the frames to be transmitted. So for each 3 transmission the value of k will be incremented. Based on that the values will be incremented at 3,6,9,12,15 and again 3.This process will continue.

III. PRIORITY QUEUE

If any network congestion occurs then we activate the heavy traffic protocol for rescue.
So, firstly our priority queue is empty. It will accept input when a collision has occurred. Once a collision has occurred the frame will be added to the priority queue. The frame will be assigned a position according to the number of transmissions it has already attempted. The node with the higher value will be before the node with a lower value. In case, both the nodes have the same value then they will follow the first come first serve algorithm to decide priority implying that the node whose value exceeded to first will get a priority. Again choosing a value as 2 for employing the following procedure is just a conjecture at this point. Further analysis can be done to determine the optimal value. For a frame 2 qualify to enter in to the priority queue. If there are more than 6 nodes in the priority queue the protocol for the congested network automatically activated and the priority queue starts producing a jamming signal to tell all nodes in the network that it is going to start transmitting.
In essence, the priority queue is just a node with the transmitter and a queue with network responsibility. It will go on transmitting until the queue is empty. After which it will send another jamming signal to notify all nodes to assume normal behavior and revert back to the original CSMA/CD protocol being followed earlier.
The use of priority queue will reduce the traffic network.

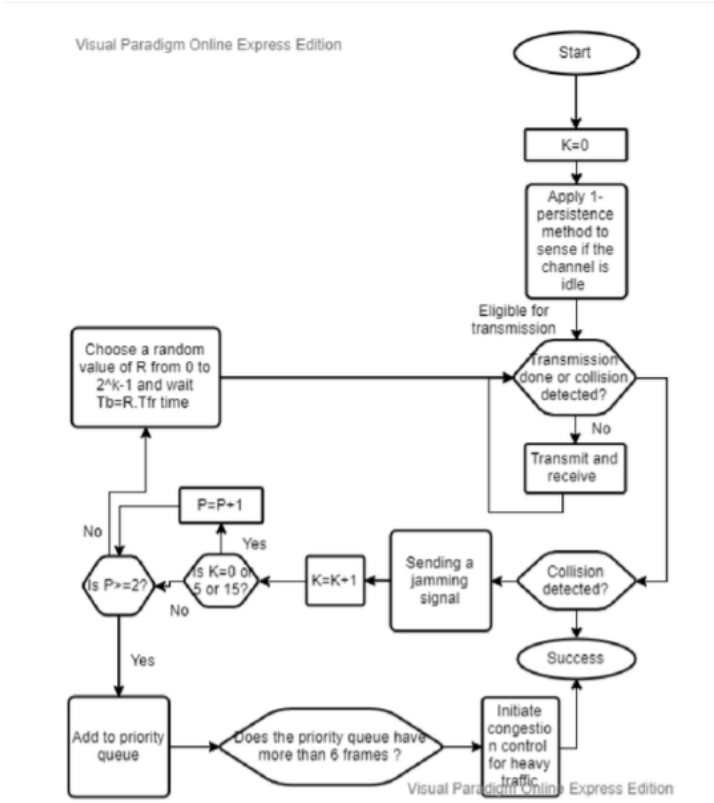

Figure 1: modified CSMA/CD Flowchart with Network Priority Queue

IV. UNDERSTANDING USING AN EXAMPLE

One of the main reasons or disadvantage of packet starvation is that many a times frames with higher priorities just because the low priority once get their chances quicker.
FOR EXAMPLE:
Consider a frame F1 and a frame F2. Here F1 has higher priority since it has encountered maximum number of collisions that F2.Suppose at time t both the frames are executed and a collision is encountered. Thus we need frame F1 to be next. But then we can't decide on which frame among F1 and F2 will executed as they would be waiting for a random amount of time and then be executed or sent. Thus, there is an equal chance for both frame F2 and F1 to be sent next.
So for resolving the above situation we use a priority queue and priority counter so that based on the frames with higher priorities they will be executed accordingly first. Thus the above case can be resolved.
A detailed representation is given in Figure 1.
Otherwise the above method works similar to the normal queue. This method is similar to technique of ageing or scheduling which is popularly used world wide.

V. CONCLUSION

The above proposed solution may be found to complicated, but then it's basically a slight change and modification of the regular CSMA/CD.

The only modification is that we are introducing a priority queue in this which helps us to sort the packet starvation problem

which is often encountered in the regular CSMA/CD. Thus the priority queue will set priorities for the frames which are more important during a collision .Hence the one with higher priority may be sent first and then the lower priorities one's subsequently increasing the fairness among transmissions.

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Feasibility Analysis of *Purse Seine* Business Units in Sinjai District

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Abstract : *The fishing communities that carry out fishing activities in Sinjai district generally use purse seine which is a relatively high productivity and effectiveness tool when compared to other fishing gear. However, efforts to utilize fish fishery resources have not been maximized when compared to the magnitude of untapped potential due to facilities and infrastructure factors, capture fisheries business that is still lacking and not yet functioning optimally.*

The purpose of this study was to examine the feasibility of a fly fishing business unit in Sinjai district. Data collected in the form of primary data and secondary data with data collection using interviews and observation techniques. The research method used is the survey method.

The results showed that the Feasibility analysis of purse seine business units in Sinjai district was obtained an average R / C Ratio of 2,42. The R / C Ratio value obtained is greater than 1, which means that the floating fishing business unit is feasible to run.

Keywords: *Layang fish, purse seine, business feasibility.*

I. INTRODUCTION

Layang fish is a type of fish that is widely marketed in several regions of South Sulawesi, especially in Sinjai district. This is influenced by the fact that floating fish is the main commodity of community consumption fish and has affordable economic value and is widely available in the market. Layang fishing catches are spread over several regions such as the Makassar Strait, Flores Sea, and Bone Bay. The largest production of layang fish in the Sinjai district in 2018 was 2.900,6 tons (Statistik Perikanan Tangkap, 2018). Catches of fishermen with layang fish commodities in Sinjai district are generally produced by Purse Seine fishermen, with a greater fishing capacity than other fishing gear. But in operation, this purse seine business unit requires a large enough cost, so it requires more capital and labor (Hudring, 2012).

Factors that influence fishermen's income are the level of profit and operational costs incurred. The more catches fishermen have, the bigger the income, to obtain high profits, operational costs must be minimized. In general, purse seine fishermen in Sinjai district are fishing businesses that still rely on their habits such as fishing methods, fishing grounds, and fishing season. This has resulted in fluctuating value of capture fisheries production. Business feasibility analysis is a criterion for investing for a certain period of production. The analysis is needed to determine the development of purse seine business in the future. To support this analysis, it is necessary to calculate economic aspects such as capital, financing, revenue, and profitability within a certain production period (Karningsih, 2014).

The purpose of this study is to calculate the economic aspects of the purse seine business unit so that it can determine the level of feasibility of the purse seine business unit in Sinjai district.

II. RESEARCH METHOD

This research was conducted in Sinjai district, South Sulawesi Province in August - October 2019. Sampling business units were taken by random sampling, which is a method of taking samples by randomizing samples simply, according to Prasetiyo (2005), which states that if the number of samples is less than 100, it is better to take all, but if the number of samples is more than 100, it can be taken between 10-15 percent of the population or depending on the ability of researchers, the size of the area and the size of the risk borne by researchers. With the total population of purse seine in Sinjai district as many as 124, so if taken 10 percent, the number of samples that can be taken is 12 samples.

Analysis of the data used in this study is the analysis of business feasibility by looking at several aspects, namely the total cost, revenue and income which will get the business feasibility value.

Total Cost

To explain the total cost in this *purse seine* business using the formula (Bangun 2010):

TC = TFC + TVC

Information:

TC = Total Cost
TFC = Total Fixed Cost
TVC = Total Variabel Cost

Revenue

To determine the acceptance of a *purse seine* business, using the following analysis (Bangun, 2010):

TR = P. Q

Information:

TR = Total Revenue
P = Price
Q = Fish sold

Income

To find out the income of a *purse seine* business, using the following analysis (Soekarwati, 2007):

π = TR – TC

Information:

Π = Income
TR = Total revenue
TC = Total cost

Feasibility

Business feasibility can be known by looking at the comparison between total revenue and total costs, which shows the value of revenue obtained from each rupiah issued. The R/C ratio can be formulated as follows (Umar, 2003):

$$R/C = \frac{TR}{TC}$$

Informaion:

TR = Total revenue
TC = Total cost

R/C Ratio Assessment Criteria:

R / C <1 = business suffered a loss
R / C> 1 = business makes a profit
R / C = 1 = attempt to break even

III. RESULTS AND DISCUSSION

Analysis of the economic aspects of the purse seine business unit can be seen by calculating the value of investments, costs, revenues, and revenues. After seeing the income, it can be determined whether the feasibility of the business is feasible or not. The following is an analysis of purse seine business units in Sinjai district:

Investment

Investment is an investment of money or capital in a business to obtain profits. The investment costs of purse seine business units in Sinjai can be seen in the following table:

Table 1. Average value based on the type of investment:

No	Jenis Investasi	Nilai Rata-rata (Rp)
1	Kapal	202,083,333
2	Jaring	100,416,667
3	Sekoci	3,666,667
4	Mesin Utama	63,333,333
5	Mesin Bantu	26,666,667
6	Mesin Roller	4,075,000
7	Mesin Genset	4,400,000
8	Basket	3,866,667
9	Lampu	440,833
	Total	**408,949,167**

Source : Research Results, 2019.

Based on table 1, the overall investment value of purse seine vessels with their completeness in Sinjai district with an average value of Rp.408,949,167 with the highest investment value in the type of ship investment with an average value of Rp.202,083,333.

Fixed Costs

Fixed costs are costs that are not used up in a single production process, which are included in fixed costs are depreciation costs. The amount of depreciation expense used depends on the length of time the investment is used. The average value of fixed costs used are as follows:

Table 2. *Purse seine* fixed costs

No	Jenis Investasi	Nilai Rata-rata (Rp) Penyusutan
1	Kapal	11.828.704
2	Jaring	20.083.333
3	Sekoci	916.667
4	Mesin Utama	4.222.222
5	Mesin Bantu	2.133.333
6	Mesin Roller	271.667
7	Mesin Genset	440.000
8	Basket	1.288.889
9	Lampu	315.000
	Total	**41.499.815**

Source : Primary data is processed, 2019.

Based on table 2 above, it can be seen that the types of fixed costs used by purse seine business units are ships, nets, lifeboats, boat engines, roller engines, generator engines, basketball, and lights. The average depreciation value of purse seine business units issued each year of the two regencies is not much different at Rp.41,499,815 with the highest depreciation value in the type of net investment of Rp.20,083,333.

Variable Costs

Variable Costs are costs that are used up in one production, costs are not fixed in the amount because it is influenced by the size of the amount of production obtained. The variable cost of the purse seine business unit is Rp. 1,513,680,000 per year with an average of the purse seine vessels in the area the trip time is only 1-4 days per trip.

Total Cost

Total cost (TC) is all costs incurred in business. The average value of the total costs incurred is Rp. 1,553,046,481 per year.

Revenue

Revenue is the multiplication of the products obtained with the selling price. The average value of purse seine fishing revenue in Sinjai district is Rp.3,827,108,333.

Income

Revenue (TR-TC) is the total net income derived from total revenues less than the total costs incurred. The average income of purse seine businesses in Sinjai district is Rp2,197,519,685.

Feasibility

The feasibility analysis of the purse seine business unit with an analysis of the balance of revenues and costs is used to find out how much the costs incurred so that it can provide a number of benefits from the revenue obtained. The average R / C Ratio in the purse seine business unit in Sinjai Regency is 2.42. The R / C Ratio value obtained by the purse seine business unit in Sinjai district is greater than 1, which means that each purse seine business unit is feasible to run.

IV. CONCLUSION

Feasibility Analysis of purse seine business units in Sinjai district, the average R / C ratio value is 2.42, the R / C ratio value is greater than 1, which means that each purse seine business unit is feasible to run.

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Factors influencing Effectiveness of Niger Seed Market Channels of Selected Primary Agricultural Multipurpose Cooperatives in Abay Chomen District, Oromia Regional State, Ethiopia

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Abstract- The total earning from the oilseeds business particularly from the export market of niger seed has increased over the past few years. However, the gain from the business is not fairly distributed and does not properly reach to the primary producers. The objective of the study was to explore key factors influencing the effectiveness of the niger seed market channels of selected primary agricultural multipurpose cooperatives in the study area. Multi- stage sampling technique was used to select the study area and 145 respondents selected using Kothari formula from four purposively selected cooperatives. The data were collected through the survey interview schedule, checklist for focus group discussions and key informant interviews. Binary logistic regression model was employed to analyze the data using SPSS version 16.0. Accordingly binary logit model, variables such as members trust on their cooperatives, access to training and market transparency were found to be the major positively influencing and the significant ones at less than 1% probability level and variables like dividend refund, price of produce, mode of selling and professional management were significant at less than 5%. From the significant variables, variables like price of produce, mode of selling and distance from cooperative market were negatively influencing the effectiveness of niger seed market channels. As per the findings indicated that greater attention should be given by all stakeholders to further improve and maintain the niger seed market channels effectiveness in cooperatives by improving the adverse influence of practices of variables such as members trust on their cooperatives, access to training and market transparency, dividend refund, price of produce, mode of selling and professional management problems in the future intervention which are aimed at for improving the effectiveness of niger seed market channels of cooperatives in the study area .

Index Terms- Cooperatives, Effectiveness, Market channels, Niger seed

I. Introduction

An estimated 2.5 billion households are involved in agriculture, of which 1.5 billion households are in smallholder farming (World Bank, 2008). According to the same source Africa's contribution to the world, agricultural output was 6.35% (about 133.1 quintals (FAO, 2007)). According to Balasubrimanian (2007), agriculture in Ethiopia continues to be the leading sector and in turn mallholder agriculture sub-sector continues to dominate this sector. The Niger seed species constitutes approximately 50% of Ethiopian. Niger seed in Ethiopia is widely grown by smallholder farmers on fragmented land holdings.

There is also large demand for it in the domestic economy since it is used to produce edible oil and oilcake. The total earning from the oilseeds business, particularly from the export market, has increased over the past few years. However, the gain from the business is not fairly distributed and does not properly reach to the primary producers who find them at the end of an extended market channel. The primary producers have no proper access to the final market and marketing and distribution of oil seeds are mainly done by small and medium scale traders with poor marketing facilities, especially for collection, storage and transportation, which cause high post-harvest losses. The marketing channel is long with many intermediaries adding little value to the final product with high transaction costs being incurred. This has been a cause for substantial income loss of the majority of farmers and lacked knowledge on how to add value through partially or fully processing the oilseed products before it is supplied to the market. As niger seed is one of the cash crops of the areas, organizing agricultural multipurpose cooperatives societies has become mandatory to solve market related problems. In order to overcome market failures and to cope with changes in the market environment many developing countries including Ethiopia are returning to agricultural cooperatives (Nicola,

2009). This is due to the fact that cooperatives can reduce transaction costs and improve the bargaining power of smallholder farmers' visa-a-vis increasingly integrated markets.

In principle, cooperatives members are supposed to sell their produce to primary cooperatives, primary cooperatives sell to cooperative unions. However, from own experience and observations cooperatives members are selling their produce more to small traders than cooperatives in the study area. However, the effectiveness of niger seed market channels in cooperatives was not grasped in these previous studies and they do not represent the situation in all regions. To increase farmer members' access to their cooperatives market, researchers and development practitioners need to understand how the niger seed market channels in cooperatives are characterized in operating more effectively and the factors influencing the effectiveness of this market channel. This research was attempt to empirically examine the above issues and helps to bridge the existing information gap by generating empirical evidences. Therefore, the objective of the study was focused on exploring factors influencing the effectiveness of niger seed market channel in selected primary agricultural multipurpose cooperatives in the Abay Chomen District, Oromia regional State.

II. METHODOLOGY

Study Area and Sampling Techniques

In this study multi stage sampling was employed to select the study area and the sampled cooperatives. From 4 selected primary agricultural multipurpose cooperatives with the total number 1,397 of the members in a representative manner to increase its validity and reliability of the study 145 respondents were selected by Kothari (2004) sampling design formula.

$$\mathbf{n} = \frac{\mathbf{z2*p*q*N}}{\mathbf{e2(N-1)+z2*p*q}}$$

Where; **n**= sample size, **N**= total population of the sample frame (1,397), **z =** 95% confidence interval level under normal curve (1.96),) and **p** & **q** are estimates of the proportion of population to be sampled. Then, **P**= proportion of population to be included in the sample 12% of the 1,397 total population.

This study used both primary and secondary data. Survey design method was adopted to collect the data because survey is relatively inexpensive, well suited for simple and short questions and easier to analyze using SPSS (Punch, 1998) to address the objective of the study. Major tools for data collection were semi structured schedules for respondents, focus group discussion and key Informant Interview guided by checklist. Likewise quantitative data were also collected through distributing questionnaires to all sampled respondents under the study, which were the total of 145 cooperatives members'.

Method of Data Analysis

Data were analyzed using binary logit econometric model through computer soft ware statistical package for social science (SPSS-version 16) at confidence level of 95% and χ^2 of association was used to test the association between the independent and dependent variables.

Theoretical framework

Binary logistic is a useful way of describing the relationship between one or more independent variable, as a probability that has only two categorical values. The dependent variable in this study is dummy variable which take the value of one or zero depending on whether the niger seed market channels in selected cooperatives is effective or not. However, the independent variables were either dummy or continuous.

Therefore, binary logistic regression model was employed to analyze the key factors influencing the effectiveness of niger crop market channels in cooperatives. The estimated model is: Pi = F(zi)……(1)

$Zi = \sum_{i}^{m} \beta jxji = \log\left(\frac{p}{1-p}\right) = \propto + \beta iXi + \cdots + \beta iXn + \cdots$ ……(2)(Engleman,1981and Gujarati,1988). Where,

Pi is the probability that the niger seed market channel is effective, the binary variable, Pi= 1 the niger seed market channel is effective and Pi=0,for ineffective market channels). zi =estimated variable for the ith observation , F is the functional relationship between pi and zi. i= 1,2,3…**m** are observation on variables of effectiveness of niger seed market channel, **m** being the sample size 145. xji is the ji^{th} explanatory variable for i^{th} observation

=1,2,….n. βj is a parameter ,j= 0,1,…n where n is the total number of explanatory variable . The logit model assume the underlying index; **Zi** is a rondam variable that predicts the probality of the the Niger seed market channel is effective. Pi (the proportion or probability of 1)Pi $=1/1+e^{-z}$ ……..……3,

pi(the proportion or the probability of 0) P $=1/1+e^{-z}$ …….4

If Pi is the probability of the niger seed market channel is effective then (1-P) is otherwise .

If the disturbance term $\mathbf{U_i}$ is taken in to account, the logit model becomes

$$Zi = \propto + \sum_{i=1}^{m} \beta iXi + \beta mXm \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.5$$

Zi =∝ + βiXi + ……..+ βmXm. before conducting of the regression analysis , multi co linearity problem of independent variables tested. According to, Gujarati,2005, variance Inflation Factor (VIF) is defined as; VIF (Xi)=1/1-R^2……..…….6

Where, $\mathbf{x_i}$ ‘ is the ith quantitative explanatory variables represented on other quantities of explanatory variables, R^2= the coefficient of determination when the variable regressed on the remaining variables. According to, Gujarati, (2003), Variance Inflation Factor (VIF) is used to test the existence of multi collinearity problem among continuous variables. According to Gujarati, (2005) Variance Inflation Factor (VIF) is defined as;

VIF (Xi)= 1/1-R^2…….6

Where, x_i is the ith quantitative explanatory variables represented on other quantities of explanatory variables, R^2= the coefficient of determination when the variable regressed on the remaining variables. And also Contingency Coefficient (CC) tested multicollinearity problem for dummy variables and the decision criterion (CC<**0.75**) is that variables with the contingency coefficient (CC) is computed as follows: **CC=**$\sqrt{\frac{x^2}{n+x^2}}$/ **……7**

Where **C**=coefficient of contingency, $\mathbf{x^{2=}}$ chi-square test**, n** =total sample size.

Table 1: Definition of Variables included in the Empirical Model and their Hypothesized Sign

Variables	Variable description	Measurement	Expected Sign
Effectiveness of Niger Seed Market channel QUNPRO	Dependent variable indicating value **1** if effective and **0** 'if ineffective channel	Dummy variable dependent variable	None
LANH	Quantity produced in quintals	Continuous variable measured in quintals	+
EXTSRV	Size of Land of house holding	Continuous variable measured in hectares	+
CREDAC	Extension service	Dummy variable 1 = Yes 0 = No	+
AMINFCO	Access to credit service	Dummy variable 1= Yes 0=No	+
PRICEPRO	Access to market information	Dummy variable 1= Yes 0=No	+
AGEH	Price of quantity produce	Continuous variable measured in ETB	-
SEXH	Age of household	Continuous variables measured in years	+
TRUSTC	Sex of households	Dummy variable 1=male 0=female	+
INCM	Trust on cooperatives	Dummy variable 1=Yes 0= No	+
MODP	Income of households	Continuous variable measured in ETB	+
DISFROC	Mode of payment	Dummy variable 1= on cash 0= on credit	+
TRANSP	Distance from cooperative	Continuous variable measured in kilometer	–
ACSEDU	Transparency	Dummy variable 1=Yes 0=No	+
ACTRAN	Access to member education	Dummy variable 1=Yes 0=No	+
TRFFCO	Access to training for boards	Dummy variable 1=Yes 0= No	+
STF	Access Transportation facility from cooperative	Dummy variable 1=Yes 0=No	+
PMGT	Storage facility	Dummy variable 1= yes 0=No	+
	Professional management	Dummy variable 1=Yes 0=No	+

Source**:** Hypothesized by the Author

III. ANALYSIS, RESULT INTERPRETATIONS AND DISCUSSIONS

4.2 Key Factors Influencing Effectiveness of Niger Seed Market Channels of Selected Primary Cooperatives

In the study effectiveness of niger seed market channels in cooperatives is expected to be influenced either positively or negatively by 17 factors including size, number of oxen, income source, price of produce, market information, patronage refund, quantity produced, distance from cooperative market, mode of selling, access to storage facility service, transparency, professional management, access to credit service, access to training, access to education , members' trust, and access to extension service. Therefore, variables which were statistically significant in the binary logistic model and remain the best predictor of dependent variable were discussed hereunder.

Table 4.1: Parameters Estimates for Binary Logistic (Variables in the Equation)

		Coefficient(B)	S.E.	Wald	df	Sig.	Exp(B)
Step1	INCM	.331	3.761	.008	1	.930	.718
	DIVIR	2.020	1.020	5.370	1	.020**	13.891
	QUNPRO	.054	1.141	.002	1	.962	1.056
	OXENH	.151	1.604	.009	1	.925	.060
	PRICEOPRO	-2.808	1.268	4.901	1	.027**	11.601
	AMINFCO	.539	.938	.330	1	.566	.583
	TRFFCO	.320	1.223	.069	1	.794	1.377
	STF	5.977	3.641	2.695	1	.100*	2.149
	DISFROC	-2.197	1.291	2.897	1	.089*	9.007
	MOPS	-3.345	1.625	7.519	1	.042**	6.456
	TRUSTC	3.45	1.401	1.65	1	.000***	24.784
	ACTRAIN	2.126	1.681	2.673	1	.003***	21.881
	ACSEDU	.516	2.257	.052	1	.819	1.675
	CREDAC	4.344	1.297	1.702	1	0.091*	9.709
	EXTSERV	2.367	1.301	3.280	1	.070*	7.124
	PMGT	2.358	1.038	5.166	1	.027**	23.322
	TRANSP	4.513	1.626	4.038	1	.000***	23.671

a. Variable(s) entered on step 1: INCMS. DIVIR, QUNPRO, OXENH, PRICEOPRO, AMINFCO, TRFFCO, STF, DISFROC, MOPS, TRUSTC, ACTRAIN, ACSEDU, CREDAC, EXTSERV, PMGT, TRANSP

Source: computed from survey data, 2014
Note: *, ** ,**and ***** is **Significant** at **1%, 5%** and **10%** probability level respectively

4.2.1 Analysis of Results from Logistic Regression Model

The influence of statistically significant variables are interpreted and discussed here under:

Members' trust on their cooperatives (TRUSTC): All the activities of the cooperative are carried out with the consent, trust and full participation of members in the cooperative market channels. Cooperatives lost trust by its members could not have effective market channel and thus cannot exist in competitive market environment. It was hypothesized that members' trust has positive influence on the effectiveness of niger seed market channels in cooperatives under the study. The result of the survey revealed that this variable is also positively associated with the independent variable and statistically significant at 1% (0.000, P-value <0.01) of probability level. This implies that the coefficient of Exp (β)) value signifies that this members' trust on their cooperative is a use full explanatory variable having positive influence on the effectiveness of niger seed market channels in cooperatives. According to the likelihood ratio, more the trust on cooperative, it is more likely an increase in the effectiveness of niger seed market channels in cooperative by 24.784 times, if other variables held ceteris paribus.

Access to Training (ACTRAIN): This variable is very crucial for the effectiveness niger seed market channels in cooperatives as it has positive influence on the effectiveness of niger seed market channels in cooperatives. In line with this hypothesis, this independent variable and effectiveness of niger seed market channels in cooperatives were positively associated and significant at level of 1%(0 .003, p<0.01) probability level. As per the binary logistic regression result shown in the table 4.1 above, as training access increases, so also the effectiveness of

niger seed market channels of cooperatives increases by factor 21.881 times , if other variables are held constant.

Transparency (TRANSP): This variable is fundamental for efficient management of cooperatives, to promote homogeneity and limit free riding or opportunistic tendencies by members (Develtere et al. 2008). It is a dummy variable with value 1, if leaders are transparent; and **0,** if not. The result of the survey revealed that this variable also positively associated with the independent variable and statistically significant at 1% (0.000, P-value <0.01) of probability level, which is dittoed by the coefficient of Exp (β)) value also. According to the likelihood ratio, the more the availability of transparency in cooperatives, the more effective will be the niger seed market channels in cooperatives, by a factor of 23.671, if other variables are held ceteris paribus.

Dividend Refund (DIVIR): Patronage dividend distribution is one of the promotional strategies that can encourage members' participation in cooperative activities. This variable is expected to positively influence the effectiveness of niger seed market channel in cooperatives. In line with this hypothesis, this independent variable and effectiveness of niger seed market channels in cooperatives were positively associated and significant at level of 5 %(0.020, P < 0.05). The Exp (β) value signifies that this variable is a useful explanatory variable having positive influence on the effectiveness of niger seed market channels in cooperatives. As an increase in the availability of patronage dividend refund contributes to an increase in the likelihood of effectiveness of niger seed market channels in cooperatives by factor of 13.891, if other variables ceteris paribus.

Price of produce (PRICEOPRO): The price influence is one form of cooperative effect that the cooperative passes on the members' economy. So, charging similar or better price for members' niger seed produces increases marketing through cooperatives. This variable influenced the members to market through cooperative channels which decreases the effectiveness of the channels at the significance level of 5 %(**.**027, p<0.05). Charging competitive price for quintals of members' seed increases the probability of effectiveness of niger seed marketing channel in cooperative. And its intensity by 11.60 is the likelihood ratio. This independent variable is hypothesized to influence positively the effectiveness of niger seed market channels in cooperatives. However, the survey result indicates negative influence on effectiveness of niger seed market channels in cooperatives. The implication is increasing in a unit likelihood ratio of the price from non- cooperatives market channels reduces the effectiveness of niger seed market channels in cooperative by a factor of 11.601, if other variables are held constant.

Distance from cooperative (DISFROC): This variable has negative influence on effectiveness of niger seed market channels in cooperatives and found to be statistically significant at less than 10% significance level(0.089, p-value <0.1). The negative relationship indicates that the farther is a household (cooperative members) from the cooperative market, the more difficult and costly it would be to get involved in the niger seed market channel in cooperatives. The influence also confirms that one-kilometer increase in cooperative market distance from the niger seed producers reduces the probability of effectiveness of niger seed market channels in cooperatives by 9.007,if other variables ceteris paribus

Storage Facility (**STF)**: This independent variable and effectiveness of niger seed market channels in cooperatives were positively associated and significant at level of 10 %(0.100, p<0.1). The variable expected positive influence on the effectiveness of niger seed market channels in cooperative. The Exp (β)) value signifies that this variable is a useful explanatory variable having positive influence on the effectiveness of niger seed market channels in cooperatives. That is, an increase in the availability of storage facility for members contributes to the more likely increase in the likelihood ratio of the effectiveness of niger seed market channels in cooperative, by a factor of 2.149, if other variables are held constant.

Mode of payment system (MOPS): This independent variable and effectiveness of niger seed market channels in cooperatives were negatively associated and significant at level of 5 %(0 **.**042, p<0.05). This implies that as the cooperative needs to purchase on credit the members' produce rather than on cash mode of purchasing; members decreased their sale proceeds through cooperative market channels. The Exp (β)) value signifies that this variable is a useful explanatory variable having negative influence on the effectiveness of niger seed market channels in cooperatives. This implies that as and when members sell their niger seed on credit to cooperatives, it will decrease the likelihood ratio of the effectiveness of niger seed market channels in cooperative by a factor of 6.456, if other variables are held constant.

Access to Extension Service (EXTSERV): This explanatory variable and the variable effectiveness of niger seed market channels in cooperatives (dependent variable) are positively associated and significant at level of 10%(0 **.**070, p<0.1) probability level. The Exp (β) value revealed that this variable is a use full explanatory variable having positive influence on the effectiveness of niger seed market channels in cooperatives, by a factor of 7.124 times ,if other variables are held ceteris paribus.

Credit Access (CREDAC): The ρ-value is 0.091 (<0.10). This indicates that it is statistically significant predictor variable, which has a positive partial effect on the effectiveness niger seed market channels in cooperatives and the same holds true with its Exp (ß) value. Therefore, the null hypothesis which states that the more credit accessibility from cooperatives received, the more effective will be the niger seed market channels in cooperatives is not rejected since a unit increase in credit services has increased the likelihood of the effectiveness of the niger seed market channels in cooperatives, by a factor of 9.709, if other variables remain constant.

IV. Conclusion

The binary logistic regression model indicated that eleven variables included in this model were found to have a significant influence on the likelihood of the effectiveness of niger seed market channels in cooperatives. Accordingly, variables such as members trust on their cooperatives, access to training and market transparency were found to be the major influential and the significant ones at less than 1% probability level From the study result it is possible to conclude that effectiveness of niger seed market channels in selected cooperatives requires set of services offered by the channels involving not only the factors, but also the provision of different services including member education and training in the study area, if not effective niger seed market

channel of cooperatives cannot be addressed. So, study on determinants of market channel preferences among niger seed farmers of cooperatives is necessary to maintain a competent market channels in cooperatives, which could be attempted by other prospective researchers in future.

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The Extent of Adopting Climate Smart Agriculture Technologies in Addressing Household Food Security in Makueni County, Kenya

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Abstract: Food insecurity is a concern for households and government. It destabilizes social, economic and political wellbeing. Despite Kenya's government efforts in provision of incentives like climate smart subsidies to address food insecurity, Makueni County still experiences food deficit. This article endeavored to assess extent of adoption of climate smart agriculture technologies in addressing household food security. Findings revealed that climate smart agriculture technology accessed and practiced had low adoption on food security. Farmers were willing to adopt technology but cultural factors hindered its adoption. From findings, limited resources was the main constraints to CSA technologies adoption and extension services provision.

Keywords: *Adoption, Climate smart agriculture, Climate smart technologies, Household food security*

Introduction

A country that is food insecure is very vulnerable to other threats that can destabilize the social, economic and political wellbeing of a country. There is global demand for agriculture to produce more on the same amount of land while adapting to a changing climate extreme weather events such as drought and floods (Steenwerth *et al*., 2014). A study by Nyongesa *et al*., (2017) cited climate change and vulnerability as one of the biggest environmental, social and economic challenges currently facing the World as well as undermining the drive for sustainable development, particularly in sub Saharan Africa. Further, the same study depicted a change in precipitation pattern that was consistent with projection that Kenya's vulnerable ASALs would experience an increase in the frequency and severity of droughts and significant declines in rainfall and river flows due to climate change and vulnerability necessitating adoption of CSA. FAO, (2014) found that CSA increases crop yields, enhance carbon content in soils and maintain soil moisture. In this regard, CSA contributes to the achievement of sustainable development goals by integrating the three dimensions of sustainable development (economic, social and environmental) to address food security and climate challenges FAO, (2013).

Across Africa, farmers are embracing "climate-smart" innovations against challenges of more frequent, intense and longer droughts, and floods which threaten sustainable development Nyasimi *et al.*, (2014). In 2011, more than 12.5 million people were affected by the prolonged drought and the result was catastrophic famine and hunger in the Horn of Africa. In response, Africa has put in place many initiatives on CSA technologies with capacity to increase agricultural productivity and build resilience. Despite these efforts, they remain unrecognized at the continental, regional and even national level (World Bank: CIAT, 2015). This CSA study provides more understanding to enhance the implementation of the Comprehensive African Agricultural Development Program, (2010) and the Malabo Declaration of the 23rd Ordinary African Union Assembly on Accelerated Agricultural Growth and Transformation as well as contributing to the Kenya's efforts under the *National Adaptation Plan*.

Agriculture in Kenya is facing productivity and food security challenges as a result of inadequate investments in CSA technologies (World Bank, 2015). This situation was exhibited in 2011 when about 3.5 million people were declared food insecure with significant numbers facing chronic hunger after consecutive years of below-average rainfall (AHDR, 2012). Further impact of the drought was felt in 2012 in Kenya where over 10 million people suffered from chronic food insecurity and poor nutrition, while 7.5 million people live in extreme poverty (Republic of Kenya, 2012). The country has continued to experience four consecutive rain seasons failures from the long rains of 2016 with population at risk increasing from 1.2 Million people in July 2016, to 2.5 Million people in February 2017 and 3.5 Million people in September 2017 (Republic of Kenya, 2014). This led to extreme drought situation in the 23 ASAL Counties and subsequent declaration of drought as a national disaster by the President in February 2017. In regard to this situation, Kenya is geared to transform its agriculture sector in order to meet the food demand for its growing population through sustainable land and water management practices (World Bank, 2015). The government efforts according to the World Bank, include scaling up of CSA technologies, practices and innovations through an institutional coordination approach as follows: the Constitution of Kenya devolves key agricultural sub-sectors to county government for timely agricultural decision making that accelerate the implementation of policies and incentivize CSA adoption; *Kenya Vision 2030* target agricultural investment in key areas such as productivity of agricultural enterprise, expansion of irrigated land for agriculture, improve market access and supply chains; the *Agricultural Sector Development Strategy 2010-2020* under the Ministry of Agriculture, Livestock and Fisheries focuses on transforming smallholder agriculture from low-productivity subsistence activities to a more innovative agribusiness.

Despite these different frameworks, policies and strategies developed over the years, coordination is critical for successful implementation of CSA interventions. In this regard, the government developed the *Kenya Climate Smart Agricultural Program 2015-2030 Framework* to provide effective coordination of CSA interventions in the country. Kenya and the World over is searching for technological and environmental solutions that can combat the resultant food deficit, change of eating habits and negative attitude towards new appropriate technological strategies (World Bank, 2015). In line with Vision 2030 and Agricultural Sector Development Strategy 2010-2020 both have objectives of transforming agriculture into modern and commercial viable sector achieving an average GDP growth rate of 10 percent per year up to 2030 in Kenya.

Measuring of adoption rate

Adoption of technological innovations in agriculture has attracted a lot of attention because new technologies have potential to provide an opportunity to increase crop production and income according to Richard *et al.,* 2003 in Jain *et al.,* (2009). These technologies implementation has partial success as demonstrated by observed rates of adoption. These adoption rates or pattern are as per the survey guide on twofold adoption of agricultural technologies developed by CIMMYT (1993) through seeking opinion of farmers (perception) on new technology and carrying out statistical comparison of adoption on the identified technologies. On perception, adopted farmers are asked to explain the reasons for using a technology and/or farmers who not adopt are given opportunity to express reasons for their choice. On the other hand, statistical comparison is by use of statistical analytical tools such as Spearman's ranking correlation, Regression, Chi-square and t-test which compare characteristics of farmers who have adopted a technology.

Climate Smart Cropland Practices

Despite the capacity to potentially generate high yields and farm income thereby enhancing food security, the adoption of climate smart agriculture technologies (CSA) has been relatively low globally (FAO, 2010). Previous empirical studies by Tiruneh *et al.,* (2015) on adoption and diffusion of agricultural innovations attributed the low adoption rate to farmers' decision being influenced by various different factors such as physical and financial capital including access to credit, farm size as well as availability of improved seed and distance to input sources (accessibility). Other factors included access to information on the productivity of the technology and farmers' attitude towards risk on the technologies, out of which those that involve lower risk have greater preference of smallholder farmers as they are more risk-averse.

Water harvesting technologies (RWHTs)

Rainwater harvesting has been in existence for many decades in the World and has positively impacted life, agriculture and economy (Scherr *et al*., 2012). For example, Singapore which has limited resources in terms of land and water has turned heavily to rainwater harvesting with 48 percent of its land is used as water catchment area. According to FARA (2016), cited in Makdaschi *et al.,* (2013) states that water harvesting is part of integrated water resource management technologies which Finger and Bore (2013), refers the major technologies as macro-catchment technologies (flood water, roads surface, runoff utilization, rock catchment, and earth dams); micro-catchment technologies (runoff close to growing crop, zai pits, strip catchment tillage) for growing medium water demanding crops- maize, sorghum and millet; rooftop harvesting technologies. The potential existing in harvesting runoff water and conservation of valley bottom reservoir according to Karina *et al.,* (2011) it supplements crop water requirements without installation of complicated equipment or with only modest investment thereby unleashing the potential for increased household food security.

Liniger *et al.,* (2011) found that an extra 10-25 percent of water runoff harvested and made available during critical periods of plant growth can double or triple crop yields. Despite the recent developments in expansion of rainwater catchment systems in Africa, adoption of rainwater harvesting technologies is slower as compared to other continent (Finger and Bore, 2013). In Kenya adoption of rainwater harvesting techniques (RWHT) is not different from the sub Saharan Africa particularly in Makueni County where despite their potential to improve food security and livelihoods, the households are slowly adopting RWHTs.

The vulnerability models

The multi-dimensional nature of the vulnerability model as posted by Roxana *et al* (2013) investigates five dimensions of assessment in household vulnerability in Makueni County. First, the physical/functional dimension which relates to the disposition of a structure, infrastructure or service to be damaged due to the occurrence of a harmful event associated with drought; second was the economic dimension which relates to economic stability of a household endangered by a loss of production, decrease of income, or consumption of food due to the occurrence of a protracted drought. The third was the social dimension that relates with the presence of human beings, individuals or communities, and their capacities to cope with, resist and recover from impacts of hazards-climate change and drought. The fourth assessment was the environmental dimensions inferring interrelation between different ecosystems and their ability to cope with and recover from impacts of hazards over time and space. Lastly, the political/institutional dimension which were the political or institutional actions such as livelihood diversification, risk mitigation strategies- insurance, credit markets, social safety net programs, government and donor-funded projects and agricultural extension or regulation control that determines different coping capacities and exposure to hazards and associated impacts.

The Bohle's vulnerability conceptual framework further illustrate the interaction between the interventions (CSA technologies) expected to increase household productivity and incomes as well as enhance resilience to impacts of hazards- climate change, drought and floods. Bohle's Vulnerability Conceptual Framework is a combination of famine and food insecurity vulnerability together with climate change and variability vulnerability (Shitangsu, 2013). The former explains vulnerability to famine in the absence of shortage of food or production failures as well as describing vulnerability as a failure of entitlements and shortage of capabilities according to Bohle *et al* (1993) as used in Shitangsu, (2013).

According to Bohle, (2001) vulnerability to food insecurity as well as climate change and variability has external and internal perspectives thereby referred to as double structure of vulnerability model. The external side of the model is related to the exposure of household to risks and shocks and is influenced by political economy approaches such as social inequities and disproportionate division of assets together with human ecology perspective which includes population dynamics and environmental management capacities. The Entitlement Perspective relates vulnerability to incapacity of household to obtain or manage assets through legal and customary rights to exercise command over food and other necessities of life (Mendes *et al.*, 2012). This complements the foregoing two models as advanced by Roxana *et al* (2013) and Bohle (2001) in strengthening and supporting the security of land tenure perspective which plays critical contribution to adoption and investment of climate smart agriculture technologies.

Methods and Materials

Study Area

The study was conducted in Makueni County in its three Agricultural Ecological Zones (AEZ) –Upper (1), Middle (2) and Lower (3) of the four (4) constituencies as follows: Mbooni-(Upper Zone-1), Kaiti/Kilungu (Upper and Middle Zones-1/2), Makueni / Kathonzweni (Middle and Lower Zones-2/3), and Kibwezi West/Makindu (Lower Zone-3). The County is characterized by a rapid growing population, water scarcity, falling food production and low resilience to climate change and variability (Republic of Kenya, 2014). The County has a total population of 883,671 people (2009 census) with an annual growth rate of 2.4%, which is projected to 922,183 in 2012 and further projected at 1,002,979 in 2018. This consists of 488,378 males and 514,601 females, out which 90% of the population settles in the rural areas (MCIDP, 2018-2022, Republic of Kenya, 2013; CBS, 2002).

Research design

Researcher used descriptive and inferential research design that employed cross sectional approach to examine the contribution of climate smart agriculture on household food security in Makueni County since the design facilitates a detailed description of the problem and inferences made in the study population as it "involves a close analysis of a situation at one particular point in time to give a snap shot result" as cited in Neville (2007) cited in Shitangsu (2013).

Sample size

The sample size was drawn from a list of 784 villages obtained from the Kenya National Bureau of Statistics (KNBS) with projected population of 1,002,979 in Makueni County. A sample size of 32 villages was randomly drawn from the population frame out of which 400 households participated in the study. Key informants were representatives from the Ministry of Agriculture, Fisheries and Livestock; Kenya Agricultural and Livestock Research Organization (KALRO), National Drought Management Authority (NDMA) and Non-governmental organizations.

Data collection

Qualitative and qualitative data was collected through a household survey questionnaire, key informant interviews and focus group discussion were administered personally by the researcher and occasionally with the help of research assistants. Observation was used to corroborate information collected using the three data instruments. Data collection instruments were developed after analysis of similar studies through literature review, deliberations with practitioners in this field. Household questionnaire had a five point Likert scale designed to assess status of food security and levels of involvement in climate-smart agricultural technologies. A focused group discussion guide was used in selected households to explore extent of adoption issues related to food security and climate smart agriculture. Key Informant Interviews (KII) guide was developed and administered to experts from various organizations that formed part of respondents. Obtained data was used to triangulate questionnaire survey feedback given that experts were purposively chosen to participate as KII. All instruments were pre-tested during piloting and adjustments made accordingly before its final administration. Piloting was mainly used to validate the tools.

Data analysis

Both quantitative and qualitative approaches were used for data analysis. Quantitative data from the questionnaire were coded and entered into the computer for computation of descriptive and inferential statistics. Statistical Package for Social Sciences (SPSS) was used to analyze collected data while qualitative data from key informants were manually processed and presented verbatim.

Results and Discussion

This section presents, interprets and discusses the extent of adoption of climate smart Agriculture (CSA) technologies in addressing household food security in Makueni County. The results reflect the demographic characteristics of the respondents and other variables that measured observed rate of adoption by seeking opinion of household (perception) and carrying out statistical comparison of adoption on the identified CSA technologies.

Climate Smart Agriculture Technologies

With regard to climate smart agriculture technologies, respondents were asked to indicate their assessment on access to and knowledge of individual and combined climate smart agriculture technology(s) in relation to their adoption. Their responses were measured on Likert scale where 1=strongly disagree 2=Disagree 3=Neutral 4= Agree 5= strongly agree. Table 1 presents summary of their feedback/responses.

Table 1 Respondents Assessment of Climate Smart Agriculture Technologies

Measure	Score	Frequency	Percent
I have access to farm inputs	Strongly disagree	57	14.3
	Disagree	39	9.8
	Neutral	14	3.5
	Agree	70	17.5
	Strongly Agree	220	55
	Total	400	100
I have access to credit facilities	Strongly disagree	203	50.8
	Disagree	48	12
	Neutral	7	1.8
	Agree	57	14.3
	Strongly Agree	85	21.3
	Total	400	100
I have access to market infrastructure	Strongly disagree	126	31.5
	Disagree	24	6
	Neutral	21	5.3
	Agree	86	21.5
	Strongly Agree	143	35.8
	Total	400	100
I have favorable land tenure system	strongly disagree	73	18.3
	disagree	35	8.8
	Neutral	11	2.8
	agree	87	21.8
	strongly agree	194	48.5
	Total	400	100.0

N=400

Table 2 Respondents Assessment of Climate Smart Agriculture Technologies

Measure	Score	Frequency	Percent
I have knowledge and use agroforestry practices	Strongly disagree	75	18.8
	Disagree	27	6.8
	Neutral	22	5.5
	Agree	69	17.3
	Strongly agree	207	51.8

	Total	400	100
Have access to extension and weather advisory services	Strongly disagree	193	48.3
	Disagree	38	9.5
	Neutral	23	5.8
	agree	65	16.3
	Strongly agree	81	20.3
	Total	400	100
Have access to and use combined climate smart agriculture technologies	Strongly disagree	187	46.8
	Agree	46	11.5
	Neutral	31	7.8
	Agree	52	13
	Strongly agree	84	21
	Total	400	100

N=400

From table 1 and 2, results indicated the climate smart agriculture technologies that were accessed in Makueni County and subsequently affecting their adoption rate. The most accessed CSA technologies for agricultural productivity included farm input at 72.5 percent majority of households, secure land tenure system (70.3%), agroforestry (69. %) and market infrastructure (57.3%) with credit and extension services not widely accessed.

However, majority of households at 62.8 per cent disagreed that they are able to access credit facilities with 57.8 percent of the households also disagreeing that they access extension services and weather advisory services that were important for their adoption. Key informants reported that most households are unable to access credit due to failure to secure guarantors, fear of high interest rates and lastly, farmers not having trust in the financial institutions.

Further the study revealed that 69 percent of the respondents had knowledge and practice agroforestry and 70.3 percent of the households found their current farm tenure system to be favorable for agricultural production and thus an incentive for adoption of CSA technologies.

In general, 34 per cent of surveyed households had access and use combined climate smart agriculture technologies in increasing agricultural productivity which indicates relatively low rate of adoption and diversification of technologies. This finding disagreed with *a national household baseline survey by MoALF, (2014) on implementation status of agricultural sector development support program* that found 52 percent of respondents had accessed to at least one new improved agricultural technology within the previous two years. However, Wekesa *et al.,* (2018) agreed that CSA technologies can be adopted in varied combinations and the adoption rate was still low with many smallholder farmers implementing low capital requirement practices which could have been attributed to resource constraints. The access to market infrastructure (57.3%) influences crop diversification and adoption rate of technologies which Kipkoech *et al.,* (2015) found that access to market provide opportunities for farmers to adopt new technologies and diversify crop production that considerably increased yields and income.

The researcher conducted further test to establish a relationship between access to and use of combined CSA technologies together with awareness and practice of CSA technologies which is a proxy for adoption. The study demonstrated a medium positive correlation of $r = 0.505$ (Table 1) with a statistically significant $p < 0.05$. Correlations analysis revealed that access to and use of combined CSA technologies is positively associated with awareness and practice CSA technologies (Adoption). This inferred that increase in knowledge and practice of CSA technologies increases the probability of households accessing to and using combined CSA technologies, thus the need for vibrant extension advisory services that increases knowledge and adoption. Further, figure 1 present correlations on relationship between individual CSA technology and awareness and practice CSA technologies as proxy for adoption. The Spearman's correlation analyzed relationship between individual CSA technology such as irrigation technique for agricultural production and awareness and practice of CSA technologies and was statistically insignificant at $p > 0.05$, approx. $p= 0.05$. Therefore, this finding shows that there is no association between using irrigation technique for agricultural production and being aware and practicing CSA technologies among the respondents. However, this study revealed that awareness and practice of CSA technologies is positively associated with having access to extension services. This analysis indicated a moderate positive correlation of access to extension services with awareness and practice of CSA technologies ($r = 0.443$) which is statistically significant at $p < 0.05$. $p = 0.000$, implying that extension services is critical for enhancement of knowledge and practice of CSA technologies (Adoption). Further, there was low positive correlation between having favorable land tenure system and awareness and practice of CSA technologies ($r =.109$) which is statistically significant p

< 0.05, p =0.29, revealing a low positive but significant relationship between awareness and practice of CSA technologies and having favorable land tenure system. The results indicated that with increased knowledge on CSA technologies can motivate the government to fast track and expand adjudication together with title issuance program.

Meanwhile, result revealed a weak negative correlation between having knowledge and use of Agroforestry practices and being aware and practice CSA technologies (Adoption) at r = -0.008). The study indicated that the relationship was statistically insignificant at p > 0.05, p= .875, depicting no association between having knowledge and use of agroforestry practices and being aware and practicing CSA technologies among the respondents. This result can be explained by suggestion that knowledgeable or high educated respondents tends to prefer high cost technologies such as agroforestry and irrigation that have diversified risks and thus negative insignificant association. Further, weak positive correlation between having access to market infrastructure and awareness and practice of CSA technologies (r =.128) was observed with statistically significant at p < 0.05, p =0.10. The findings had a low positive but significant relationship between awareness and practice of CSA technologies and having access to market infrastructure meaning that access to market is an enabler to high adoption rate. The same analysis depicted a medium positive correlation between access to credit facilities and awareness and practice of CSA technologies (r = 0.480) which was statistically significant at p < 0.05. p =0.000. Correlations revealed that access to credit facilities is positively strongly associated with having awareness and practice of CSA technologies. This finding suggest that respondents who have increased access to credit are more knowledgeable and practice CSA technologies depicting enhanced adoption rate for CSA technologies.

Further, the researcher sought to examine the households practicing climate smart agriculture technologies such as agroforestry, conservation agriculture, irrigation and extension services with respect to their age. In this regard, the study examined age as a determinant factor in the practicing of climate smart agriculture in Makueni County using Pearson Chi-Square Test. The age categories were 15-25, 26-35, 36-45, 46-55 and over 56 years.

Table 3: Age categories with respect to practicing of CA, agroforestry, Irrigation and Extension Services

	Age Category in years				
CSA Practice	**15-25**	**26-35**	**36-45**	**46-55**	**Over 56**
Conservation Agriculture	37.5%	32.6%	46.9%	59.2%	46.2%
Agroforestry	66.7%	55.1%	64.2%	75.5%	55.8%
Irrigation	47.9%	62.9%	53.1%	53.1%	42.3%
Extension services	2.1%	26.4%	33.5%	47.9%	26.9%

N=400

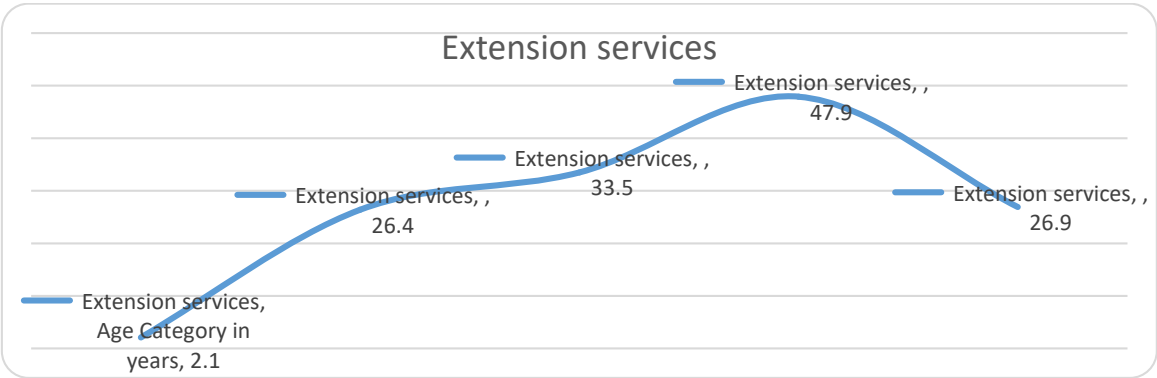

Figure 1: Age versus access to Extension services in CSA

The finding was presented in table 3 and figure 1. The results showed that the youthful households, from 15 to 35 years were not so active in practicing CSA technologies confirming that they migrate to urban areas as compared to the farmers from 36 years and above. For instance, with Conservation agriculture, from ages 15-35 constituted youth at 34.3%, ages 26-35 constituted 32.6%, ages 36-45 were 46.9% while over 56 years were 46.2%. Access to extension services was also determined by age, at 15-25 years, 2.1% reported to have received extension services. The percentages kept on rising to a climax of 47.9%, which constituted households at the age of 46-55 years as the most active respondents adopting and practicing CSA technologies and suddenly declined from the age of 56 years and above to 26.9% of households. This means as the households start to age, they get less involved in agricultural practices. The age over 56 years becomes less active because they do not have the energy, vigor and resources as they used to do. They also decide to give an opportunity to the youthful farmers to take over. Similar findings have been documented by Akinwalere, (2017), in his study on the determinants of adoption of agroforestry practices among farmers in southwest Nigeria.

Awareness and Practice of Climate Smart Agriculture (Adoption rate of different CSA technologies)

With regard to analyzing adoption rate and/or pattern as well as exploring extent of adoption of CSA technologies, the researcher further sought opinion (perception) of households, their proportion that were aware and practiced climate smart agriculture

technologies such as conservation agriculture, agroforestry, irrigation, access to credit, input and extension services. Every respondent was asked to indicate whether they were aware and practice climate smart agriculture technologies. Their responses are given on figure 2

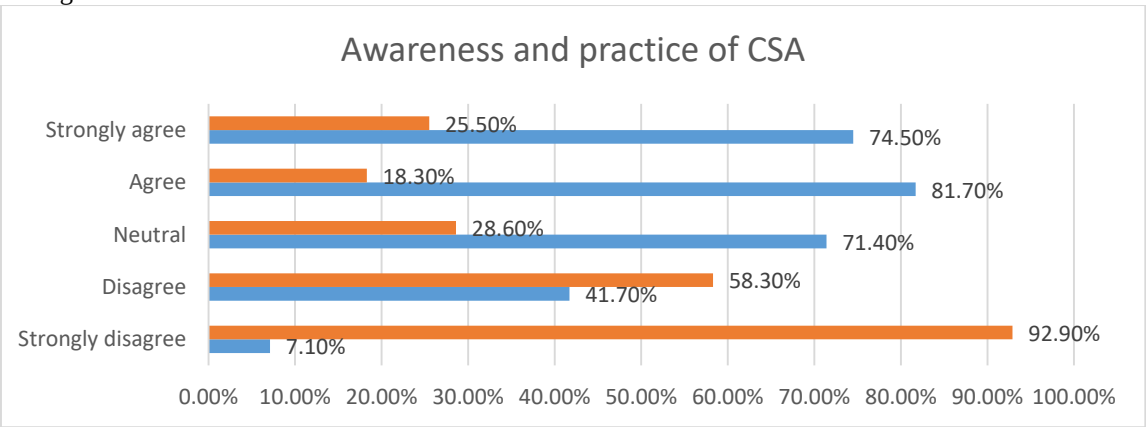

Figure 2 Knowledge and practice of CSA

The study in figure 2 showed that majority of respondents (93%) strongly disagreed that they have knowledge and/or practice climate smart agriculture. This result agreed with the level of education where 36 per cent of the households having acquired primary education and below affecting the choice and investment in CSA technologies coupled with age above 55 years of respondents at 13 percent. This implied that level of education of the respondents can hinder them access credit and extension services thus reducing adoption rate. This agrees with FAO, (2010) that despite the potential of CSA to generate high yields and farm income thereby enhancing household food security, the adoption of CSA technologies has been relatively low globally. In this aspect, Wekesa *et al.*, (2018) attributed this low rate of practice of CSA to resource constraints resulting in implementing low capital agricultural practices such as use of manure and crop residue while Chesterman & Neely, 2015) cited that uncoordinated policies and institutions have potential to undermine the farmers' effort to gain access to inputs and credit.

With respect to knowledge and use of agroforestry practices as preferred low risk CSA technology, the Ministry of agriculture, livestock and fisheries while evaluating the Agricultural Sector Development Support Programme (2014) found that majority at 92 per cent of the farmers surveyed expressed willingness to adopt agroforestry techniques with at least 42 percent of households practiced agroforestry (ASDS, 2010-2020). However, farmers were not knowledgeable about agroforestry as a land-use practice or about the various systems that may be applied on their agricultural farms. In this regard, among those who practiced agroforestry, the evaluation study found that 42 per cent of households were most common planted trees for windbreak, followed by shade trees (37%) and fruit trees at 11 per cent while multi-storey cropping was not very common at 1 percent of households used this system of agroforestry. Gender responsive CSA technologies can lead to the betterment of the lives of different smallholder farmers (Nelson *et al.*, 2016). The study explored five CSA technologies and evaluated how households were involved in the practices and adoption, according to gender.

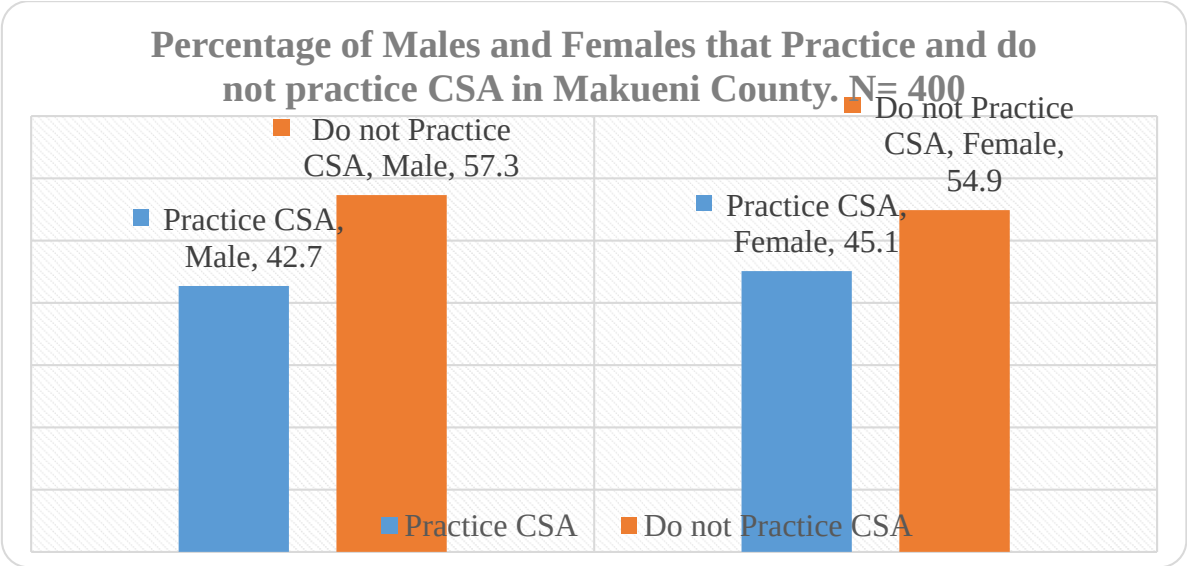

Figure 3: Practice of CSA by Gender

In 2011, Food and Agricultural Organization (FAO) documented that women in the agricultural sector comprises 43 percent in the developing countries. The results of this study in figure 3 indicated percentages of men and women that practices and hence adopted CSA were 42.7 percent and 45.1 percent respectively. The result revealed more women practice CSA than men affirming that the later (men) migrate to urban areas searching for employment, thus the observed high off-farm source of income (31.25%)

of the household in Makueni County. Women have a higher labor burden than men because they engage in unpaid household responsibilities in collecting fuel, fetching water and still afford to dedicate significant time and resources in agriculture (Team *et al.*, 2011). The percentages of men and women involved in climate smart agriculture are comparable an indication that adoption of gender responsive CSA technologies has livelihood benefits such as incomes, ability to access credit and changes in intra-household decision making.

The researcher further sought to determine the level of adoption of different CSA technologies by using statistical comparison of Spearman's Ranking and Correlation of awareness/practice of climate smart agriculture and the individual/combined CSA technologies. Findings are presented on table 4.

Ranking was done in order of strength of spearman correlation analysis to determine adoption level of different CSA technologies.

Table 4 Spearman's Ranking and Correlation

CSA Technologies	Spearman correlation value	Nature of correlation	Level of correlation
Conservation agriculture practice	0.748	Positive and statistically significant	High
Have access to and use combined CSA technologies	0.505	Positive and statistically significant	Medium
have access to Credit facilities	0.489	Positive and statistically significant	Medium
Have access to extension services	0.443	Positive and statistically significant	Medium
I practice water harvesting that I use to farm	.327	Positive and statistically significant	Low
have access to market infrastructure	0.128	Positive and statistically significant	Low
I have favorable land tenure system	0.109	Positive and statistically significant	Low
I use irrigation for my agricultural production	0.037	Positive and statistically insignificant	Low
I have knowledge and use Agroforestry practices	-0.008	Negative and statistically insignificant	Low

There was evidence of statistically significant bivariate and positive association between the household awareness and practice of climate smart agriculture with access to credit facilities, access to market infrastructure, land tenure system, access to extension and weather advisory services together with combined CSA technologies as well as water harvesting techniques. Meanwhile, the association of knowledge and use of agroforestry is negative and not significant to the awareness and practice of climate smart agriculture.

The results presented on Table 4 mean that higher rho coefficients denote a stronger magnitude of relationship between variables. Smaller rho coefficients denote weaker relationships**.** This analysis was used to rank households adoption rate on CSA technologies with evidence showing that conservation agriculture together with combined technologies and household awareness and practice of climate smart agriculture rank highest and medium adoption because of strongest relationship of Spearman's value of rho .748 which is ranked high adoption and .505 ranked medium respectively with strong statistically significant and positive bivariate association. This implied household preferred practicing conservation agriculture and different CSA technologies in their farms to reap the synergy exhibited in the practice of combined technologies and crop diversification. This high adoption rate could have been attributed to households' diversification of climate smart agriculture technologies which had potential of enabling them to invest in risk reduction and high intensive capital techniques and practices such as conservation agriculture and irrigation which can stabilize food production.

Further, access to credit facilities (rho .480) and access to extension and weather advisory services at rho.443 are ranked medium followed by water harvesting techniques at rho.327 ranked low. These technologies had positive correlation which was statistically significant at the 0.01 level (2-tailed). Further, the other technologies had low adoption level with rho value of .128 and .109 for access to market infrastructure and having favorable secure land tenure system respectively with positive correlation which was significant at the 0.05 level (2-tailed). Surprisingly, use of irrigation for agricultural production and access to input had low adoption rate with spearman's rho value of .037 and .030 respectively, implying a positive relationship with climate smart agriculture but not statistically significant which could have been attributed to the fewer households who accessed farm input and practiced irrigation as these technologies are high intensive capital investment. The finding was similar to that of Kipkoech *et al.*, (2015) who opined that existing policies target smallholder farmers who lack resources to adopt innovations such as CSA

technologies. This leads to the slow rate of up-take (adoption) of innovations such as use of improved seeds, agroforestry and irrigation agriculture particularly in short term due to significant cost involved. The practice of wide range of CSA technologies has the potential to increase food production and enhance the resilience of food production systems, thus CSA should be embedded into National Agriculture Food Security and Investment Plan as well as the Sendai Framework to transform food system and reduce vulnerability of households to effects of disaster risks such as climate change, drought and floods.

Another interesting finding was on the low adoption level of agroforestry practice which had spearmen's value of -.008, indicating a negative relationship with climate smart agriculture awareness and practice that is not statistically significant. This contrast with findings of this study when research questions on agroforestry systems and practices sought to determine whether households practice agroforestry and the result was that majority of households at 62.8 percent practice agroforestry with majority of 251 households that practice agroforestry involved in multistory tree garden at 77.7 percent as the preferred agroforestry system. However, the adoption of agroforestry with the least spearman's rho value (-.008) agrees with other studies by Dawson *et al.,* (2013) who called for understanding why there has not been wider uptake of agroforestry in Ethiopia, Kenya, Tanzania and Uganda, thus suggesting for policy makers to reorient and promote agroforestry as a climate smart land use practice through embracing tree and land tenure policy as well as addressing the constraints including inadequate knowledge to enhance crop yields and farm income, thus increasing food security in Makueni county and other ASALs in the country.

Cropland Management Practices

The study further sought to establish various cropland management practices in use by households. For instance, households were asked whether they received subsidized fertilizers and seeds from government and whether they use pesticides, herbicides, fungicides to control crop diseases to boost their yields. Table 6 presents responses.

Table 5a Statement on Access to Farm Inputs

Variable	Score	Frequency	Percent
I get subsidized fertilizer from government	Strongly disagree	261	65.3
	Disagree	59	14.8
	Neutral	14	3.5
	Agree	29	7.3
	Strongly agree	37	9.3
	Total	**400**	**100.0**
I use organic fertilizer from my farm	Strongly disagree	82	20.5
	Disagree	25	6.3
	Neutral	13	3.3
	Agree	66	16.5
	Strongly agree	214	53.5
	Total	**400**	**100.0**
I get subsidized certified seeds from government	Strongly disagree	306	76.5
	Disagree	65	16.3
	Neutral	16	4.0
	Agree	5	1.3
	Strongly agree	8	2.0
	Total	**400**	**100.0**
I get subsidized seeds from private sector and NGOs	Strongly disagree	298	74.5
	Disagree	45	11.3
	Neutral	10	2.5
	Agree	4	1.0
	Strongly agree	43	10.8
	Total	**400**	**100.0**

N=400

Table 5b Statement on Access to Farm Inputs

Variable	Score	Frequency	Percent
I use mechanized services from county	Strongly disagree	335	83.8

government to farm	Disagree	43	10.8
	Neutrality	15	3.8
	Agree	3	.8
	Strongly agree	4	1.0
	Total	**400**	**100.0**
I hire mechanized services to farm	Strongly disagree	223	55.8
	Disagree	28	7.0
	Neutral	20	5.0
	Agree	44	11.0
	Strongly agree	85	21.3
	Total	**400**	**100.0**
I use pesticides, herbicides, fungicides to control crop diseases	Strongly disagree	77	19.3
	Disagree	18	4.5
	Neutral	20	5.0
	Agree	82	20.5
	Strongly agree	203	50.8
	Total	**400**	**100.0**
I don't use inorganic fertilizer because it is expensive, and I cannot afford it	Strongly disagree	242	60.5
	Disagree	54	13.5
	Neutral	19	4.8
	Agree	27	6.8
	Strongly agree	58	14.5
	Total	**400**	**100.0**

N=400

Table 5 (a) shows the results of the assessment on access to farm input with respect to received subsidized inputs, use of organic fertilizers and pesticides as climate smart cropland practices. The results indicated the level of households accessed to farm input in Makueni County between 2017- 2018 as follows: majority of households surveyed (80.1%) did not receive any subsidized fertilizer from national government, 92.8 percent did not receive subsidized certified seeds from county government and 85.8 percent did not get subsidized seeds from private sector and NGOs. Results further showed as presented in table 5b, that 94.5 percent did not use mechanized services from Makueni County Government to farm. Higher proportion of respondents (70%) also affirmed that they use organic fertilizer from their farms to undertake farming activities, whereas similar proportion at 71.3% confirmed that they use pesticides, herbicides, fungicides to control crop diseases. Study also showed that majority of households at 74 per cent does not use inorganic fertilizers in the farms as they find them to be very expensive that they cannot afford. Similarly, majority at 94.6 per cent of the respondents confirmed that they do not use tractors from county government to farm while only 32 per cent hire tractor to prepare their land.

The findings of this study indicate that the public sector (national government, county government) and private sector did not provide subsidized inputs making household not to adequately adopt the climate smart cropland practices. This leads to low crop yields and incomes affecting food availability and accessibility, thus negatively influencing household food security in Makueni County. This result is consistent with Kenya's *Policy framework (ASDS, 2010-2020)* which states that adoption of improved inputs by household farmers is relatively low. For instance, Mwangangi *et al.,* (2012) in their study on *Baseline Household Survey* in Makueni, Kenya found that more than 94 per cent of the households do not use fertilizer. This is attributed to cost implication and high risk of crop failure because rains are not reliable and farmers do not risk investing a lot in rain fed seasonal crops. However, organic fertilizer (Farm yard manure) and pesticides are applied to fruit trees and irrigated vegetables which are major sources of income in the farms (in-farm income). This finding is in consistent with a study by Kipkoech *et al.,* (2015) who observed that organic fertilizers from household organic wastes and farm yard manure were the widely used form of fertilizers and is a climate smart option that increases yields. Similarly, this result is in conformity with that of Mwangagi *et al.,* (2012) who explained the use of pesticides (84 per cent of respondents) on mango and citrus as major crops in the county and pesticides use is a must for realizing meaningful yields.

Separately, this finding contrast that of Ochola *et al.,* (2015) who found that the Government of Kenya has created and sustained a relatively stable policy environment, financing infrastructure and supporting fertilizer markets to encourage household farmers' access to climate smart cropland subsidies. This was through the Ksh. 36 billion input subsidy programme- *The National Accelerated Agricultural Input Programme* that created demand for extension services, input, market, credit and partnerships resulting in increased maize production from 4 to 20 bags per acres and reduced distances to input sources from 15 to 35 km to 3

to 9 km thus increased household food security. This is indicative of great potential of climate smart subsidies only that there is need to be provided to initiatives that support and promote CSA in ASAL and beyond.

Agricultural extension and advisory services

The researcher lastly sought to establish whether households received agricultural extension and advisory services during the period of review. Responses are presented on table 6

Table 6 Agricultural extension and advisory services

Measure	Score	Frequency	Percent
Ever received extension services advice	yes	114	28.5
	No	286	71.5
	Total	**400**	**100.0**
Source of extension services	Public sector (National and county government, parastatal, research and training institutions)	46	40.4
	Private sector (companies, civil societies, NGOs, FBOs, CBOs)	33	28.9
	Contact farmers	16	14.0
	Traders	3	2.6
	Agriculture bulletin, newspaper or magazine	1	.9
	Agricultural programmes in radio and Television	9	7.9
	Membership of farmers' informal group	2	1.8
	Agricultural Mobile phone Applications	4	3.5
	Total	**114**	**100.0**
Contact with extension services	Very frequent - Once per every two weeks	6	5.3
	Frequent - Once per month	38	33.3
	Not frequent - Once per three months	30	26.3
	Irregular -When I have a problem	40	35.1
	Total	**114**	**100.0**
Are extension services accessible?	Strongly disagree	176	44.0
	Disagree	55	13.8
	Neutral	58	14.5
	Agree	46	11.5
	Strongly agree	65	16.3
	Total	**400**	**100.0**

Table 6 shows that majority of households at 71.5 percent have never ever received advice on agriculture from extension services officers in years 2017/2018 with majority of 114 households that confirmed to have received extension services, 40.4 percent stating their main source was public sector that comprise of national and Makueni county government, parastatal, research and training institutions and 28.9 per cent private sector. This is in line with policy guidance as government efforts to include but not limited to adoption of a sector wide approach to provide extension services whereby public and private sector are involved (World Bank, 2011). This finding when corroborated with FGD sessions, the participants confirmed that County Government had employed extension service officers who are expected to support farmers at grassroots level. However, the study findings show that extension officers have interacted with selected villages and sub counties and therefore are not covering the entire county. Moreover, the study showed that even in those areas and households that received extension services during the year under review, majority of respondents at 35.1 percent stated that they consider contact with extension service providers to be irregular and they only received those services only when they had problems in their agricultural practice.

This finding was affirmed by respondents at 57.8 per cent that indeed, extension services is not accessible and according to (World Bank, 2011) it affect dissemination and adoption of CSA technologies due to low level of knowledge from declining extension services as a result of reduced operational budget and human resources in the sector Ministry of Agriculture. Another study by Kipkugat *et al.*, (2015) observed rapid decline in agricultural extension services affecting the living status of small scale farmers in Wereng Sub County, in Uasin Gishu County. Separately, Wekesa *et al.*, (2018) underscored that extension services influences agricultural production and income through sharing knowledge, technologies, agricultural information and linking the farmer to other actors in the economy. This study indicate the need to reorient the conventional extension policy approach to enhance contact of extension services with farmers through the farmer-to farmer (FtF) extension approach as promoted in Ethiopia according to Tiruneh *et al.*, (2015).

Further, the same researchers (Wekesa *et al.*, 2018) suggested that technology innovation and transfer can be through group membership and belonging to a farmer group increased the probability of adopting CSA technologies by18.8 per cent. This means those farmers groups are important channels through which extension agents can use to access farmers thereby increasing the number of contacts with extension services providers. In this regard, one more annual contact with extension agents increased the probability of adopting CSA by 0.46 per cent and thus increasing crop yields and income. This study finding has provided insight into the potential contribution of agricultural extension services to household food security in Makueni County which concurs with suggestion by (Abdi & Worth, 2011) that it is of value to establish how agricultural extension services and advisory can contribute to achieving food security.

Summary

The study showed that only 43.3 percent of the respondents were aware and use climate smart agriculture (CSA) technologies. This result was corroborated and found to be attributed to majority of respondents (93%) strongly disagreed that they have knowledge and/or practice climate smart agriculture. This could have been due to level of education where 36 per cent of the households had acquired primary education and below affecting the choice and investment in CSA technologies by impeding them from access to extension services and credit.

This Spearman ranking Correlation analysis on adoption levels (High, Medium and Low) of climate smart agriculture technologies showed that conservation agriculture together with access to and use of combined technologies ranked high (value of rho .748) and medium (.505) respectively with strong statistically significant and positive bivariate association. This implied household preferred practicing different CSA technologies in their farms to reap the synergy in the combined practice through diversification of climate smart technologies which have potential in risk reduction and high intensive capital such as conservation agriculture and irrigation thus stabilizing food production. Further, the other technologies had adoption level with rho value of .128 and .109 for access to market infrastructure and having favorable land tenure system respectively with positive correlation which was significant at the 0.05 level (2-tailed). Surprisingly, use of irrigation and access to input had spearman's rho value of.037 and .030 (both low) respectively, implying a positive relationship with climate smart agriculture but not statistically significant which could have been attributed to the fewer households who accessed farm input and practiced irrigation because these technologies demand for high intensive capital investment.

On the adoption level of agroforestry practice interestingly had spearmen's value of rho -.008, indicating a negative relationship with awareness and practice climate smart agriculture that is not statistically significant. This contrast with findings of this study when research questions on agroforestry systems and practices sought to determine whether households practice agroforestry and the result was that majority of households at 62.8 percent practice agroforestry. However, the adoption level of agroforestry (-.008) agrees with Dawson *et al.*, (2013) who called for understanding why there has not been wider uptake of agroforestry in Ethiopia, Kenya, Tanzania and Uganda. This could have been attributed to farmers being not knowledgeable about agroforestry as a land-use practice or about the various systems that may be applied on their agricultural farms.

Lastly, evidence has showed that majority of households did not access credit during the period under review. CSA technologies practiced like agroforestry require farmers to have access to specific inputs, such as tree seedlings, seeds or fertilizers and lack of such inputs constrains widespread adoption.

Conclusion

The study shows that majority of households do not have knowledge and/or practice conservation agriculture (CA) though it has the highest positive and significant adoption rate of the climate smart agriculture (CSA) technologies. Despite more than half of household's surveyed practice CA, majority are not comfortable practicing this new method of agriculture due to lack of knowledge and resource constraints. However, adoption of wide range of combined CSA technologies was ranked medium adoption level after (CA) and has the potential to increase food production, income and enhance the resilience to climate change. In this regard, CSA should be mainstreamed into National Agriculture Food Security and Investment Plan as well as incorporated in the Sendai Framework to transform food system and reduce vulnerability of households to effects of disaster risks such as climate change, drought and floods. The study further revealed that limited resources was one of the main constraints to CSA technologies adoption more so provision of extension services.

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Explaining cross section of stock returns: A comparative analysis of listed financial and non-financial firms in Nepal.

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Abstract- This paper examines the effect of firm specific variables on stock returns of financial and non-financial enterprises in Nepal. Fixed effects regression models are estimated to identify causal relationship of firm size, book-to-market ratio, leverage, earnings yield and assets growth with adjusted stock return. A balanced panel data of 110 observations for 11 non-financial firms and 120 observations for 12 commercial banks listed in NEPSE are taken for the study covering a 10 year period from 2009 till 2018. Comparative analysis is done by estimating sector wise regression models. For non-financial firms, fixed effects model performed better than random effect model and OLS model suggested by Hausman test and Wald test. OLS model showed better by Wald test for financial firms. The findings reveal that size and book-to-market equity ratio have significant negative impact on stock returns in the non-financial firms. However for financial firms only book-to-market ratio shows significant negative impact on stock returns in univariate and bivariate models. Leverage is observed to have positive impact on stock return at 10 percent level of significance in univariate model for financial firms.

Index Terms- Stock returns, Firm specific variables, Fixed effect, OLS model, Random effect

I. Introduction

Important constituent of a free-market economy, stock market helps to arrange capital for the companies from shareholders in exchange for shares in ownership to the investors. Stock exchange facilitates businesses to raise capital by selling shares to the investor (Black and Gilson, 1998). Studies have proved that the stock market plays an important role in economic prosperity, fostering capital formation and sustaining the economic growth of the economy (Adjasi et al., 2008; Pilinkus, 2015). The motivating factor for investments in stock market is return. Investors consider return as fundamental reason for trading stocks. Adjusted return is normally capital appreciation/depreciation along with dividend received if any. Investors generate return in the stock market by trading shares in the secondary market. Usually, by buying stock at lower price and selling it at higher price in secondary market keeps the investor in earning position (Idris and Bala, 2015). After the seminal work of Banz (1981), it is becoming gradually accepted that stock returns have more predictable components in addition to market beta that was earlier proposed by Sharpe (1964), Lintner (1965) and Black (1972) through Capital Assets Pricing Model. Banz (1981) revealed that fundamental variables such as size along with earning yield, book-to-market ratio, cash-flow yield and leverage are important determinants of stock return. Other empirical works on asset pricing have identified a lot of variables that have explanatory power to determine stock returns. Earning's yield (Basu, 1983), leverage (Bhandari, 1988), size and book-to-market ratio (Fama and French, 1992) and asset growth (Michael et al., 2008) are observed to have significant explanatory power.

The results and implications drawn from the paper of Fama and French (1992) motivated a whole stream of subsequent studies. These studies extend the findings of Fama and French (1992) by looking at different countries, different samples and different time periods. Interesting to see is that the findings of these studies seem to be very specific to the studied country and time period. For instance in the US studies (Fama and French, 1992; Kim, 1997; Howton and Peterson, 1998) there is an overall tendency to find a size and book-to-market factor risk premium compared to UK studies (Chan and Chui, 1996; Strong and Xu, 1997; Morelli, 2007) that do not find this size effect, but rather find leverage and book-to-market to be significant. Studies on the Asian market (Wong, Tan and Liu, 2006; Lau, Lee and McInish, 2002; Mohanty, 2002) show that apart from size and book-to-market variables sales growth and cash flow-to-price ratio are also important factors in the cross-section of stock returns. When comparing the results of studies on developed and emerging markets (Claessens, Dasgupta and Glen, 1995) show almost all of the signs of the variables change. For example whereas in developed countries the size effect consistently states that small firms tend to outperform large firms, the opposite effect is found for many emerging markets.

Lau, Lee, and McInish (2002) found that there is a conditional relationship between beta and stock returns with positive relation during positive market returns. During negative market excess returns the relation is negative. The study further document a negative relationship stock returns with size and sales growth for Singapore and positive relationship with earnings to price ratio for Malaysia. Cooper et al. (2008) compared the result of asset growth rates with book-to-market ratios, size, lagged returns, accruals and other growth measures and found that firm's annual asset growth rate emerges as an economically and statistically

significant to explain the cross-section of US stock returns. Srinivasan (2012) explored panel data over the period from 2006 to 2011 along different industries in India and revealed that size is significant and positive in all sectors except for manufacturing sector where the relationship is positive but insignificant.

In a comparative study by Menike et al. (2015) regarding firm-specific variables and stock returns in Sri Lanka and United Kingdom (UK) found assets growth, book to market ratio and leverage have insignificant negative relationships with stock returns. Though insignificant the relationship of size and earning price ratio with stock returns are positive in Sri Lanka using fixed effect models. On the other hand random effect firm factor model in UK shows that earning price ratio, book to market ratio, fixed assets growth rate, size and return on assets are significant variables determining the stock returns. Size, return on assets and earning price ratio are positively related to stock returns whereas assets growth rate and book to market ratio are negatively related in UK stock market. Impact of firm specific variables on stock prices in Ghana Stock Exchange using panel regression analysis conducted by Aveh and Awunyo-Vitor (2017) found a positive and significant relationship of return on equity, earning per share, book value per share and size with market price of shares. The findings also show insignificant and inverse relationship of leverage with market price of stocks. Hu et al. (2018) investigated cross-section of returns for Chinese stock market and revealed significant size effect but no robust value effect.

In the Nepalese context, Pradhan and Balampaki (2004) observed earning yield and cash flow yield to have significant impact on dividend yield. Size was observed to have a negative impact on dividend yield whereas book-to-market is statistically strong in predicting capital gain yield. Dangol (2008) tried to study the linkage between political uncertainty and common stock returns. Joshi (2012) found dividend having significant effect on market stock price. Pradhan (2014) revealed that beta has very weak positive relation with stock returns whereas size, dividend yield and book-to-market ratio have been revealed as significant factors affecting stock returns. Gautam (2017) found a positive relationship between leverage, size, dividend payout and dividend yield with stock return. The study further revealed that there exist a negative relation between book-to-market, growth of assets and earning price ratio with stock return. In the latest study Bhattarai (2018) revealed that earning per share, dividend per share, price earning and size are positive and statistically significant in determining stock prices.

Abundance of studies have been conducted of factors determining stock returns and most of these studies are in developed and big capital markets. Hence, the findings of these studies as well as the theoretical relevance in context with the emerging and small capital markets are worth examining. Also in accordance to the above findings, it is therefore not possible to use the results from one or several studies on a specific country, market and time period to derive the factor risk premia of another market for a specific time period. This means that every particular market and time period should be studied individually in order to determine which factors are important in explaining stock returns.

Regardless of the works carried out in different countries, markets and points of time, our main empirical finding is size and book-to-market ratio are strong predictor of stock returns in non-financial firms.

The remainder of this paper is organized as follows. Section I describes that data and model selection. Section II presents the empirical results. Section III discusses and concludes the study findings.

II. Data and Model Selection

A. Sample selection

All listed commercial banks and non-financial firms in NEPSE constitutes the population of the study for financial and non-financial respectively. The non-financial firms represent 18 firms in manufacturing and processing, 4 in hotels, 19 in hydropower, 4 in trading and 4 in others category that make up 49 non-financial firms as population. 27 commercial banks are listed in NEPSE as of F/Y 2017/2018 constitute the population for financial firms represented in this study by commercial banks. Sample firms have been selected as per the information available required for the study. This is primarily because of unavailability of financial data of the firms and dormant trading in stock exchange. However special care has been taken to assemble data that would assure having of all firms for all intended period of study. For each firm, financial data for 10 fiscal years covering the period of 2009 to 2018 are collected. While doing so, firms to be considered must have 10 years of consecutive data of stock trading. Firms with less than 10 years of consecutive trading are excluded. Few firms are also excluded on basis of unavailability of their annual financial reports. As such, 12 commercial banks and 11 non-financial firms (3 manufacturing and processing firms, 3 hotels, 3 hydropower companies and 1 each from trading and others sectors) are selected for the study. As such balanced panel data of 120 observations for financial firms (commercial banks) and 110 observations for non-financial firms is analyzed.

B. Model Estimation

The relationship between stock return and explanatory firm specific variables have been estimated using panel data set on regression methodology. Using pooled data, the basic regression estimation model is (Greene, 2000):

$$Y_{i,t} = \alpha_i + \gamma' X_{i,t} + \varepsilon_{it}$$

where, αi is the individual effect, which is assumed as constant over time and specific to the individual cross-sectional unit in the fixed-effects model. $\varepsilon_{i,t}$ is a stochastic error term assumed to have zero mean and constant variance. In random-effect model, α_i is disturbance specific to cross-sectional unit. The regression techniques in estimating regression model with panel data are pooled OLS, the fixed-effects model and the random- effects. Using Eviews 10, we conducted Hausman test to choose the model from fixed effect model and random effect model. In context of choosing fixed effect model from Hausman test, we further carried out Wald test to choose the appropriate model from fixed effect and OLS model and the final models are tested

for the relationship among the variables. The testable regression model is:

$$Y_{it.} = \alpha_0 + \gamma_1 lnME_{it} + \gamma_2 ln(BE/ME)_{it} + \gamma_3 ln(DA)_{it} + \gamma_4 AG_{it} + \gamma_5 E/P_{it} + \varepsilon_{it}$$

where, Y_{it} is dependent variable stock return for enterprise i in the year t. ME = Size or Market Capitalization, BE/ME = Book to Market ratio, DA = Leverage, AG = Assets growth, E/P = Earning yield and ε = Error term.

C. Variables and priori expectation

Stock return is the sum of capital gain yield and dividend yield. Banz (1981), Bhandari (1988), Fama and French (1992), Chen, Roll and Ross (1986), Amtiran, Indiastuti, Nidar and Masyita (2017) have used stock return as dependent variable in their studies. The logarithm of market equity proxies for the firm size. Banz (1981) found small firms have on average higher returns than larger ones. It has been well documented in the literature that a firm's stock return is influenced by its size and the relation is negative (Reinganum 1981, Bhandari 1988, Fama and French 1992, Kothari et al. 1995, Howton and Peterson 1998, Hu et al. 2018). The book-to-market ratio is the ratio of a firm's book equity to its market capitalization and helps investors and analysts identify if a stock in under or overvalued. Studies confirm the book-to-market ratio as a significant explanatory variable of stock returns (Fama and French 1992, 1993, Kothari et al. 1995) with positive association. Leverage refers to the fact how much of the firm's capital is financed with debt. Some studies find positive relation between stock returns and leverage (Bhandari 1988) and some studies find negative relation with stock return (Menike et al. 2015 and Aveh et al. 2017). Earnings-Price (E/P) ratio is the relationship of earnings per share to current market price of stock commonly used to compare the relative attractiveness of stocks. Review of the literature of previous studies document a positive relationship between earnings yield and stock returns (Basu 1983, Porta 1996, Srinivasan 2012 and Menike et al. 2015). The annual firm asset growth used as independent variable is calculated using the year-on-year percentage change in total assets. Cooper et al. (2008) found that firm's annual asset growth rate emerges as an economically and statistically significant to explain the cross-section of stock returns with negative coefficients. Profilet and Bacon (2013) found that assets growth has a negative relation with share price volatility in the US capital market. Expected relationships with return are presented in the table below.

Table 2.1
Computation of Variables with Expected Signs

Variable	*Abbrev.*	*Description*	*Sign*
Return	R_t	$[(P_t - P_{t-1} + D_t)/P_{t-1}]$	
Size	Ln(ME)	Natural logarithm of market equity	-
Book-to-Market Ratio	Ln(BE/ME)	Natural logarithm of firm's book equity divided by market capitalization	+
Leverage	Ln(DA)	Natural logarithm of firm's total debt to total assets.	-
Assets Growth	AG	Ratio of the change in total assets at the end of the year to the level of total assets at the beginning of the year. Negative asset growth is taken zero..	-
Earnings Yield	E/P	Earning price per share to market price per share. Negative E/P ratio is taken zero.	+

III. Empirical Results

Table 3.1 presents descriptive statistics of all the variables under study. Panel A shows that the stock return has a mean of 1.21 with minimum -72.03 and maximum 190.46 in financial firms whereas the mean return is higher for non-financial firms with 26.66. However the standard deviation of 86.45 shows greater volatility in the stock returns and the data is widely dispersed from the mean among the non-financial firms. Another fact revealed through the descriptive statistics is that financial leverage is larger in financial firms with 90% in average indicating that almost 90 percent of the total assets is being financed by the creditors. On the other hand the financial leverage of 42% for non-financial firms reveal very low use of debt financing. The result supports Fama and French (1992) that says that higher leverage beyond a certain point is associated with lower expected return but contradicts Bhandari (1988) that showed positive relationship between leverage and return. The average size of the financial firms is greater (27769.04) as compared with non-financial firms' average size (14950.61). The standard deviation of around 24499 which is less than the mean shows less variability in the size of the firms among financial institutions. The case in non-financial firms is different where that dispersion seems to be very high among the firms. Assets growth is higher in financial firms and earnings yield is better for non-financial firms. Comparatively financial firms are observed to have higher financial leverage and higher assets growth but lower return and earnings than the non-financial firms. However, the returns and earnings in financial firms are less volatile than the non-financial firms.

The correlation coefficients in Table 3.2 reveal that no independent variables are highly correlated with return. Moreover relationships of the independent variables with return are observed to be opposite to the expected priori. Gujarati et al. (2015) suggests that if the correlation between two variables is more or equal to 80%, then it can be the case of concern regarding multicollinearity. In the present paper although most of the variables show far less correlation, the variables with book value of equity and market value of equity show slightly higher correlations. 66.6% between BE/ME and ME for financial firms and 64.6% between BE/ME and ME for non-financial firms. This could be because both the variables have market value of equity.

Table 3.1
Descriptive Statistics of Variables

The table shows descriptive statistics (mean, standard deviation, minimum and maximum values) of stock return and related exogenous variables for 12 financial firms in panel A and 11 non-financial firms in panel B. The study period covers 10 years through 2009 till 2018. Ri is dividend and capital appreciation adjusted annual stock return, ME is market value of equity representing size in million, BE/ME is ratio of book-to-market equity, DA is the ratio of total debt to total assets representing leverage, AG refers to the assets growth and EP refers to the earnings yield.

Panel A: Financial Firms

	Observations	Mean	Maximum	Minimum	Std. Dev.
Ri	120	1.21	190.46	-72.03	54.21
ME	120	27769.04	111494.00	2164.00	24499.85
BE/ME	120	0.30	1.21	0.05	0.19
DA	120	0.90	0.94	0.81	0.03
AG	120	20.48	80.50	-16.59	16.03
EP	120	5.02	41.43	-5.29	5.02

Panel B: Non-financial firms

	Observations	Mean	Maximum	Minimum	Std. Dev.
Ri	110	26.66	564.00	-52.53	86.45
ME	110	14950.61	108150.00	99.00	26247.37
BE/ME	110	1.32	13.72	0.06	2.85
DA	110	0.42	0.85	0.02	0.22
AG	110	10.86	167.20	-26.27	19.62
EP	110	7.78	75.10	-62.42	12.93

Table 3.2
Correlation Matrix of Variables

The table presents Pearson's correlation coefficients among different variables used in the study. The coefficients of variables for financial firms are in lower left triangle whereas for non-financial firms they are in upper right triangle of the matrix. The data are extracted from the annual reports of sample firms trading in NEPSE and the annual report of NEPSE for the period of 2009-2019. Ri is dividend and capital appreciation adjusted annual stock return, ln(ME) is log of market value of equity representing size, ln(BE/ME) is log of ratio of book-to-market equity, ln(TA/BE) is the log of ratio of total asset to book value of equity representing book leverage, ln(TA/ME) is log of ratio of total asset to market value of equity representing market leverage, EP refers to the positive earnings yield and AG refers to the positive assets growth.

Correlation Coefficients of Non-financial Firms' Variables

Correlation Coefficients of Financial Firms' Variables	Ri	Ln(ME)	Ln(BE/ME)	Ln(DA)	AG	EP
Ri	1	0.143	-0.189	0.099	0.043	-0.057
Ln(ME)	0.083	1	-0.646	-0.463	0.006	-0.332
Ln(BE/ME)	-0.191	-0.666	1	0.224	-0.054	0.565
Ln(DA)	0.156	0.005	-0.499	1	0.080	0.245
AG	0.135	-0.126	-0.088	0.186	1	-0.031
EP	-0.090	-0.298	0.332	-0.205	-0.024	1

To further check that the relationships observed are not of serious concern of multicollinearity to our study a Variance Inflation Factor (VIF) test is conducted that showed a mean VIF of 1.98 for the variables in financial firms and 1.67 for the variables in non-financial firms as presented in Table 3.3. The VIF less than 10 as per the rule of thumb affirms the absence of any serious multicollinearity. The test thus reveals the absence of serious multicollinearity, because VIF are consistently below 10 both both the sectors as presented in the table below.

Table 3.3
Variance Inflation Factor Test

Variables	Financial Firms	Nonfinancial Firms
ME	2.57	2.14
BE/ME	3.30	2.34
DA	1.82	1.35
AG	1.08	1.01
EP	1.15	1.53
Average	**1.98**	**1.67**

Panel data has greater chances of leading to error that are clustered and possibly correlated overtime. The primary reason is each company have its own entity specific characteristic that may influence its market price which is referred to as unobserved heterogeneity. This is the reason both Hausman Test ant Wald Test are carried out to choose the appropriate model. The Hausman Test suggests that fixed effect model is more appropriate that random effect in both financial and nonfinancial firms. χ^2 value of 26.81 with probability value of 0.00 in non-financial firms and χ^2 value of 18.81 with probability value of 0.00 suggest no entity specific attributes affect the dependent variable and thus null hypothesis of choosing random effect is rejected to fixed effect in both sectors. However Wald test shows explanatory variables in the model are significant in fixed effects for non-financial and OLS

regression for financial firms. F-statistic of 3.32 with probability 0.00 for non-financial fails to accept the null hypothesis that OLS model is appropriate and thus fixed effect is chosen. Whereas f-statistic of 1.73 with probability of 0.07 for financial firms fails to accept the null hypothesis that OLS model is appropriate.

Table 3.4 exhibits the result of both univariate and multivariate analysis of adjusted return with firm's specific variables estimated as fixed effect models. As far as estimated results are concerned, the significance of models 2, 6, 7, 8 and 9 indicate the appropriate estimation. The table shows positive effect of size of firm as measured by the natural logarithm of market value of equity on adjusted return in univariate analysis. However in bivariate and multivariate models size has negative impact on adjusted return that confirm priori expected sign and size is statistically significant in all models. This result indicates that the adjusted return is highly affected by the company's size in the Nepalese non-financial enterprises. The result is consistent with the findings of Banz (1981), Reinganum (1981), Bhandari (1988), Srinivasan (2012), Hu et al. (2018).

Book-to-market ratio in both univariate and multivariagte models is negative which is not as per the priori expected sign though the coefficients are statistically significant. This result indicates that the return is affected by book-to-market ratio in the Nepalese listed non-financial enterprises. The result is consistent with Fama and French (1992), Pradhan (2014), Gautam (2017). The coefficient of leverage in univariate model is positive but in all other multivariate models the coefficient is negative as expected. The coefficients are however not significant. Assets growth is observed to have opposite sign than expected though insignificant coefficients. Earnings yield have mixed outcome but the coefficients are not significant.

Table 3.4

Estimates of the Relations of Returns with Firm Specific Variables for Non-financial Firms using Fixed Effect model.

The table presents the results of regression model designed to analyze the impact of firm specific variables on adjusted return. The regression model used is,

$$R_{it.} = \alpha_0 + \gamma_1 lnME_{it} + \gamma_2 ln(BE/ME)_{it} + \gamma_3 ln(DA)_{it} + \gamma_4 E/P_{it} + \gamma_5 AG_{it} + U_{it.}$$

*Data are from 11 non-financial firms listed in Nepal Stock Exchange for the period of 2008/09 to 2017/18. In all models dependent variable is adjusted return calculated by adjusting dividends and capital gains. The firm specific independent variables Ln(ME) is log of market value of equity representing size, Ln(BE/ME) is log of ratio of book to market equity, Ln(DA) is the log of ratio of total debt to total assets representing leverage, E/P refers to the earnings yield and AG refers to the assets growth. Negative E/P and AG are taken as zero. Table also shows the value of F-statistic, R-square and Durbin Watson test statistic of each model. The reported values are intercepts and slope coefficients of the independent variables with t-statistic in parenthesis. *, ** and *** show coefficients are significant at 0.10, 0.05 and 0.01 level of significance.*

Model	Intercept	Ln(ME)	Ln(BE/ME)	Ln(DA)	AG	EP	R^2	F	Sig.	DW
1	-628.59**	29.69**					0.12	1.17	0.31	1.79
	(-2.48)	(2.58)								
2	-30.12**		-72.17***				0.23	2.79	0.00	1.7
	(-2.16)		(-4.85)							
3	44.71			16.22			0.06	0.56	0.86	1.89
	1.30			(0.54)						
4	24.48**				0.18		0.06	0.54	0.86	1.89
	(2.37)				(0.37)					
5	38.57***					-1.36	0.07	0.67	0.75	1.86
	(3.02)					(-1.24)				
6	1160.08***	-56.33***	-139.79***				0.29	3.39	0.00	1.74
	(2.72)	(-2.79)	(-4.96)							
7	1197.07**	-58.38**	-141.96***	-5.90			0.29	3.09	0.00	1.74
	(2.57)	(-2.57)	(-4.68)	(-0.20)						
8	1173.75**	-57.53**	-142.16***	-6.08	0.35		0.30	2.91	0.00	1.73
	(2.51)	(-2.53)	(-4.68)	(-0.21)	(0.79)					
9	1159.94**	-57.00**	-142.74***	-5.58	0.36	0.22	0.30	2.69	0.00	1.74
	(2.44)	(-2.48)	(-4.66)	(-0.18)	(0.82)	(0.21)				

OLS model estimation presented in Table 3.5 exhibits both univariate and multivariate analysis outcomes. Models 2, 3 and 6 are observed through their significance to indicate the appropriate estimation. The table shows positive effect of size of firm as measured by the natural logarithm of market value of equity on adjusted return in univariate analysis. However in bivariate and multivariate models size has negative impact on adjusted return. Although this negative sign is as per priori expected sign, it is not statistically significant in all models. This result indicates that the adjusted return is not affected by the company's size in Nepalese financial enterprises. Though sign is consistent with the findings of Banz (1981), Reinganum (1981), Bhandari (1988), Srinivasan (2012), Hu et al. (2018) the result contradicts in terms of size being not significant.

As presented in the table, book-to-market ratio in all the models is negative which is not as per the priori. The univariate and bivariate coefficients are statistically significant that indicates that the return is affected by book-to-market ratio in the Nepalese listed financial enterprises. The result is consistent with Fama and French (1992), Pradhan (2014), Gautam (2017). The coefficient of leverage is positive in all models, an opposing sign than priori. Leverage is significant only in univariate model, hence its impact on stock return is very weak. Asset growth and earnings yield however not significant have inconsistent relationship with stock returns than expected.

Table 3.5

Estimates of the Relations of Returns with Firm Specific Variables for Financial Firms using OLS model.

The table presents the results of regression model designed to analyze the impact of firm specific variables on adjusted return. The regression model used is,

$$R_{it.} = \alpha_0 + \gamma_1 lnME_{it} + \gamma_2 ln(BE/ME)_{it} + \gamma_3 ln(DA)_{it} + \gamma_4 E/P_{it} + \gamma_5 AG_{it} + U_{it.}$$

*Data are from 11 non-financial firms listed in Nepal Stock Exchange for the period of 2008/09 to 2017/18. In all models dependent variable is adjusted return calculated by adjusting dividends and capital gains. The firm specific independent variables Ln(ME) is log of market value of equity representing size, Ln(BE/ME) is log of ratio of book to market equity, Ln(DA) is the log of ratio of total debt to total assets representing leverage, E/P refers to the earnings yield and AG refers to the assets growth. Negative E/P and AG are taken as zero. Table also shows the value of F-statistic, R-square and Durbin Watson test statistic of each model. The reported values are intercepts and slope coefficients of the independent variables with t-statistic in parenthesis. *, ** and *** show coefficients are significant at 0.10, 0.05 and 0.01 level of significance.*

Model	Intercept	Ln(ME)	Ln(BE/ME)	Ln(DA)	AG	EP	R^2	F	Sig.	DW
1	-109.26	4.67					0.01	0.81	0.37	1.85
	(-0.89)	(0.90)								
2	-22.62*		-17.19**				0.04	4.48	0.04	1.73
	(-1.84)		(-2.12)							
3	29.25*			267.09*			0.02	2.95	0.08	1.90
	1.71			(1.72)						
4	-8.58				1.47		0.02	2.19	0.14	1.91
	(-1.04)				(1.48)					
5	6.17					-0.98	0.01	0.95	0.33	1.87
	(0.87)					(-0.97)				
6	78.12	-4.54	-21.99**				0.04	2.45	0.09	1.73
	(0.51)	(-0.66)	(-2.02)							
7	47.74	-2.50	-17.09	105.10			0.04	1.70	0.17	1.76
	(0.29)	(-0.31)	(-1.17)	(0.50)						
8	-1.08	-0.67	-14.58	93.91	0.38		0.05	1.62	0.17	1.78
	(-0.01)	(-0.08)	(-0.99)	(0.45)	(1.16)					
9	9.28	-1.06	-14.32	86.33	0.37	-0.32	0.05	1.30	0.27	1.78
	(0.05)	(-0.13)	(-0.96)	(0.41)	(1.15)	(-0.29)				

IV. Summary and Conclusion

The study uses panel regression models to examine the impact of firm specific variables on stock returns of financial and non-financial firms. The data comprise stock return, size, book-to-market ratio, leverage, asset growth and earnings yield of 11 non-financial firms and 12 commercial banks listed in NEPSE for the period 2009 till 2018. The results show higher but highly volatile return, lower leverage and higher book-to-market ratio in non-financial firms. Positive correlation is observed in size, leverage and asset growth with stock returns and negative correlation in book-to-market ratio and earnings yield. Hausman and Wald tests statistics suggest that fixed effect model reflect an appropriate regression model for non-financial firms and OLS model for financial firms. Regression results suggest size and book-to-market have significant negative impact on stock returns among the non-financial firms. Book-to-market ratio is observed to be negative and significant in univariate and bivariate OLS models for financial firms.

Fama and French (1992) found that size and book-to-market equity ratio provide a powerful characterization of the cross-section of stock returns that challenged the central prediction of CAPM model of Sharpe(1964), Lintner (1965) and Black (1972) which says market beta is sufficient to describe the cross-section of stock returns. Earlier Banz (1981) documented a strong and negative impact of firm size on average return. Bhandari (1988) observed leverage to impact positively and Basu (1983) found earning yield to have positive relation with stock return. Menike et al. (2015) documented assets growth, book to market ratio and leverage to have insignificant negative relationships with stock returns. Pradhan (2014) revealed size and book-to-market ratio as significant factors whereas Gautam (2017) found size and leverage to have positive relationship with stock returns in Nepal.

These results suggest that the documentation of significant firms-specific variables affecting the stock returns is both time and model sensitive. Thus, this study reaches a conclusion close to Fama and French (1992) and confirms that size and book-to-market ratio are significant factors affecting stock returns in Nepal. More specifically, size and book-to-market ratio have significant negative impact on stock returns for non-financial firms whereas book-to-market have negative significant impact for financial firms. The larger the size of the firm the lower is the return. It may be however too early to rule out the possibilities of other variables as there are many other variables studied at different period of time and geography.

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Characterization of Clays from selected sites for Refractory Application

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Abstract- Clay is a stony or earthy mineral aggregate composed of fine-grained minerals, which are plastic at appropriate water content and hardens up when fired. Clay soils have various mineral groups such as kaolinite, smectites, illites and palygorskite-sepiolite with unique properties for industrial applications. Uses of clay include manufacture of cement, tiles, ceramics, bricks, drilling clays, lead pencils, printing inks and paints. This project determined elemental and mineralogical composition of clays from Githima (0º 46´ 40´´ S, 37º 6´ 31´´E), Kimathi (0º 40´ 0´´S, 37º 10´ 28´´E) and Ithanje (0º 36´ 30´´ S, 37º 6´ 46´´E). The elemental and mineralogical composition were determined using AAS and XRD techniques respectively. The results indicated that clays composed of SiO_2, Al_2O_3, and Fe_2O_3 as the major components in the following ranges of 40.80-55.40%, 16.27-30.33% and 3.90-20.53% for SiO_2, Al_2O_3, and Fe_2O_3 respectively. Mineralogical results showed that the main mineral present in the clays were kaolinite, illite and quartz. Apparent porosity, linear shrinkage, bulk density, refractoriness and thermal shock resistance were 26.31-31.33%, 1-3 %, 1.56-1.68 g/cm^3
1609-1686 ºC and 20-26 cycles, respectively

Index Terms- Clay; Minerals; Refractory.

I. Introduction

Refractory refers to the quality of materials to retain their strength at higher temperatures [1]. Refractories are composed of thermally stable mineral aggregates which are inorganic and nonmetallic. They have unique physical and chemical properties that promote resistance to physical wear, high temperature and corrosion [2,3,4]. They are used in constructing high temperature components of structures such as furnaces, kilns, heat exchangers, and incinerators. Refractories belong to the category of ceramic materials, that are utilized for prime temperature typically higher than 1100ºC [5]. Most refractories are made from naturally occurring high melting point oxides such as SiO_2, Al_2O_3, MgO, Cr_2O_3, ZrO [6]. The base material for refractory production is clay. Clays are naturally occurring sediments produced by chemical actions resulting from weathering of rocks [7]. Clay is a stony or earthy mineral aggregate composed of fine-grained minerals, which are plastic at appropriate water content and hardens up when fired, Clay has silica, alumina, and water as

primary constituents, other constituents are iron, alkaline, and alkaline earth metals [7]. Clay minerals are important industrial minerals and millions of tons are used yearly in various modern technology applications such as in ceramics, refractories, paper, foundry, rubber, paints, plastics, insecticides, pharmaceutical, textile, and adhesive industries [8]. Their applications are tightly dependent upon their structure, composition and physical attributes. The data of those characteristics will facilitate for best exploitation and eventually could open up new areas of applications. They conjointly contain non-clay minerals like quartz, feldspar, mica, calcite, dolomite etc. Deposits of clay are widely distributed in Kenya [9,10,11,12]. In order to determine their refractory applications, it is important to determine their mineralogical and elemental composition. In this project we report the mineralogical and elemental composition of selected Kenyan clays.

II. Materials and Method

Purposive non-probability sampling design was used to select sampling sites. Samples were obtained from sites whose clays were being used commercially for pottery. The clay deposits investigated were collected from Githima-clay (0º 46´ 40´´ S, 37º 6´ 31´´E), Kimathi-clay (0º 40´ 0´´S, 37º 10´ 28´´E) and Ithanje clay (0º 36´ 30´´ S, 37º 6´ 46´´E). The clay samples were collected at two depths that is 0.5 and 1.0 meter. In each site the clay samples were obtained from three (3) points that were at least 100 meters apart. From each sampling point/depth 10 kg samples were collected and packed in new cleaned plastic buckets which were then covered with their lids.

III. Elemental Analysis

Weighed 0.1g of clay sample was placed in a 125-mL plastic beaker, 1.0 mL of aqua-regia was added followed by 3.0 mL of hydrofluoric acid and left to digest for 8 hours. Further, 50 mL boric acid was added and the mixture allowed to digest for one hour. The solution was topped to 100 mL using distilled water. Samples were analyzed alongside the standards [9,11,13]. This was done using AAS SPECTRA AA10 Model, at

department of Mines and Geology, Ministry of Environment and Mineral Resources, Kenya.

IV. Mineralogical Analysis

About 3.0 g of the pulverized clay sample was poured into the well of a low background sample holder. The holder was tapped on a bench to help fill and properly pack the sample to avoid sample displacement which causes peak shifts. Using a sharp razor, the sample surface was slowly tapped into either direction pushing excess sample slowly to the end of the well and finally scrapping it off the holder. The sample was then loaded into the defractometer and measurements taken. This was done using a Bruker D2 Phaser defractometer at the Department of Mines and Geology, Ministry of Environment and Mineral Resources of Kenya.

Development of refractory brick

Test refractory bricks were made using wooden boxes molds having internal dimensions of 8.0 cm long, 4.0 cm wide, and 4.0 cm high. The test refractory bricks were air-dried then oven dried at 105^0C until the bricks attained a constant weight. Dried test bricks were then fired in a furnace at a temperature of 1000^0C for 6 hours [12].

Apparent porosity Tests

Test brick was dried in an oven set at 1050C until it achieved a constant mass. The brick was cooled then weighed and weight recorded as W1. The test brick was completely soaked in water for 24 hours, after which it was wiped then reweighed and the weight recorded as W2. Dimensions of the test brick were measured and used to calculate its volume. Percent apparent porosity was calculated using the following formula [14];
Apparent porosity, PA={(W2-W1)/V*100}
Where: W1= Weight of dry test brick, W2= Weight of test brick after soaking in water overnight, V= is the volume of the test brick cm3.

Bulk density

Air-dried test brick was oven dried at 1050C, cooled and weighed. Dimensions of the test brick was obtained and used to calculate test brick volume, bulk density was obtained by calculation using the equation [14,15]:
Bulk density, BD=DW/V g/cm3.

Where, DW=Weight of the dry brick, V= Volume of the dry test brick.

Firing shrinkage test

Firing shrinkage was determined by measuring dimensional changes that took place in a test brick after drying at 1050C and after firing it at 10000C. Firing shrinkage was calculated using the following formula [6, 14,16];
Firing shrinkage = (LD-LF)/LD
Where LD= Length of test brick dried at 1050C, LF=Length of test brick fired at 10000C.

Refractoriness

The refractoriness of a clay sample was calculated using equation below [17];
Refractoriness = {(360+%Al_2O_3)/0.228}-Ro
Where Ro is the sum of all other elements apart from alumina and silica in the composition.

Loss On Ignition (LOI)

Powdered clay samples (2.0 g) were weighed in a crucible. The crucible and its contents were fired at 1000ºC in a furnace for 3 hours after which it was allowed to cool in a desiccator before reweighing. Loss on Ignition was calculated using the equation below [16]:
Loss on ignition ={(W1-W2)/W1}100 where W1 = weight of the crucible + weight of the sample before firing and W2 = weight of the crucible + weight of the sample after firing.

V. RESULTS AND DISCUSSION

Elemental composition

Results of elemental analysis of clays from the selected sites are shown in **Table 1** below

Table 1: Elemental composition of clays

Composition	Githima	Kimathi	Ithanje	*Standard clay for refractory bricks
SiO_2 %	40.80±0.06	55.40±0.20	44.03±0.03	51-70
Al_2O_3 %	16.27±0.05	22.40±0.02	30.33±0.15	25-44
CaO %	0.56±0.04	0.67±0.05	0.53±0.03	0.1-2.0
MgO %	0.02±0.01	1.82±0.02	0.02±0.01	0.2-1.0
K_2O %	0.96±0.03	2.65±0.03	0.84±0.02	
TiO_2 %	7.62±0.03	0.62±0.03	3.49±0.03	
MnO %	0.08±0.02	0.06±0.02	0.23±0.15	
Fe_2O_3 %	20.53±0.15	3.90±0.02	10.40±0.20	0.5-2.4
LOI %	11.47	12.2	10.84	8-18.0

*Reference [18]

The major elements present in clay from the selected sites were silica SiO_2, alumina Al_2O_3, iron (III) oxide Fe_2O_3. The other elements present in appreciable levels were potassium oxide K_2O,

titanium oxide TiO_2 and magnesium oxide MgO, while those present in trace amounts are calcium oxide, CaO and manganese oxide, MnO. The clays were found to have percentage range composition of 40.80-55.40% SiO_2, 16.27-30.33% Al_2O_3, 0.53-0.67% CaO, 0.02-1.82% MgO, 0.84-2.65% K_2O, 0.627.62% TiO_2, 0.06-0.23% MnO and 3.90-20.53% Fe2O3, while LOI was 10.84-12.20%. LOI for all the clays fall within the international acceptable limits for refractory application [18]. Based on SiO_2 content Kimathi clay was within the standard value for refractory application. Ithanje clay had the highest Al_2O_3 content compared to clays from other sites. The level lies within the standard value for refractory application. High levels of Fe_2O_3 is not desirable in refractory material, all clays from selected sites had higher levels of Fe_2O_3 above the standard value for Fe_2O_3 content for refractory materials [18]. Calcium oxide (CaO) of all selected clays were below the standard levels for refractory application. Magnesium oxide (MgO) content was found to be within the standard requirement except for Kimathi whose content was slightly higher than the recommended value.

Mineralogical Composition

The minerals present in the clays were determined using XRD and the results are as given in Figure 1 and Table 2 below.

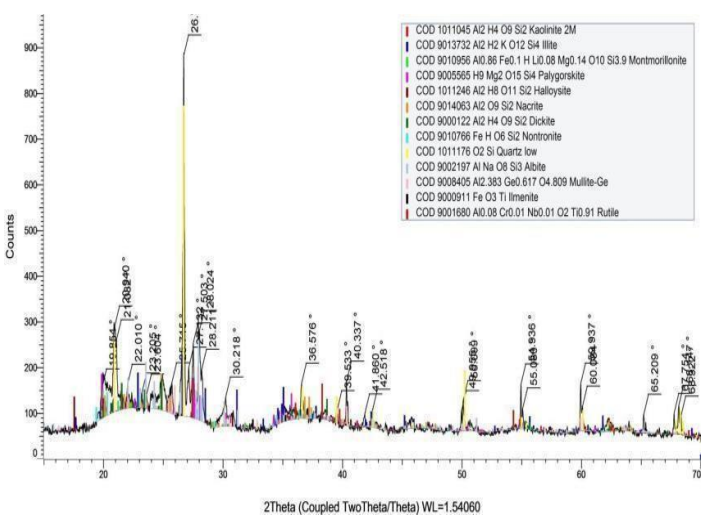

Figure 1: XRD spectrum for Ithanje clay

Table 2: Mineralogical composition of selected clays

% Mineral	Githima	Kimathi	Ithanje
Kaolinite	15.0	8.3	17.0
Quartz	17.6	11.6	4.8
Illite	37.9	15	13.9
Nacrite	6.2	10.3	16.8
Dickite	5.8	7.4	16.4
Montmorillonite	2.8	4.8	3.7
Ilmenite	1.8	0.5	2.3

XRD results showed that kaolinite, quartz and illite were the major mineral components in selected clays. Kaolinite levels ranged between 8.3 and 17.0% while illite concentration ranged between 13.9 and 37.9%. Kaolinite and illite are important clay minerals and due to their high levels, these clays may be used for refractory purposes with some enhancement. Quartz had a concentration in the range of 4.8-17.6%. The selected clays also contained nacrite and dickite which belong to kaolin group clay mineral.

Physical and thermal properties

Physical and thermal properties of selected clays compared with standard properties for refractory bricks are shown in Table 3 below.

Table 3: Physical and thermal properties of selected clays

Property	Githima	Kimathi	Ithanje	*Standard clay for refractory bricks
Fried Linear Shrinkage (%)	1	3	3	2-10
Permeability to air	37	45	53	25-90
Apparent porosity %	26.31	26.72	31.33	20-30
Bulk density g/cm3	1.56	1.68	1.56	2.2-2.8
Thermal Shock Resistance (cycles)	20	24	26	20-30
Refractoriness, 0C	1609	1655	1686	1500-1750
Loss On Ignition	11.47	12.20	10.84	

*Thermal properties international standard [19]

The clays had a range of 26.31-31.33% apparent porosity, 1-3 linear shrinkage, 1.56-1.68g/cm^3 bulk density, 1609-1686 ºC refractoriness. Refractoriness of clays from selected sites were within the standard limits. Permeability to air values were within the recommended range [19]. Ithanje clay apparent porosity was slightly above the standard limit whereas Githima and Kimathi clay apparent porosity are within the acceptable range. Thermal shock resistance of these clays were within the standard range of 20-30 cycles. However, bulk densities of the clays were below the standard values for refractory materials.

VI. Conclusion

Githima, Kimathi and Ithanje clays are composed of SiO_2 and Al_2O_3 as major constituents hence are fit for use as a source of alumino-silicate refractories. However, further research should the carried out to improve their properties for refractory application.

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The Communication Process Analysis of Corporate Social Responsibility Program of Ancol Zero Waste

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Abstract- This study entitled the Communication Process Analysis of Corporate Social Responsibility Program of Ancol Zero Waste. This research was motivated by PT. Pembangunan Jaya Ancol Tbk who wanted to contribute to the community in the form of implementing CSR programs. The CSR Program of Ancol Zero Waste was done to minimize the impact of company activities, protect the environment, foster harmonious relations and maintain the continuity of the company's business. This study aimed to understand and explain what the communication process was implemented in implementing the communication process of the corporate social responsibility program of Ancol Zero Waste. This research method was qualitative with a single case study design. The results of this study are expected to provide a variety of recommendations related to communication innovation, regarding how the communication model fits the characteristics of the Ancol Zero Waste Corporate Social Responsibility program. Academically, this research is expected to be a reference in further research, and can enrich the field of communication science, especially Public Relations, regarding the discussion of the application of communication models in CSR programs.

Index Terms- Communication Program, CSR, Zero Waste

I. Introduction

Ancol Zero Waste is a waste management program into compost conducted by PT. Pembangunan Jaya Ancol Tbk or Ancol since 2012 until now. The Ancol Zero Waste Program was carried out by Ancol as a form of corporate social responsibility towards Occupational Safety and Health and the Environment. Program Ancol Zero Waste was done to minimize the impact of the company's activities, protecting the environment, foster a harmonious relationship and maintain the continuity of Company's business.

Ancol put the Corporate Social Responsibility (CSR) as one of the strategies undertaken to develop synergies and harmonious relationships between the community and stakeholders. This reflected the commitment of Ancol as an ethical company and has the responsibility to contribute to the achievement of targets to improve the quality of environmental life that is better and beneficial, especially for companies, communities and community-based economic development. According to Lord Holme and Ricard Watt, "CSR is a company's commitment to sustainability and as a contribution to development to improve the quality of life of employees, family members and the wider community" (Rifka, 2014: 609).

In addition to being part of the company's business strategy, Ancol also understands that the community and the environment are the most important parts for Ancol, because it has a strategic role in the company's sustainable business growth. Environmentalists give their attention against the company, while the public service is not only to support the activities of Ancol CSR but also contribute to operations of the company as an employee in the existing business units. Society can change by influencing a company's sustainability. According to Rhesal Kesali "Every group or community in and outside the company environment has a role to influence and determine the success of a company (Yosal, 2004: 7)

Ancol strives in the Ancol Zero Waste program to be a land for employment for the community around the environment and the community can contribute by developing expertise and energy as well as being residents' land income. Implementation of the Ancol Zero Waste program, Ancol has a stake in the provision of land and equipment in processing waste into compost.

The approaches taken by Ancol Public Relations (PR) to take the initial steps of the waste management program into compost starting from the approach to the community providing training and providing land and equipment, up to the formulation of program planning steps, and implementation to overcome problems that exist in the community or residents around Ancol. In every activity of Ancol Zero Waste, certainly Ancol has found many obstacles encountered, however, this activity is still going well until now.

It is not easy to maintain an activity to keep growing awareness about the environment and the balance of development. There needs to be a program with ongoing activities and not just temporary activities with temporary results. The recognition and support from stakeholders so that these programs are running and community participation is a support for the success of a CSR program.

The CSR program is basically a corporate social responsibility towards stakeholders, by doing CSR the company can establish good and harmonious relations with stakeholders. In this study, the researcher focused on the aspects of communication and socialization of CSR programs, where the activity of managing waste into compost is not an easy program, so communication and comprehension become an important key in the realization of this program.

Based on these explanations, the writer was interested in researching and focusing this research on how the Communication Process of the Ancol Zero Waste Corporate Social Responsibility Program**.** Through this research, the writer want to understand and

explain what the communication process is implemented in implementing the communication process of the Ancol Zero Waste corporate social responsibility program. The results of this study are expected to provide a variety of recommendations related to communication innovation, regarding how the communication model fits the characteristics of the Ancol Zero Waste Corporate Social Responsibility program**.** Academically, this research is expected to be a reference in further research, and can enrich the field of communication science, especially Public Relations, regarding the discussion of the application of communication models in CSR programs.

II. LITERATURE REVIEW

Public Relations and Corporate Social Responsibility

Rex Harlow explained that Public Relations is a management function that is distinctive and supports coaching, maintaining a common path between an organization and its community, concerning communication activities, understanding, acceptance and cooperation; involving management in dealing with problems, helping management to be able to face public opinion; support management in following and utilizing change effectively; act as an early warning system in anticipating trends in the use of research and communication techniques, and healthy and ethical communication as a primary means (Yuliawati & Irawan, 2016: 211).

Public relations as a management and communication discipline needs to understand that it is strongly influenced by information and communication technology, especially in the last decade. At present Public Relations cannot avoid dealing with digital media, social media and cell phones. These media are part of the work that will become one of the new job drivers in the scope of Public Relations work (Vercic et al. 2014: 1).

Conceptually CSR is part of PR. Previously, public relations activities aimed at forming and maintaining relationships with the community were called community relations and community development. (Ardianto & Machfudz, 2011: 1). Public relations activities through CSR are specifically for communities that need help in developing their performance and empowerment through various CSR pillars, such as: the pillars of education, economy, environment, human resources, security, health, culture, religion, and others (Ardianto & Machfudz, 2011: 1).

Viewed from the definition, CSR definition is varied. Essentially, CSR is a business operation committed not only to increase the corporate profit financially, but also to build a social-economic area holistically, institutionally, and sustainably. Some other names are identical to CSR are corporate giving, corporate philanthropy, corporate community relations, and community development (Zukhruf and Irawan, 2018).

A similar opinion was also stated by Kotler and Lee (2005) that CSR is part of a company's commitment to improve community conditions for the better through discretionary business practices and contributions from company resources. In this definition, Kotler and Lee emphasize the discretionary component, which can be interpreted as the volunteerism of companies in implementing business practices that benefit community welfare (Irawan, 2018: 116).

Referring to this definition, CSR can be interpreted as an organizational or company commitment in contributing as a form of social responsibility to the community, with the aim of meeting the expectations of stakeholders, especially the community, in realizing sustainable development and improving the welfare of the community or CSR program recipients. Essentially the long-term orientation of a CSR program is the realization of sustainable development.

Sustainable development includes three policy matters, namely economic development, social development, and environmental protection. John Elkington in the triple bottom line chart as a meeting of the pillars of development namely "people, planets, and profits" which is the goal of development, is: 1) Corporate responsibility to maintain the ability of the environment to support the sustainability of life for the next generation (planet), 2) Form of corporate responsibility to shareholders (profit), 3) The presence of the company must provide benefits to stakeholders and the wider community (people), and 4) Sustainable development must be supported by a balanced commitment between economic, social, and environmental (sustainability development) (Rahman, 2018: 34).

Besides the benefits of doing CSR can also make the company reputation is seen as good, and the public has confidence in the company and the products it produces. Building consumer loyalty based on ethical values applied by each company that are different from one another, thus forming differentiation and becoming a trademark characteristic based on the values adopted (Wardhani, 2011: 143).

Various studies have shown that CSR programs play an important role in shaping cognitive responses, attitudes, and behaviors from stakeholders who have different interests. CSR programs have also been found to increase purchase intentions for customers, foster positive appreciation from customers, strengthen customer loyalty, and increase customer confidence in the company. In addition, the implementation of CSR programs can also attract potential employees and increase employee commitment and pride in the company. Furthermore, the implementation of CSR can influence investors' decisions and preferences through increasing company confidence. Indirectly, the implementation of CSR programs has benefits as well as the aim of increasing reputation and strengthening the company's competitive advantage in the long run (E Arikan et al, 2016: 132).

The Concept of Community Participation

Community involvement in development should be the concept of development today. To involve the community as the subject of development is a necessity, and this can be realized through the principle of community empowerment. Community empowerment can be done through the learning process so that it has the ability to have access in development. Through this empowerment, the community is expected to have the ability to seize opportunities for available resources. In addition, the community is also able to act as a decision maker and determinant in selecting and utilizing these opportunities.

Empowerment and participation is the center of attention in the recent development process in various countries. Furthermore Craig and Mayo explained that many countries showed great attention to the strategy of community participation as a means of accelerating the development process. Therefore, it is necessary to

emphasize the increase in the importance of alternative approaches in the form of development approaches that are initiated by the empowerment process (Susanto, 2009: 4).

Therefore, we need to understand what is meant by empowerment. McArdle explained that empowerment is a process of decision making by people to achieve collective goals independently through the accumulation of knowledge, skills and other resources in order to achieve their goals without relying on external help. In various countries, furthermore Craig and Mayo explained that many countries showed great attention to the strategy of community participation as a means of accelerating the development process. Therefore, it is necessary to emphasize the increase in the importance of alternative approaches in the form of development approaches that are initiated by the empowerment process (Irawan, 2018: 117).

Successful development based on community empowerment is very closely linked to community participation. Craig and Mayo stated that participation is an important component in the generation of independence and the empowerment process. The process is done cumulatively so that the more skills a person has, the better the ability to participate. Paul further stated that empowerment and participation are very potential strategies in order to improve economic, social and cultural transformation. This process will ultimately be able to create people-centered development. One international agency, the World Bank for example, believes that community participation in the third world is an effective means of reaching the poorest people to be able to live independently (Irawan, 2018: 117).

The Communication Model

Communication experts have tried to create models to describe and classify the communication process. Richard West, in his book Introduction to Communication Theory: Analysis and Application (2008) classified it into 3 communication models i.e. communication as action (linear model), communication as interaction (interactional model), and communication as transaction (transactional model). Claude Shannon and Warren Weaver, in 1949 conveyed communication as a linear process (linear communication model). They are inspired by radio and telephone technology, so as to describe information that passes through various channels. This approach explains that communication consists of several key elements. They are the source, or the sender of the message, sending a message to the recipient (receiver) who will receive the message. All of these communication processes occur in a channel that is directly related to the sense of sight, taste, smell, hearing and tactical (real perception). This communication also involves interference (noise), which is all things that are not intended by the source/ sender of the message.

Communication as action (linear model) is considered too narrow. Therefore, Wilbur Schramm (1954) tried to observe the relationship between sender and receiver. Then composed the concept of interactional model of communication (interactional model of communication), which emphasizes the two-way communication process i.e. from the sender to the recipient and from the receiver to the sender. In other words, communication takes place both ways and one of the important elements in the interactional communication model is feedback, or the response to a message that occurs after the message has been received, not when the message is being sent. Another element that is also important in interactional communication is one's field of experience i.e. how one's culture, experience and place of origin can influence one's ability to communicate with each other.

The third model of communication is the transactional model of communication which was introduced by Barnlund in 1970. This model underlines the continuous sending and receiving of messages. Transactional is defined as cooperative communication; the sender and receiver are both responsible for the impact and effectiveness of the communication that occurs. In the transactional model, the sender and receiver of communication establish a common meaning. Each party needs to be aware of the effect of one message on another (West & Turner, 2008: 14).

III. RESEARCH METHODS

The method to be used in this research is a qualitative method with a single case study design. A single case study has three rationalizations: firstly, when the case states an important case in testing a well-developed theory, secondly cases present an extreme or unique case and thirdly it is a disclosure case (Yin, 2011: 46). The uniqueness of the CSR program implemented by PT. Pembangunan Jaya Ancol Tbk, the writer tried to reveal how the company's efforts to involve community participation in CSR programs through the illumination of its communication model. This research tried to observe, understand and analyze the implementation of the program.

The research employed the purposive sampling technique. Purposive sampling is a sampling technique with a certain consideration. For example, conducting research on food quality, the sample data source is a food expert. This sample is more suitable for qualitative research, or studies that do not make generalizations (Sugiyono, 2004: 124). Selected speakers include the HSE Division as the manager of the Ancol Zero Waste program. Corporate Communication of PT. Pembangunan Jaya Ancol Tbk. Corporate Development of PT. Pembangunan Jaya Ancol Tbk. and the community involved in the program.

The methods of collecting data were interviews and documentation studies. Interview is a conversation with a specific intention by two parties, the interviewer as the complainant/ giver of the question and the interviewee as the giver of the question. Interviewees were managers and community members involved in CSR programs at PT. Pembangunan Jaya Ancol Tbk. Study documentation. Documentation study is one of the data collection techniques used in social research methodologies to trace historical data. The writer conducted a documentation study by collecting documents such as letters, reports, photos, pictures, clippings, diaries, and the website of PT. Pembangunan Jaya Ancol Tbk and other documents.

Essentially, qualitative data analysis is carried out together with the data collection process. Data analysis techniques according to Miles and Huberman include three concurrent activities: data reduction, data presentation, and drawing conclusions (verification) (Basrowi, 2008: 209). Then the data analysis techniques chosen in this study were as follows: 1) Data reduction. Field data obtained through observations and interviews in the form of field notes and records of course are quite a lot and difficult to understand, so the data reduction was conducted. 2)

Data Presentation (Display data). To make it easier to read the data obtained, the reduced data is then presented (displayed) in the form of a comprehensive description of each aspect studied, together with tables/ charts, relationships between categories, etc. 3) Draw conclusions and verification. Verification is interpreting data that has been compiled. Based on these interpretations, the writer could arrange into a conclusion, where this conclusion is the result of research that can answer research questions that have been formulated previously.

To establish the validity of the data, the writer conducted a triangulation technique. Triangulation is a data checking technique that utilizes something other than research data for checking or comparison purposes. Denzin distinguishes four types of triangulation as an examination technique that utilizes the use of sources, methods, investigators and theories (Moleong, 2013: 330). The triangulation technique used in this study is source triangulation. Through triangulation of sources, the writer compared and checked back the degree of trust in information obtained by: (1) comparing observational data with interview data (2) comparing the consistency of the respondent's answers by comparing what the resource person said in public for example, by what is said privately (3) comparing a person's perspective with others in his work team.

IV. DISCUSSION

The communication process in the initial planning of the Ancol Zero Waste CSR program involved the role of PR, Community Development, communicating directly to the community. Ancol came to the community and interviewed the community and found out what many people wanted by the presence of Ancol in the midst of the community environment. After knowing what the community wanted towards Ancol then the equality of desire between Ancol and the community would be carried out. The approach of equating this opinion was conducted to be able to determine what the community wanted at that time. The community's desires that made Ancol finally made a CSR program.

Furthermore, the initial approach made by Ancol communication strategy used a linear approach to the communication process approach (linear communication models) of Claude Shannon and Warren Weaver. The linear communication process (linear communication model) is communication applied by Ancol to the community through various channels through the approach. This approach explains that communication consists of several key elements, the company as a source or sender of a message, send a message of CSR to the society as a receiver of CSR message or the target of program implementation.

All of these communication processes occur in a channel that is directly related to the sense of sight, taste, smell, hearing and tactical (real perception). This communication also involves interference (noise), which is all things that are not intended by the source/ sender of the message. After Ancol has been accepted by the community, Ancol descended directly to be able to communicate with the community and know what people want from Ancol. Messages and information related to CSR given by Ancol to the community were given to get feedback or community response to Ancol through various interactive discussions and dialogues.

This concept is the development of the concept of Wilbur Schramm (1954) who tried to observe the relationship between the sender and receiver of the message. The interactional model of communication emphasizes the process of two-way communication, i.e. from the sender to the receiver and from the receiver to the sender. In other words, communication takes place both ways and one of the important elements in the interactional communication model is feedback, or the response to a message that occurs after the message has been received, not when the message is being sent.

In delivering messages the sender to the recipient of the message is influenced by other elements that are also important in interactional communication is one's field of experience i.e how one's culture, experience and place of origin can affect one's ability to communicate with each other.

In 2016, Ancol worked with Vendors to ensure the sustainability of the program, Ancol developed and implemented CSR implementation through evaluation activities, monitoring the program continuously and involving the community. The role of Ancol and the community is equally responsible for all parties (senders and recipients) in the effectiveness of the results and the impact of communication. The intensity of giving messages to Vendor makes this CSR program sustainable to the present.

This communication model including the transactional model introduced by Barnlund in 1970, he underlined the sending and receiving of messages that take place on an ongoing basis. Transactional is defined as cooperative communication; the sender and receiver are both responsible for the impact and effectiveness of the communication that occurs. In the transactional model, the sender and receiver of communication establish a common meaning. Each party needs to be aware of the effect of one message on another

Program Communication to Stakeholders is a corporate strategy in implementing corporate responsibility. The strategy is a means to describe the vision, mission and social responsibility policy which will implemented. In Ancol, social responsibility carried out refers to the Public Relations strategy. This Public Relations Strategy is intended to achieve the objectives of Social Responsibility in order to build and instill public perceptions about the company (building image). Conceptually, PR activities aim to establish and maintain harmonious relationships, one of them with the community and the community is called Community Relations and Community Development, but now through Corporate Social Responsibility/ CSR is also a part of the conceptual homework (Elvinaro & Dindin, 2011: 1)

The success of a CSR program cannot be measured in a year, or two years, but in a continuous, planned, and measurable manner. In this case there is a need for corporate and community communication (stakeholders).

Communication with Corporates, the steps of corporate communication in CSR are: (1) providing extensive information to the community in their environment about CSR activities and other corporate activities and how corporations carry them out (2) Providing information to the community about the opportunity to compete in making CSR activities (3) Interacting and monitoring actions together with the community so that the collaboration works effectively (4) Socializing of the importance of being

responsible with the surrounding environment (Ardianto & Dindin, 2011: 14-1)

Based on the steps of communication with the corporate stages of CSR activities and theoretical studies above, it can be seen that the existence of CSR Programs Communication towards Corporate and Community can be seen from several activities carried out by Ancol, there were three stages.

Firstly, Ancol used the Annual Report, Website and Internal Magazine to communicate the Ancol Zero Waste CSR program to investors. Secondly, Ancol provided a variety of garbage bins along with garbage trucks for visitors (customers) who were also Ancol publics. Lastly, in the implementation of HSE and the Vendors was condunted by weekly meetings to evaluate the Ancol Zero Waste program, along with Ancol units.

V. CONCLUSION

Based on the results of research related to the process of communication of corporate social responsibility Ancol zero waste, it can be concluded as follows. Firstly, the communication activities of the Ancol Zero Waste Program before 2016, consisted of several stages i.e. (1) The process of approaching the community environment (2) Determining the vision, mission, objectives, target organizational structure and indicators of success (3) Determining the place of activity, Budget Plan and Permit for the place of activity (4) Designing the implementation (5) Evaluating and reporting. In 2016, communication activities consisted of several stages i.e. (1) Designing Implementation with Vendors, (2) evaluating and reporting with Vendors. Secondly, the transactional communications model or continuous communication carried out by the HSE (Ancol) to the Vendor make Ancol Zero Waste program can run well up to now. Program communication is carried out during program control and program evaluation conducted by HSE and Vendors. Thirdly, the communication of Ancol Zero Waste Program: (1) Through the Annual Report, Website, Internal Magazine for communicating CSR program Ancol Zero Waste to Investor. (2) Ancol provides various types of garbage bins and garbage trucks for visitors (customers) who were also Ancol publics. (3) Ancol conducted weekly meetings to evaluate the Ancol Zero Waste program, along with Ancol units.

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Impact of Banking Sector Reforms On Stock Market Performance in Nigeria (2004-2018)

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Abstract: Central Bank of Nigeria (CBN) has over time structured out different kinds of banking sector reforms to boost commercial banks and its allies in the sector to adequately perform essentially their intermediation function. Therefore, this study critically examined banking sector reforms impact on stock market performance in Nigeria considered from 2004-2018; with particular interest to proxy banking sector reforms: as broad money supply, domestic credit to the private sector and interest rate spread. The variables employed in the study where tested using an ADF, Johansen co-integration and model stability test, while the error correction mechanism (ECM) was used to estimate the individual parameters and to validate the hypothesis outlined in the study. The empirical results of the study found a collective insignificant impact of banking sector reforms on stock market performance for the period under study. The study further reveals that, broad money supply as a reform proxy has a linear relationship with stock market performance. The study strongly recommends the need for Central Bank of Nigeria (CBN) and other monetary authorities to periodically review and sustain existing banking sector reforms in consonance with current challenges in the banking sector so as to boost performance in the Nigerian stock market.

Keywords: banking sector, reforms, stock market, performance, financial intermediation.

1.0 INTRODUCTION

The financial sector is one of the dominant economic sectors in Nigeria, and banks are key players in any country's financial sector. The banks occupy a strategic position in the economic equation of any country such that their good or bad performance invariably affects the economy of the country (Wilson, 2006). Hence, reforms to modernize and strengthen the financial sector have continued in recent years. The Nigerian financial system, which represents the umbrella of financial markets, intermediaries, instruments, regulatory agencies and the body of rules, norms and regulations that governs the interaction in the system, has evolved from a rudimentary to a more sophisticated one over the past few decades. Reforms are predicated upon the need for reorientation and reposition of existing status quo in order to attain an effective and efficient state (Ajayi 2005). Compos and Esfahani (1996) stressed that policy reform means "a renegotiation of contracts that entails direct government involvement in production towards more efficient market oriented ones. Also, Okeke (2007) posits that reforms are deliberate actions by the government to fast track, jump start and consolidate specified sectors of the economy to achieve desired objectives.

In the past three decades, the Nigerian banking sector has witnessed five distinct phases of banking sector reforms. During 1986 to 1993, when the banking industry was deregulated in order to allow for substantial private sector participation, the re-regulation era of 1993-1998, following the deep financial distress, the return of liberalization and the adoption of the universal banking model in 1999, banking sector consolidation which commenced in 2004 which was meant to correct the structural and operational weaknesses that constrained the banks from efficiently playing the catalytic role of financial intermediation and banking reform meant to substantially improve the banking infrastructure, strengthen the regulatory and supervisory framework and address the issue of impaired capital and provision of structured finance through various initiatives, so as to provide cheap credit to the real sector, and financial accommodation for small and medium-scale enterprises (Anyanwu, 2010).

Nevertheless, prior to the 2004 recapitalization policy, it was reported that a total of thirty two (32) licensed banks went into distress and were eventually liquidated. Out of these, thirteen (13) were commercial banks, eighteen (18) merchants banks, and one (1) cooperative bank (NDIC, 2004). More so, only 10 of the commercial banks were rated as sound, 51 were classified as unsatisfactory, 16 were rated as marginal, while another 10 were categorized as unsound (CBN, 2004). According to the then governor of Central Bank of Nigeria (CBN), Charles Soludo, the banking reform (the recapitalization policy) was meant to:

(1) Reposition the nation's banking industry for global competitiveness

(2) Ensure a strong and reliable banking sector that will guarantee the safety of the depositor's money

(3) Play active development role in the nations' economy

(4) Make the banks less dependent on public sector fund and

(5) Be capable of financing the real sector (New Age April 17, 2005).

Generally, the reforms were anchored on four cardinal pillars, namely, enhancing the quality of banks, establishing financial stability, enabling healthy financial sector evolution, and ensuring that the financial sector contributes to the real economy. Following the fourth phase of the reforms which began in 2004, banks were consolidated through mergers and acquisitions, raising the capital base from ₦2 billion to a minimum of ₦25 billion which reduced the number of banks to 25 from 89 in 2005 and later to 24 at the end of December 2007, with the merging of Stanbic Bank Plc and IBTC Bank to form Stanbic IBTC. And to 23 thereafter with Fin bank merging with FCMB Plc. And finally Diamond bank acquisition by access bank Plc, making current total of 22 commercial banks in Nigeria.

The Central Bank of Nigeria (CBN) intervened again purportedly to save the banking industry from imminent collapse. Five banks were identified for rescue as a result of poor capital adequacy, high risk assets, poor corporate governance tending towards CEOs corruption, erosion of shareholders fund, high liquidity ratio and credit crises. Whereas the twenty five (25) banks that passed the recapitalization test were declared sound in 2005, by 2006, ten (10) were declared sound, five (5) satisfactory, five (5) as marginal

and five (5) unsound (CBN, 2010). The other components of the recent banking sector reforms in Nigeria, according to (Sanusi, 2012), include the adoption of risk focused and rule-based regulatory framework, adoption of zero tolerance in regulatory framework in data/information rendition/reporting and infractions, strict enforcement of corporate governance principles in banking, expeditious process for rendition of returns by banks and other financial institutions through e-FASS, revision and updating of relevant laws for effective corporate governance and ensuring greater transparency and accountability in the implementation of banking laws and regulation.

Beyond the need to recapitalize the banks, the reforms focused on ensuring minimal reliance on public sector for funds, but rather relying on the private sector. However, a new set of problems were said to have emerged and threatened the financial system from 2008, following the global financial crisis.

The surge in capital did not only put pressure on the availability of human capacity in the sector but it also led to margin loans and other high risk investments, among other things. The balance sheet of banks became eroded to the extent that most of them remained for some time on 'life support' from the CBN. Interbank rates spiked as banks could borrow at any rate in order to remain afloat, the size of non-performing loans enlarged, customer panic re-emerged and several unethical conducts among the managements of banks were revealed. These problems, according to Sanusi (2012) led to a new set of reform, whose cardinal pillars encompassed: Enhancing the quality of banks; establishing financial stability; enabling healthy financial sector evolution and ensuring that the financial sector contributes to the real economy.

The Central Bank of Nigeria (CBN) equally articulated a blue print known as **"***The Project Alpha Initiative"* for reforming the Nigerian financial system in general and the banking sector in particular following the 2008 global financial crisis. The reforms were meant to remove the inherent weaknesses and fragmentation of the financial system, integrate the various ad-hoc and piecemeal reforms and unleash the huge potential of the economy.

The Nigerian stock market is an important component of the Nigerian financial system. According to Anyanwu (1993), the stock market is a complex mechanism made up of procedures, instruments and institutions through which efficient economic units (the users of funds, e.g. government, corporate bodies) and the surplus units (i.e. suppliers of funds) carries out mutual transactions on daily basis.

The Nigerian banking sector has undergone series of reforms as stated earlier from 1959 till date. This is basically to ensure a stable and sound banking system that will support bank's financial performance and the general economic development of the country. This notion is tied to the school of thought who holds that banks via the mobilization of surplus funds through their heterogeneous branch networks help stimulate their financial performance by channeling investible funds efficiently to deficit business units of the economy. This is otherwise known as finance leading economic growth hypothesis.

Therefore, the question of whether banking sector reforms has an unprecedented effect on the Nigerian stock market performance still remains' unanswered. However, this study is to examine the impact of the above mentioned subject.

This study is partitioned in five sections. Section one is the introduction, section two is review of related literatures, section three is the methodology, section four is for analyses and interpretation of data and section five is on summary, conclusion and recommendations.

2.0 REVIEW OF RELATED LITERATURES

2.1 Conceptual Framework

2.1.1 Stock Market and its Operations

As the activities on a stock market tends to be specialized and understood by common people, this conceptual review will give some basic definitions, stock market history, participants, operations and its importance, so as to serve as a basis for understanding how the stock market can help promote investment and trade in a monetary zone.

Definition: Although common, the term stock market is somehow abstract for the mechanism that enables the trading of company stocks. It is also used to describe the totality of all stocks especially within a country. For example in the phrase "the stock market was up to day or in the term "stock market bubble"

Stock market is different from stock exchange, which is an entity (a corporation or mutual organization) in the business of bringing buyers and sellers of stock together. For example, the stock market in the United States includes the trading of stocks listed on the New York Stock Exchange (NYSE), NASDAQ and Amex and also on the OTCBB and pink sheets.

History of stock market: In 12th century France, the courratier de change was concerned with managing and regulating the debts of agricultural commodities on behalf of the banks because these men also traded with debts. They could be called the first brokers.

The early 13th century, Bruges commodity traders gathered inside the house of a man called Van der Beurse, and 1309 they institutionalized this but until then informal meeting and became the Brugse Beurse. The idea quickly spread around Flanders and neighbouring counties and beurzen and zoon opened in Ghent and Amsterdam.

In the middle of the 13th century, Venetian bankers began to trade in government securities. 1351, the Venetian government out lawed, spreading rumors intending to lower the price of government funds. Bankers in Pisa, Verona, Genoa and Florence also began trading in government securities during the 14th century. This was only possible because these were independent city states not ruled by a duke but a council of influential citizens.

The Dutch latter started joint stock companies, which let shareholders invest in business ventures and get a share of their profit or loses. In 1602, the Dutch East India Company issued the first share on the Amsterdam Stock Exchange. It was the first company to issue stocks and bonds.

The first stock exchange to trade continuously was the Amsterdam Beurs. In the early 17th century, the Dutch pioneered short selling option trading. Equity swaps, Merchant banking, Units Trust and other speculative instruments much as we know them.

Now, there are stock markets in virtually every developed country and most developing countries of which Nigeria is no exception. Worldwide, the biggest markets are in the United States of America, UK, Germany and Japan.

Stock Market Participation and Trading: Many years ago, worldwide, buyers and sellers were individuals investors such as wealthy businessmen, with long family histories (and emotional ties) to particular corporations think over time, markets have become more institutionalized with buyers and sellers largely institutions. E.g.: Pension Funds, Insurance Companies, Mutual Funds, Hedge Funds, Investors Groups and Banks. The rise of institutional investors has brought with it some improvement in the stock market operations, but not necessarily in the interest of the small investors or even of the naïve institutions of which there are many.

Now, participants in the market ranges from small individuals stock investors to large hedge funds traders. Who can be based anywhere. Their orders usually end up with a professional at a stock exchange who executes the order.

Most stocks are traded on exchanges. E.g: NYSE which are places where buyers and sellers meet and decide on a price. Some exchanges are done in a physical location where transactions are carried out on a trading floor, by a method known as open outcry.

The other type of exchange is virtual kind. Eg: NASDAQ, composed of a network of computers where trades are made electronically via traders at computer terminals.

Actual trades are based on auction market paradigm where a potential buyer bids a specific price for a stock and a potential seller ask a specific price for a stock. When the bid and ask prices match, sale takes place on the basis of first come first serve if there are multiple bidders and askers at a given price.

The purpose of a stock exchange is to facilitate the exchange of securities between buyers and sellers, thus providing a market place (virtual or real). Really a stock exchange is nothing more than a super sophisticated farmers market providing a meeting place for buyers and sellers.

Importance of Stock Market

Just as it important that network of transportation, electricity and telecommunications properly, so it essential that payment can transacted, capital can be saved and channeled to the most profitable investment projects and that both households and firms get help in handing financial uncertainty and risk as well as possibilities of spreading consumption overtime. Financial market constitutes an important part of the total infrastructure for every society that has passed the stage of largely domestic economies. Stock market which is part of the financial markets, perform the following functions in an economy:

i. **Raising Capital for Business:** The stock exchange provides companies with the facility to raise capital for expansion through selling shares to the investing public.

ii. **Mobilizing Savings for Investment:** when people draw their savings and invest in shares, it leads to a more rational allocation of resources because funds, could have been consumed or kept in idle deposits with banks, are mobilized and redirected to promote business activities with the benefit for several economic sectors such as: agriculture, commerce and industry, resulting in a stronger economic growth and higher productivity levels.

iii. **Facilitate Company Growth:** companies view acquisition as opportunity to expand product line, increase distribution channels, hedge against volatility, increase its market share or acquire other necessary business assets. A takeover bid or merger agreement through the stock market is the simplest and most common way to company growing by acquisition or fusion.

iv. **Redistribution of Wealth:** By giving a wide spectrum of people a chance to buy shares and therefore become part owners (shareholders) of profitable enterprises, the stock market helps to reduce large income inequalities. Both casual and professional stock investors through stock price rise and dividends get a chance to share in the profits of promising business that were set up by other people.

v. **Corporate Governance:** By having a wide and varied scope of owners, companies generally tend to improve on their management standards and efficiency in order to satisfy the demands of these shareholders and the more stringent rules for public corporations by public stock exchange and the government.

Consequently, it is believed that public companies (companies that are owned by shareholders who are members of the general public and trade shares on the public exchanges) tends to have better management records than privately held companies (those companies where shares are not publicly traded, often owned by the company founders and/or their families and heirs or otherwise by small group of investors).

However, some well documented cases are known where it is alleged that there has been considerable slippage in corporate governance on the part of some public companies. (MCI WorldCom, Nig breweries, Nestle, Total Nig Ltd or parmalat).

vi. **Create Investment Opportunities for small Investors:** As opposed to other businesses that require huge capital outlay, investing in shares is open to both the large and small stock investors because a person buys the number of shares they can afford. Therefore the stock exchange provides an extra source of income for small savers.

vii. **Government Raise Capital for Development Projects:** The Government and even local municipalities may decide to borrow money in order to finance huge infrastructure projects such as sewerage and water treatment works or housing estates by selling another category of securities known as bonds.

These bonds can be raised through the stock exchange whereby members of the public can buy them. When the government or municipal councils gets this alternative source of funds, it no longer has the need to overtax the people in order to finance these development projects.

viii. **Barometer of the Economy:** At the stock exchange, share prices rise and fall depending largely on the market. Share prices tend to rise or remain stable when companies or the economy in general show signs of stability. Therefore the movement of share prices can be an indicator of the general trend in the economy.

The Behavior of the Stock Market

From past experience, it is known that investors may temporally pull financial prices away from their long term trend level. Over reactions may occur so that excessive optimism (euphoria) may drive prices unduly high or excessiveS pessimism may drive prices unduly low.

2.1.2 The Concept of Banking Reforms

Banking reforms can be referred to as regular or irregular interception in rules and regulations guiding the operation of financial institution, toward attainment of international best standard, and sufficient backing of economic performance and development in a country. Many inextricable factors may warrant reform in the sector, but majorly prompted with hope of regulating milieu of macroeconomic variables. In addition, it's generally recognized the need to deepen the financial sector and its repositioning for increase equally propelled banking sector reforms. Banking reform can be categorized into systemic and big-bang banking reforms.

The systemic banking reforms: This banking reforms refer to a reform designed to resolve a combination of banking sector or economy wide problem(s). This normally takes the forms of liberalization, recapitalization, and deregulation of interest and credit operations (Okafor, 2011).

The big-bang reforms: This is targeted to achieve a particular course (for example: increase capital base of banks i.e. the 2004/2005 bank recapitalization exercise) is a good example of the big-bang reforms. Narrowly, the essentials of sound banking system can be viewed as liquidity and profitability. Crowther cited in Jhingan (2004) pointed out that, "The secret of successful banking is to distribute resources between the various forms of assets in such a way as to get a sound balance between liquidity and profitability, so that there is cash in hand or quickly realizable to meet every claim, and at the same time enough income for the bank to pay its wages

and earn profits for its shareholders." Other benefits that go with banking reforms are: (i). Safety of depositors' values. (ii). Stability of operation. (iii). Elasticity with respect to loan facility. (iv). Efficient reserve management. (v). Expansion which is a *sine-qua-non* to deposits mobilization and credit facilities availability (Jhingan, 2004).

The rationale behind banking reforms in Nigeria was for achievement of macroeconomic goals of price stability, full employment, high economic performance and internal and external balances. However, the reforms were expected to play actual role in financial intermediation, financial stability and confidence in the system (CBN, 2012). The backdrop of correcting structural and operational weakness in the year 2004, which was the fourth phase of banking reform in Nigeria, was the revitalization of financial intermediation in the sector.

2.2 Theoretical Framework

This study rests on the theoretical linkage between financial development which is appropriate from banking reforms and stock market performance, as it was rightly established by: the doctrine of necessity and Goldsmith theory of financial development in 1969.

2.2.1 The Doctrine of Necessity: This posits that banks are the hub of every economy and as such plays a vital role in the survival of the entire economic system. The larger economy therefore depends on the banking system. For this reason, it becomes necessary to regulate the activities of the banks to fit into the economic policies of the government. As a result, banking regulations and control as well as banking reforms appear to be unavoidable instruments not only of banking sector management but of national macroeconomic management (Fries and Taci, 2002, cited in Okafor, 2014).

2.2.2 Goldsmith Theory of Financial Development in 1969: Peak of Goldsmith's theory is the recognition that financial development matters in turning the economic fortunes of nations as it lowers market imbalance which in essence increase the domestic savings rate and attract foreign capital. Supporting this assertion, Goldsmith analyzed the total assets of various financial institutions, trends in their types and allocation, in relation to long-run economic performance. According to Goldsmith, this helps indicate the extent and character of financial interrelations, which in turn helps to determine how capital expenditures are funded and how existing assets are shifted among others.

Explaining his position, Goldsmith opined that as a result of the fact that in the first quarter of the 20th century, the financial transactions of other financial institutions increased in relation to the funds mobilized by commercial banks, the central bank's ability to control or direct financial performance was weakened.

There is also a theoretical link between financial policy reforms and money market operations. In the conventional Keynesian theory and policy, impact of monetary policy can be transmitted to the rest of the economy through the monetary system. For instance, there is the assumption that in the presence of an efficient money market, interest rate elasticity permits the distribution of funds among competing uses in an efficient way. It is believed therefore, that liberalization of interest rate, accompanied by price competitiveness of the banking system would stimulate the rate of savings in a given level of income and hence supply of domestic capital (Ndekwu 2002).

2.3 Empirical Review

Most recent studies globally and within the national boundaries on the edge of this study found mixed results on the studied phenomenon. The following are just few among many others: Usman (2008) studied the impact of consolidation reform on stock market performance, proxy's performance as efficiency and profitability between the period 2003 to 2008.The finding show that consolidation has impacted on both profitability and efficiency but not significant.

Sanni, Ebo and Adereti (2012), reported a positive significant difference between earnings per share of nine banks, following their study of post consolidation on profitability in Nigeria, using a time frame of 2006 to 2010, also employing cumulative earning per share as the profitability measure.

Adegbaju and Olokoyo (2008), considered recapitalization and bank performance, using yield on earnings asset, return on asset and return on equity as performance proxy. The study found a positive significant relationship between recapitalization and profitability (ROA and ROE) and a negative significant relationship with yield on earning asset (YEA).

Ritu, Pablo, David and Raul (2004) reported a strong positive significant effect of bank consolidation reform on bank performance, which implies that bank return increases with consolidation. However, the reverse is the case with insolvency risk.

Umoren and Olokoyo (2007) also found return on equity to be positively and negatively significant to asset profile and capital structure of a bank which was used as proxy for consolidation in their study of merger and acquisition in Nigeria, analysis of pre and post consolidation between 2006 to 2008.

Appah and John (2011) analysed the profit efficiency effects of Mergers and acquisition in the Nigerian Banking Industry. The Study used ex-post research design with data drawn, the annual reports of sampled banks for the period 2003 -2008 using ROE as proxy for profit efficiency while the sample size consist of 10 banks. The paired sample T-test statistics and descriptive analysis was used for analysis. Findings revealed that sampled banks performed better during the Pre-merger and acquisition period (2003-2005). The study concluded that there is no significant difference in ROE of all banks combined between the pre and post-merger period. This position was confirmed by:

Taiwo and Musa (2014) who examined the impact of consolidation on the performance of listed deposit money banks in Nigeria covering a period of 12 years from 2000 to 2011 (6yrs pre & post); using a sample of four banks. Paired sample T-test was used to test the hypothesis formulated with reference to the variables; Return on Asset, Return on Equity and Net profit margin. The study concluded that the consolidation reform in the Nigerian banking sector has impacted positively on Return on Assets, Net profit margin, but does not impact on Banks Return on equity.

However, Onikoyi and Awolusi (2014) differs from the earlier position on equity in their research; the effects of mergers and acquisitions on shareholders' wealth in Nigerian banking industry. In a bid to establish relationship between; increase in capital base and shareholders wealth, merged and acquired banks market shared and shareholders wealth, increase in merged banks revenue and shareholders wealth, cost savings and shareholders wealth; exploratory and correlation research designs were used to analyses a sample of fifteen (15) merged banks. Five hundred and fifty seven (557) questionnaires were administered to the staff of the merged banks and a response rate of 58.3% was obtained.

The instrument was validated and Cross batches. Alpha coefficient result of 0.708 was obtained indicating the internal consistency of the instrument. The findings of study showed that there was a significant relationship between shareholders wealth and capital base (P-value of 0.000), market share (ρ-value of 0.000), and bank revenue (ρ-value of 0.000), cost savings (ρ-value of 0.000). The study concluded that mergers and acquisitions have positive effect on the shareholders wealth.

Olokoyo (2013) reviewed bank reforms if they have been able to achieve predetermined goals and set objectives in Nigeria. The study gathered data for analysis through the instrument of questionnaire. One hundred (100) copies were administered out of which eighty (80) copies were collated for the analysis. Analysis of Variance (ANOVA) method was used to test the hypothesis.

The study shows that the recapitalization and consolidation process has significant effect on the manufacturing sector of the economy and thus on the Nigerian economy at large. The study further reveals that despite the reforms, post consolidation challenges like challenges of increased return on investment still exist.

Odetayo and Olowe (2013) conducted an empirical analysis on the impact of post -merger on Nigerian Banks profitability. Multiple regression analysis and the estimation is OLS with the aid of STATA software was used to analysed date covering 2005-2012 for Net Assets and shareholders fund. The sample consists of 2 banks. The result showed that post-merger has not significantly impacted on bank's profitability.

Fadare (2010) investigated the effect of banking sector reforms on economic growth in Nigeria over the period of 1999-2009, using OLS regression technique.

The study found that interest rate margins, parallel market premiums, total banking sector credit to the private sector, inflation rate, size of banking sector, capital and cash reserve ratios account for a very high proportion of the variation in economic growth in the country.

Ikenna (2012) studied the long and short run impact of financial deregulation and the possibility of a credit crunch in the real sector, using Autoregressive Distributed Lag (ARDL), and time series data ranging from 1970-2009. The study found that deregulating the Nigerian financial system had an adverse effect on the credit allocation to the real sector in the long run and in the short run. The study suggested mandatory credit allocation even in the long run as of utmost necessity as it had started with the latest banking reform.

Omankhanlen (2012) examined the financial sector reforms and its effect on the Nigerian economy from 1980-2008, using OLS method.

Financial intermediation was found to be necessary condition for stimulating investment, raising productive capacity and fostering economic growth.

Alajekwu and Obialor (2014) carried out a study on the Nigeria bank recapitalization reforms: effect on banks and the economy. The ordinary least square (OLS) regression was used for the analysis that span between the periods of 2000-2012. The study found that financial deepening was significantly influenced by the recapitalization.

Iganiga (2010) in his study: Evaluation of the Nigerian financial sector reforms. To assess the effect of the reforms on the effectiveness and efficiency of the Nigeria financial institutions, The classical least square technique was used for the analysis of the data sets from 1986-2009.

The study found out that the performance of financial sector has been greatly influenced over time by the reforms.

Related studies within the national boundaries reviewed have not considered sample coverage from 2004-2018. Hence this study aimed at bridging this obvious gap in literature. This will enable us assess and captured the real impact of banking sector reforms on the Nigerian stock market performance on current basis.

3.0 METHODOLOGY

Hypothesis: The hypothesis is formulated in null form in order to bring fort clarity of purpose. **Ho:** Banking sector reforms have no significant impact on the Nigerian Stock market performance.

Data Requirement and Sources: Given the nature of this study, it is imperative to choose data that will permit the estimation and testing of the hypothesis formulated. Broad money supply (M_2), credit to the private sector (CPS) and the prime interest rate spread (PITR) as proxy of the impact variable (banking reforms) while market capitalization (MKPZ) is used as the explained variable (stock market performance) for the period under study.

Time series data are employed for this study. The data were obtained from Central Bank of Nigeria (CBN) annual statistical bulletin and National Bureau of Statistics (NBS) 2018.

- **Broad Money Supply (M_2):** This represent a financial performance indicator for banks development, it is a ratio of broad money supply (M_2) to Gross Domestic Product (GDP). This ratio is a measure of the size of the banking sector in relation to the economy as a whole.
- **Credit to Private Sector (CPS):** We used the domestic credit to the private sector in ratio of Gross Domestic Product (GDP) as one of the proxy for banking reforms because it account for financial intermediary development. Since both banks and stock markets intermediate funds (savings) towards investment projects, they can either complements or substitutes each other.
- **Prime Interest Rate Spread (PTR):** This is the rate of interest at which banks charges for lending money to individuals or corporate bodies which rates varies from time to time.
- **Stock Market Capitalization (MKPZ):** Market capitalization refers to the total market value of a company's outstanding shares; commonly referred as "market cap" It is calculated by multiplying a company's shares outstanding by the current market price of one share. The investment community uses this figure to determine a company's size as opposed to using sales or total asset figures.

Using market capitalization to show the size of a company is important because company size is basic determinant of various characteristics in which investors are interested including risks.

Data Analysis Method: The following econometric techniques shall be employed for the analysis of the data-set and the estimation of the model:

(a). Augmented dickey-fuller (ADF) test. (b). Johansen Co-integration test for variables employed. (c). Test of stability of the model. (d). Ordinary least square regression (OLS) method and (e). Error Correction Mechanism (ECM) shall be employed in the study.

3.1 Model Specification

In accordance with the formulated hypothesis in this study, the model of this study will be specified as: stock market capitalization (MKPZ) as determinant for stock market performance, which is the explained variable while broad money supply (M_2) domestic credit to private sector (CPS) and prime interest rate spread (PTR) are all explanatory variables employed in the study.

The specification of econometric model is based on economic theory relating to the studied phenomenon and as such, basic steps are required:

1. Determination of the dependent and independent variables.
2. Theoretical apriori expectation and signs of functional parameters relationships.
3. Determination of the mathematical form of model (Gujarati, 2004).

In analyzing the studied phenomenon we adopt and modified an empirical model of Osisioma, Egbunike and Adeaga (2015). Their model was used to study the impact of corporate governance on banks performance in Nigeria.

Their model will be adjusted to reflect the current study showing the functional relationship of the variables employed.

$$MKPZ = f(M_2, CPS, PTR,) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where,

MKPZ = Stock market capitalization.

M_2 = Broad money supply.

CPS = Domestic credit to private sector.

PTR = Prime interest rate spread.

The econometric specification of the explicit form of the multiple regression models is given as follows;

$$MKPZ_t = a_o + a_1M_{2t} + a_2CPS_t + a_3PTR_t + Ue_t \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where:

a_0 = intercept

$a_1 \ldots a_3$ = Coefficients of the explanatory variables to be estimated. They measure the effect of a unit change in banking sector reforms on stock market performance in Nigeria.

Uet = Error term of the time series for data set.

Decision Rule: In this study the decision rule is to reject the null hypothesis (H0) if the calculated t* is greater than the table value at 5% level of significance.

4.0 ANALYSIS AND INTERPRTATION OF DATA

DATA PRESENTAION

YEAR	M2/GDP	CPS/GDP	PTR	MKPZ (Nbn)	MKPZ/GDP
2004	10.8	7.3	16.72283192	2.11	23.3
2005	11.8	8.3	16.54839096	2,90	37
2006	13.3	8.0	16.84844693	5.12	53
2007	15.5	11.2	16.84238679	13.3	60
2008	20.5	17.7	16.42141957	9.5	39
2009	21.3	20.7	17.20401138	7.03	29
2010	20.2	18.6	16.92596997	10.33	32
2011	19.3	16.9	16.86833333	10.34	33
2012	19.4	20.4	16.69333333	10.11	31
2013	18.9	19.7	16.56342526	9.1	30
2014	19.9	19.2	17.13666667	11.12	46
2015	20.1	19.8	17.08333333	14.33	51
2016	21.3	20.8	16.08333333	14.21	44
2017	21.4	23.8	17.78333333	13.54	42
2018	22.4	25.0	18.08333333	15.3	41

SOURCE: CBN statistical bulletin 2018

Table 1.1 Unit root test results for Market Capitalization (MKPZ)

Null Hypothesis: MKPZ has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.167743	0.0364
Test critical values:	1% level	-5.124875	
	5% level	-3.933364	
	10% level	-3.420030	

Source: E-view 9 output
Interpretation: Order of integration at 5% = 1(0)

Table 1.2 Unit root test results for Broad Money Supply (M_2)

Null Hypothesis: M_2 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.466892	0.0006
Test critical values:	1% level	-5.124875	
	5% level	-3.933364	
	10% level	-3.420030	

Source: E-view 9 output
Interpretation: Order of integration at 5% = 1(0)

Table 1.3 Unit root test results for Domestic Credit to Private Sector (CPS)

Null Hypothesis: D(CPS) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.506405	0.0276
Test critical values:	1% level	-4.121990	
	5% level	-3.144920	
	10% level	-2.713751	

Source: E-view 9 output
Interpretation: Order of integration at 5% = 1(1)

Table 1.4 Unit root test results for Prime Interest Rate Spread (PTR)

Null Hypothesis: PTR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.302193	0.0243
Test critical values:	1% level	-4.886426	
	5% level	-3.828975	
	10% level	-3.362984	

Source: E-view 9 output
Interpretation: Order of integration at 5% = 1(0)

[

Table 1.1 to 1.4 shows the unit root test results of the variables employed in the study. The results shows that almost all variables employed in the study are integrated at their levels, symbolized by 1(0) except for CPS that is integrated at first difference, symbolized by 1(1), all at 5% significance level.

Thus, this means that variables employed has no unit root problem. Note, a variable is stationary (has no unit root problem) if the test statistics is greater than the critical value in absolute terms. This shows that data employed can be used for meaningful decision making and forecasting.

Table 1.5 Johansen Cointegration Test Results

Date: 08/07/19 Time: 08:46
Sample (adjusted): 2008 2018
Included observations: 11 after adjustments
Trend assumption: Linear deterministic trend
Series: MKPZ CPS M2
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

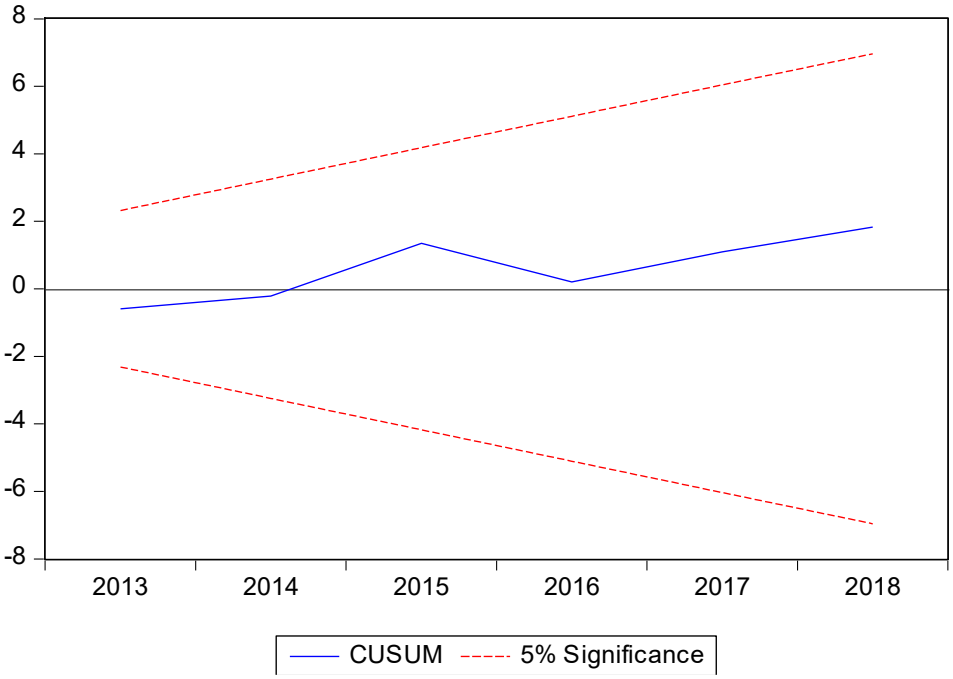
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.974896	49.86346	29.79707	0.0001
At most 1	0.529398	9.331397	15.49471	0.3356
At most 2	0.090232	1.040219	3.841466	0.3078

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values
Source: E-view 9 output

Table 1.5 evidenced the Johansen cointegration test result that indicates the existence of one cointegrating long run relationship among variables employed in this study. We arrive at this conclusion by comparing the trace statistic against the Critical Values at 5% level of significance.

Graph 1.1 Model Stability Test



Source: Author's computation: E-view 9 output

Graphs 1.1 for test of stability of the model shows that all variable used in the model are valid. This is because the blue line starts from the point of zero and increases gradually to fluctuate between the two red lines given. Therefore, we can run a regression on them for individual parameter estimate.

Table 1.6 Parsimonious Error Correction Model (ECM)

Dependent Variable: D(MKPZ)

Method: Least Squares

Date: 08/07/19 Time: 09:38

Sample (adjusted): 2008 2018

Included observations: 11 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.730145	0.675224	1.081338	0.3211
$D(M_2)$	0.417980	0.788216	0.530286	0.6150
D(CPS)	-0.624340	0.412169	-1.514767	0.1806
D(PTR)	-0.423734	1.071383	-0.395502	0.7062
ECM(-1)	-0.338644	0.333985	-1.013948	0.3497

R-squared	0.776931	Mean dependent var	0.181818
Adjusted R-squared	0.494884	S.D. dependent var	2.237985
S.E. of regression	1.879262	Akaike info criterion	4.402590
Sum squared resid	21.18975	Schwarz criterion	4.583452
Log likelihood	-19.21425	Hannan-Quinn criter.	4.288583
F-statistic	2.045518	Durbin-Watson stat	1.721937
Prob(F-statistic)	0.006787		

Table 6 X-rays the impact of banking sector reforms on stock market performance in Nigeria. The t-test output will be used to test the hypothesis outlined in study. The error correction term will tell us the speed with which our model returns to equilibrium following short run fluctuations not captured in the Johansen test. The ECM coefficient of -0.338644 indicates that ECM is well specified and the diagnostic statistics are good. The negative sign depicts the short run adjustment of the explanatory variables to the

explained variable. The ECM term also shows 34% slow speed of adjustment towards equilibrium. This implies that 34% of disequilibrium caused by exogenous shocks or short run fluctuations in the previous period is corrected in the current year.

Using the a priori criteria of evaluating the parameters, all the variables including the constant (M_2, CPS, PTR and ECM(-1)) did not meet a priori expectations hence not fulfilling the economic criterion of the model.

The results also show that CPS and PTR is non-linear (negative) and statistically insignificant to MKPZ both in short and in the long run, while M_2 is linear (positive) and also statistically insignificant to MKPZ both in short and in the long run respectively. Furthermore, the results of the test of the overall significance of the model using F-statistics shows that the entire model is statistically significant. We arrive at this conclusion because the F-statistics of 2.045518 is greater than the F-probability of 0.006787. Coefficients of determination (R^2) indicate that approximately 78% of total variation in MKPZ is explained by the explanatory variables in the model. This means that the model is of good fit. Finally, the Durbin-Watson statistics, a rule of thumb for the measure of autocorrelation is greater than Coefficients of determination (R^2) (1.721937>0.776931) thus, indicating the absence of first order autocorrelation.

TEST OF HYPOTHESIS

Table 6 above reveals that broad money supply (M_2), domestic credit to private sector (CPS) and prime interest rate spread (PTR) as proxy of banking sector reforms have t-statistic of 0.530286, -1.514767 and -0.395502 with their probability values of 0.6150, 0.1806 and 0.7062 which are greater than 5% level of significance. This means banking sector reforms has no significant impact on stock market performance in Nigeria for the period under study. Therefore the null hypothesis is accepted.

4.1 DISCUSSIONS OF FINDINGS

The outcome of the error correction model (ECM) shown that the banking sector reforms introduced from 2004-2018 have had insignificant impact on the Nigerian stock market performance. As evidenced from our empirical results, the banking sector reforms proxy (broad money supply, domestic credit to the private sector and prime interest rate spread) had combined insignificant impact on the Nigerian stock market proxy (market capitalization) for the period under study. Boyd and Smith (2001) profess that banks and stock markets complement each other rather than been substitute. Empirically, Demirgue Kunt and Levine (2000) exhibited that the level of stock market performance has a direct positive impact on baking sector reforms. Conversely, the findings of Garcia (2002) conform to the findings of this study. He finds that Central Banks may generate negative relationship between banking reforms and stock market performance. However, broad money supply, which is an indicator for financial development (banking reforms) exhibit a positive relationship with stock market performance. It measures the extent of financial deepening in relation to the economy

as a whole, while credit to private sector measures the role of financial intermediaries in the provision of short and long term financing of investments for individual corporations. Upgrading of existing institutions is of utmost importance to stock market performance because it will remedy unstable economy, as well as to enhance regulatory authorities to improve external financing.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

Several banking sector reforms has been embark upon in Nigeria ranging from privatization, debt management, pension and tax administration, insurance and banks consolidation, amongst others in the last decade. This study revealed that the banking sector reforms collectively, impacted insignificantly on Nigerian stock market performance for the period under study.

Thus, this is not withstanding that, the implementation of banking sector reforms has caused an unprecedented process of revival and resuscitation of the Nigerian banking sector, shrinking the number of commercial banks from 89 to 22 banks.

Our conclusion therefore, is that banking sector reforms are good for Nigeria banking sector. What remains, is how the country will constantly maintain and review existing banking sector reforms from time to time to sustain the tempo of survival and stability in the banking sector which may affect stock market performance in the long-run.

From the empirical findings of the study, we are constrained to recommend as follows:

1. Central Bank of Nigeria and other monetary authorities should continue with its banking sector reforms with an effective implementation strategies structured out for its onward strives for stock market performance in respect to broad money supply (m_2), domestic credit to the private sector (CPS) and prime interest rate spread (PTR). And
2. Regulatory authorities should be strengthened to embark on proactive measures to put in place the Nigerian stock exchange (NSE).

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Significance of Symbols in Poetry Titles: A Study on A. E. Houseman's "Farewell to Barn and Stack and Tree."

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***Abstract* –** This research study explores the significance of using symbols in poetry titles. Taking A. E. Houseman's poem "Farewell to Barn and Stack and Tree," the study explores the geographical and social background that is created using symbolism in the title. This study also analyses the contribution these symbolic elements of the title make towards the better understanding of the poem. Though there is a plethora of studies conducted on the significance of symbolism in poetry, very few have focused on the typical usage of symbolism in the poetry titles. Moreover, this selected text remains unexplored in terms of the understanding of the title. By using textual analysis method, and by the application of the understanding of symbolism, the study is taken forward with an approach to explore further. The analysis understands, that symbolism used in title influences readers' understanding of the poem in terms of the background, and that is, the Barn as the symbol of home, stack as the workplace and tree, the social space.

***Index terms* –** Symbolism, Poetry, Titles, Geographical, Social.

I. INTRODUCTION

Symbolism in poetry is a technique of using linguistic symbols to represent ideas and objects. Symbolism is also is the practice or art of making use of an object or a word to be representational of an abstract idea. An action, person, place, word, or object can all have a symbolic meaning in terms of suggesting an idea which is not directly mentioned. In a differing perspective it is understood as something in the world of the senses, including an action, that reveals or is a sign for something else, often abstract or otherworldly. A rose, for example, has long been considered a symbol of love and affection. Every word denotes, refers to, or labels something in the world, but a symbol (to which a word, of course, may point) has a concreteness not shared by language, and can point to something that transcends ordinary experience (*Symbol | Poetry Foundation*). Looking back at the origins of symbolism in literature, especially poetry, the following is understood. It is understood that the art and the study of symbolism originated in the revolt of certain French poets against the hard and static conventions governing both technique and theme profoundly found in literary movements and traditional French poetry, as evidenced in the precise description of Parnassian poetry. The Symbolists wished to liberate poetry from its expository functions and its formalized oratory in order to describe the fleeting, immediate sensations of man's inner life and experience instead. The attempt that the symbolists made to evoke the ineffable intuitions and the sense impressions of the inner life of man and to communicate the easy-not observable mystery of existence through a free and highly personal use of metaphors and images that, though lacking in precise meaning, is understood as not conveying the state of the poet's mind and hint at the "dark and confused unity" of an inexpressible reality." (*Symbolism | Literary and Artistic Movement | Britannica.Com*) The struggle to liberate poetry from the common descriptions of everyday life, and to have it as an art form to bring out the inner struggles and feeling of man is evident in these notations. The art of using symbols to convey has also been a point of discussion over the ages. Through the development of this literary technique, it was not only possible to explore the inner self of man, but also to find similarities between different aesthetic forms. The inter-disciplinary approach between various art forms has seen the synchronisation of the expression of aesthetics to be paralleled.

Commenting on a comparative analysis of symbolism in painting and poetry, W. B. Yeats comments as follows: "William Blake has written, 'Vision or imagination' - meaning symbolism by these words – "is a representation of what actually exists, in real or unchangeable." The daughters of Memory form fable or Allegory.' Continuing the comment he says that the German insisted with many determined and suitable gestures, that Symbolism pronounced things which could not be said so perfectly in any other possible way, and needed but a right instinct for the understanding; while allegory said things needed a right knowledge for its understanding. On one side the symbols gave the dumb things a voice, and bodiless things a body; while the other read a meaning - which had never lacked its voice or its body - into something heard or seen, and loved less for the meaning than for its own sake. The only symbol that he had cared for were the shapes and the motions of the body; the ears

hidden by the hair, to make one think of a mind being busy with inner voices; as in Blake's 'Vision of Bloodthirstiness,' Yeats mentions, is to call up an emotion of bodily strength; and that he would not put a lily, or rose, or poppy into a picture to express the sense of purity, or love, or sleep, because he thought such emblems were allegorical in essence, and had their meaning by a traditional and not by a natural right." (*W. B. Yeats, 'Symbolism in Painting' & 'Symbolism of Poetry', in Ideas of Good and Evil (1903)*)

William van O'Connor in his study published as *Symbolism and the Study of Poetry* comments that man uses signs, sometimes in the way animals use them. Connor mentions, it is used in a way that is unique to him: man uses signs not only as a way to indicate things, but also as an avenue to represent them in the possible art form. The animal mind directly transmits messages to the motor-centers. The understanding is that many words are not signals of something about, likely, to happen. They remind us of things rather than announce things. Signs of this latter category are more properly considered symbols. Symbols and signs may be seen to differ in this approach: signs are proxy for the objects they represent, symbols are understood as the vehicles for the conception of objects. A person reacts toward a sign or is aware of it; one conceives a symbol, and it is this conception that the symbol directly means. The single word can be both sign and symbol-the sign indicate the object, whereas the symbol allows of a conception of the object. (Connor).

Commenting on the meaning symbols and the perception of symbols in poetry, Louis Cazamian says "Our effort has been, so far, to dissociate from the historical meaning of symbolism as a method of literary expression, another sense, infinitely wider and freer. But in one direction at least, it is time that a limit should be set to the widening process. Symbolism has not necessarily anything to do with symbols, or symbols with symbolism. A writer may find room 'in his work for definite symbols, partaking more or less of the nature of allegories, without using that method of expansive suggestion which is the essence of symbolism. Too definite a symbol, in our view, will lower the poetic value of the symbolism, and eventually destroy it. On the contrary, effective symbolism can very well do without definite, and, so to say, individualized symbols. Symbolist poetry of the highest order may convey a powerful and thrilling suggestion, while its meaning cannot be translated into the hard-and-fast language of ordinary life. The positive-minded reader will say that its meaning is obscure, or that it means just nothing at all; and the positive-minded reader will not be wrong. Therefore, the price the symbolist poet has to pay is that, his appeal being mainly to emotional and imaginative intuition, he is less sure than is the writer who deals in definite symbols. Our response to symbolist poetry is largely individual, and its fuller effectiveness may be restricted to a few. On the other hand, it is more sure in its elementary appeal than any other kind, of poetry, because a certain degree of emotional and imaginative sympathy is almost universal.(Cazamian) The individual perspective towards symbols and the way how the understanding of the symbols are unique to each individual is understood.

Moreover, considering the influences and techniques used by A. E. Houseman in his poetic expressions, Brooks provides the dominant and repeating theme that is found in his poems. It is claimed that in all of his poetry, Housman continually returns to significant themes. One of the prominent themes discussed by Cleanth Brooks in the Ricks collection of essays, is inevitability of death. […] "Housman frequently deals with the plight of the young soldier, and he is usually able to maintain sympathy both for the youth who is the victim of war and for the patriotic cause of the nation." (*A. E. Housman | Poetry Foundation*). Thus, death has always been a dominating theme in Houseman's poems and "Farwell to Barn and Stack and Tree" is not an exception. By way of crime, guilt and fleeing, the idea of death is dealt in differing ideas.

On one of the earlier analyses on symbolism conducted by the researchers of this study, a descriptive idea of how the long lasting effect of the initial suggestive symbols could result in positively affecting the understanding was mentioned. "The study focused on the symbolism used in "The Voyage" by Katherine Mansfield and how this literary technique has been effectively used to project the psychoanalytic diagram of the subconscious mind of Fenella. The Textual analysis of the text, using the psychoanalysis-subconscious, as the theoretical framework finds that few significant symbols are used by Mansfield which either project or indicate the subconscious mind of Fenella. It can be concluded that there is an effective projection of the subconscious through the literary technique of symbolism. The study further encourages researchers to venture into parallel literary techniques that are used effectively in the text to project the inner-thoughts of Fenella." (Dananjaya and Veerasingam)

Contradicting to some of the understandings and notions of the coupling of Houseman and symbolism, "A Survey of the Criticisms of A.E. Housman' s Poetry" by Claudia Newton Jackson provides a different view. Placing Houseman in the time period of the end of the celebrated era of symbolism, she identifies him being liberated from the extensive use of symbols. She continues by saying "Housman appeared in the midst of the declining years of the first full bloom of symbolism." Jackson continues to say that Houseman came with a poetry different from any of the cults. He continues to say that he had no new poetic theory and no political axe to grind; Carlyle, with his Sartor Resartus, was not from Housman's world; Ruskin and Rossetti were entirely too sensuous and passionate […] and he saw no use for symbols when simple words carefully arranged could so clearly express a desired image or thought" (Jackson).

Furthermore, in search of few examples where symbolic titles have been influential for the texts that followed them, some of the examples direct this research directly to the platform. Elie Wiesel's novel *Night*, where the night is used throughout the book to symbolize death, darkness, and loss of faith, Nathaniel Hawthorne's *The Scarlet Letter*, where the letter "A" symbolizes adultery, *A Raisin in the Sun*, where a plant on the windowsill symbolizes need and hope and needs the sun to grow and Dr. Seuss's *How the Grinch Stole Christmas!*, where Grinch steals the symbols of Christmas, like trees, presents and food, to find

out in the end, Christmas was more than those material things. (*Examples of Symbolism in Literature*).

With the synchronization of all the above discussed study of available literature, it is understandable that this research study could narrow down the need for the study into a particular category. As symbolism is still a literary technique of the art form of poetry, and since the symbolic title has been a widely-used device, it is noteworthy of concentrating on the title. Symbolism used in the titles of poetry is an area that has been less studied. Moreover, the idea of finding out the background that it creates for the poem based on the individual understanding of each reader is vital for this study. The notion that Houseman did not intend to base the understanding of his poems based on symbolism is an ignorable fact, as it is clearly observable on the first observations of this text that he has made a deliberate attempt to create the background for the poem by the symbols used in the title, namely barn, stack and tree.

II. SYNCHRONIZATION OF THEORY

The theoretical background for the textual analysis of this poems relies heavily on the theoretical implications of symbolism as a device. The practice of using symbolism as literary device, with consideration of the essential features of symbols, will be used for the analysis. The considered symbols will be filtered through the essential elements and functions that symbolism as a literary device is expected to contribute to the understanding of the text. Considering the elements that are essential features to analyze the symbols, the characteristics that designate symbols can be a suitable framework. In such a perspective, one of the theoretical explanations of symbols can be considered. “In the usage of literary historians, however, Symbolist Movement designates specifically a group of French writers beginning with Charles Baudelaire (*Fleurs du mal*, 1857) and including such later poets as Arthur Rimbaud, Paul Verlaine, Stéphane Mallarmé, and Paul Valéry. Baudelaire placed the symbolic mode of his poems in part on the example of the American Edgar Allan Poe, but especially on the ancient belief in correspondences—the doctrine that explains that there exist inherent and systematic analogies between the human mind and the outer world, and also between the material and the spiritual worlds. As Baudelaire put this doctrine: “Everything, form, movement, number, color, perfume, in the *spiritual* as in the *natural* world, is significative, reciprocal, converse, *correspondent*.” The techniques of the Symbolists, who exploited an order of private cummings, and Wallace Stevens. Symbols in a poetry of rich suggestiveness than explicit signification, was having a greater influence throughout Europe, and (especially in the 1890s and later) in England and America on poets such as Arthur Symons and Ernest Dowson” (see *Decadence*) as well as W. B. Yeats, Ezra Pound, Dylan Thomas, Hart Crane, e. e.” (Norton et al.)

Thus, the elements to be continued in this approach towards understanding the elements for the analysis would be through the definitions of symbolism and how symbols are viewed. The symbols to be analysed will be filtered through the suggestive nature that they attain through the inclusion of the reception senses. The sensory faculty of the human mind to absorb both the spiritual and natural world elements in looked as the basic element in order to find the significance that the symbols in a poem’s title could attain. Presenting the initial impression to the reader to be carried out throughout the poem in order to attain the written purpose is a higher task to achieve. The study would synchronize the basic elements of symbolism and the functions of symbols and would tend to analyse the initial impact that the symbols prevalent in the title would find its influence in the following poem. An affective setting of the background, especially a country geographically and the setting for ballad.

III. METHODOLOGY

The methodology preferred to be used by the researchers for the purpose of analysis is the Textual Analysis method. By understanding the meanings, and by reading between the lines in order to explore the second layers of meanings, the analysis would set the platform for the comparison of the title and its significance concerning the narrative initiated in the text. With the findings of the meanings, the background for the text would be analyzed in terms of the impact the title creates. By using the designating elements of symbolism, the analysis will explore the symbols mentioned in the title of the text and then proceed in order to study how the symbols in the title of the text has enabled a better understanding of the text by creating significant backgrounds for the text. The analysis aims at finding whether the symbols used in the title has positively influenced the reader’s reception of the themes of the poem. The researchers are that the methodology will be a limitation to find definite answers, but more of a suggestive approach.

IV. ANALYSIS

A. E. Housman provides an elaborate and empathetic expression of a person, probably a country lad, who is suffering from the feeling of guilt. This feeling of guilt leads the speaker to bid farewell to his own surrounding and seclude himself from the environment which is suggestive of the incident that happened on the same day. By allowing free flow of the emotions out of the speaker in this symbolic text, Housman attains his purpose of providing this explicit empathetic expression of a person suffering from fear and guilt. The research study believes that this understanding is a result of the suggestive nature of the symbols provided in the title of the poem.

"Farewell to barn and stack and tree,
Farewell to Severn shore.
Terence, look your last at me,
For I come home no more.” (Houseman)

A farewell. The title that begins with the word that suggests a farewell, indeed becomes a prelude before the essential symbols are introduced. This suggestive nature influences the first impression and the understanding of the first stanza and its receptions. A painful farewell that a country lad is giving to his familiar environment. The sense of pain that the word "no more" creates portrays that this lad is with the decision that he will not be returning. The reason for this urgent decision to leave his surrounding is suspected to be a crime; probably a murder this person has committed without premeditation. Suggestively, an argument has erupted within siblings while they were at work, and it has resulted in this murder. The country lads have fought for the same young mistress, probably. It is also evident that the brothers have been together until the noon in which probably the argument had broken in between them. Therefore, this person who is bidding farewell is in a shock not able to accept that he had done such a gruesome and regretful act. The speaker's words are for this barn and stack and tree, which are his familiar surroundings, realizing the essential fact that he had just now killed the only companion who was there for him in this place. While bidding farewell to the speaker's familiar surroundings, the speaker brings out the feeling of urgency in him. And the speaker requests his brother whom he had just killed, to look at himself for the last time. The speaker here addresses a third person referred by the name "Terence." Even though we are not assured about who this third person could be in the narrative, by the words that are addressed to this Terence, we understand that the speaker has made a decision not to return to this his own place, his won surroundings. While we also attempt to guess who this person could be, we may end up with conclusions which are depending on our perspectives. Either a neighbour, a friend of these siblings or the mistress for whom the brothers were fighting for. The first stanza itself provides this much-expressed urgency and suspense which leads the reader to go further into the incident and inquire about this in the following stanzas.

"The sun burns on the half-mown hill,
By now the blood is dried;
And Maurice amongst the hay lies still
And my knife is in his side." (Houseman)

This is the first instance where the reader realizes that this urgent bidding of farewell follows a murder. The 'sunburn' being mentioned here shows that it is probably noontime. While the 'half-mown hill' reminds us of a landscape of farming background and the countryside, it is followed by an explicit expression that it was a bloody murder, and this crime had happened early in the day, so that the blood is dried. The victim's name is introduced - Maurice. The name is being mentioned than any other word in order to refer to the dead person in the middle of this feeling of guilt shows that they were very close to each other. It brings in that personal attachment the assailant had with the killed. And he had committed the murder with his knife that he had left near the person in a hurry in order to evacuate from the place where he had murdered.

"My mother thinks us long away;
'Tis time the field were mown.
She had two sons at rising day,
To-night she'll be alone." (Houseman)

This stanza again proves the vital point the speaker and the person who was killed are brothers; the murderer and the victim. The speaker remembers his own family, his mother, and he would have found it an impossible act to face her ever again. He imagination with the guilt is about how his mother would be waiting for her sons who had set out for mowing that morning to the fields. He goes further in empathising the sorrow and pain that their mother will go through. The same morning his mother had two sons in her side, and today when the day ends one of them is killed and the other has ran away. This stanza evokes in the reader feelings of their mother. It creates empathy.

"And here's a bloody hand to shake,
And oh, man, here's good-bye;
We'll sweat no more on scythe and rake,
My bloody hands and I." (Houseman)

Remembering the times they, as brothers, have worked together, shared proud moments of both accomplishment and failure, as men who live together under the same roof in the same family, the speaker is even unable to say a proper heartfelt farewell. He would have not expected to bid such an urgent farewell to his own brother, with such blood-stained hands. He remembers that these moments are not going to repeat.

"I wish you strength to bring you pride,
And a love to keep you clean,
And I wish you luck, come Lammastide,
At racing on the green."
"Long for me the rick will wait,
And long will wait the fold,
And long will stand the empty plate,
And dinner will be cold." (Houseman)

It is a farewell to the social, professional and personal memories and moments he had experienced. As the speaker bids farewell, he remembers the festivals and the celebrations that he had been celebrating with his family. We are with a question here. Why would the speaker wish something for the dead person, and with the guilt of knowing he is a reason behind this murder? Especially for the Lammastide or for the racing on the green? It was, probably, the speakers imaginary thinking that his brother would enjoy and cherish the same things in his life after death. The speaker remembers all that he is leaving behind while he is fleeing and going away and also remembers that this is going to be a changed life for him from now on. And what he chooses to do will be a different profession for the survival, somewhere far away from his home and surroundings. To make the lines more personal, Houseman has presented the speaker with the fear that he would even end in someplace without the basic necessities and needs for his life. In order to show that the speaker's return is not a possibility, Houseman mentions the "long wait." The phrase also gives the reader hope; a return after the suffering of guilt is over. This is literally a (Veerasingam) The analysis proves that the initial suggestions displayed in the

title of the poem have positively influenced the understanding of the background of the poem.

Barn, as the symbol of Home.

The analysis of the text finds the first symbol mentioned in the title - barn, being symbolic of the home of the speaker. It suggests an impression that is profoundly bringing in the feelings and emotions connected with home. In the middle of the countryside, the barn is the place where the homeliness is felt. The barn is the place where the family lives, gathers the harvest and keeps themselves safe from the environment, and this being mentioned in the title of the poem suggests the home of the speaker. He is expressing his farewell to his home, first of all. It is a farewell to his home first. Fleeing from the guilt and the fear of facing his surroundings after such an unforgivable crime, the speaker expresses his farewell to his home. Thus, the barn being employed into the title of the poem is not a mere expression, but a powerful symbol of that being in the feelings and emotions of home. It is used here as a powerful technique to be suggestive of this part of the farewell.

Stack, as the symbol of Workplace.

The second symbol included in the suggestive title is the stack. Based on the analysis of the text it is evident that the stack is being used as a symbol of the workplace. Same as the speaker had expressed his farewell to his home, now a step further, he remembers his workplace and the farewell that he bids is not just to his home and its surroundings but also to his workplace. The speaker remembers the times he had spent in the stack, it being the centre of all the work they did, and bids farewell to the workplace too. As the farming and pastoral culture had given the importance to the result of the hard work. The stack is a symbol of harvest, and in turn, harvest turns out to be the result of the hard work that has been put in the workplace. It is reminder of the season's work that has been done. And when the speaker is bidding farewell to the stack, it is symbolic in providing the understanding that he is, in real, bidding farewell to the work and the workplace that he remembers. It is also symbolic of the times he had spent with his brother, mowing the land, and the stack is pregnant with memories which will haunt him for the coming days, probably years. Thus, it is observable that stack has been used as a powerful symbol to bring in the impressions of the workplace.

Tree, as the symbol of Social Space.

The third symbol used in the title by Houseman is the tree. It is a highly compressed, symbolic image that is being presented in terms of the country landscape. In the midst of the vast landscape of fields, the mowing takes place with the entire community of farmers, working on their own lands. The trees that are in the midst of these lands become the place where they gather to take rest. And while taking rest, there is a vast possibility of socialisation. Probably, underneath the trees, the food and thoughts could be shared. The memories of the laughter and sadness that is being shared in the midst of the day remains powerful in each community member's mind and these moments of socialisation could be the time that the country lads yearn for to free themselves in the middle of the hard work of the day. Thus, the tree being included in the title of the poem is heavily suggestive of the social space. As the speaker is bidding farewell to his environment, he remembers that he also is bidding farewell to his society.

V. CONCLUSION

Based on the approach the study took towards understanding the symbols used in poetry titles, it is evident that symbolic titles in poetry positively influence the readers in terms of being suggestive of the background of the poem. The symbols, such as barn, stack and tree are functioning as powerful symbols in the understanding of the background of the poem. They are highly suggestive of the essential elements of a country lad's places of memory such as home, workplace and social space, namely. The study is indicative that symbols used in poetry titles positively influence the readers in the process of creating a background. The literary art of using symbols in poetry, especially the titles of poems, can be studied further as a powerful literary technique that enables a better understanding of the poem in terms of the suggestive nature of symbols. Further study on this field could be developed by way of analyzing symbols employed into various literary texts and how they contribute to the understanding of the poem.

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Proximate Composition And Organoleptic Properties Of Whole Wheat Biscuit Fortified With Moringa (*Moringa oleifera*) Leaf Powder

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Abstract- Fortification of biscuit was carried out by blending wheat flour with moringa leaf powder on 1:10 (w/w) ratio. The moringa wheat flour biscuit (MWFB) was evaluated for proximate composition and organoleptic appeal against biscuit produced from wheat flour (WFB). Results show that addition of moringa leaf powder marginally ($p>0.05$) increased the moisture content of biscuit from 15.90 to 16.01%, ash from 3.75 to 4.09%, protein from 11.14 to 11.47%, and significantly ($p<0.05$) increased the fiber from 0.71 to 1.28%. There was marginal ($p>0.05$) decrease in carbohydrate from 49.38% in (WFB) to 47.80% in MWFB. Sensory results show that (WFB) was significantly ($p<0.05$) superior in color with 7.95 compared to the 6.70 of MWFB. The MWFB significantly ($p<0.05$) excelled in texture with 7.5 compared to the 7.25 of the WFB, and in taste (7.85) against 7.40. The general acceptability score (8.0) of the MWFB was significantly ($p<0.05$) higher than the 7.50 of WFB. The results suggest that moringa leaf powder can be used to improve nutritional and sensorial qualities of biscuits.

Index Terms- Moringa, wheat, biscuits, sensory, blending, nutrition

I. Introduction

Biscuits are flour-based snacks usually sweetened to delight of the younger age. However, certain brands with little or no sugar are produced to meet age or health requirements. Biscuits are made with baking soda or powder as a chemical leavening agent rather than yeast (Alan, 2008). Biscuits are ideal for their nutritive value, palatability, compactness and convenience (David, 2003). Since they have low moisture content than cakes and bread, biscuits are generally safer from microbiological spoilage, and hence have long shelf life. Owing to appealing sensorial and textural characteristics, ready-to-eat convenience as well as cost advantage, biscuits have always be one of the most popular snacks across the globe. Biscuits are traditionally baked from wheat flour, though other flour sources have been recently employed.

Composite flours derived from more than one agricultural material, with the intention to improve the functional and nutritional properties are increasingly experimented. Biscuits are fortified to deliberately increase the content of desired macro or micro nutrients such as proteins, fiber, vitamins, minerals (including trace elements), with the expected public health benefits. Plants with high pytochemical reserves such as moringa can be a potential fortifier. Herbal biscuits are made by incorporating *Morina oleifera* leaf powder in a mixture of whole wheat flour, vegetable oil, baking powder, skim milk powder, egg white, salt, water and other approved ingredients.

The moringa leaf powder is rich in protein, vitamins A, B and C, and a whole range of minerals. A 100g portion of fresh moringa leaf has 9.3g protein, 434mg calcium, 404mg potassium, 738µg vitamin A, and 164mg vitamin C (Olson, 2010). Moringa, with its over ninety (90) verifiable nutrients has significant portions of vitamins B_1, B_2, B_3, D and E, polyphenols (antioxidants), minerals, fiber, and is one of the highest, naturally occurring sources of chlorophyll (Dada-Mouny, 2009).

Moring plant is totally edible and this presents a great advantage in many poor areas of Africa, where the leaves are important food supplements to fight and prevent malnutrition. Capalakrishnan et al. (2016) reported that leaves of *Moringa oleifera* fresh or dried are known to be excellent source of antioxidants and they have significantly higher antioxidant content comparing to fruits such as strawberries known for high antioxidant content. Saini et al. (2016) found that the relative bioavailability of folate from *M. Oleifera* leaves using rat model was very high (approximately 82%) suggesting that the *M. Oleifera* leaves can be a potential source of dietary folate.

The leaves have bioactive molecules which include carbohydrates, phenolic compounds, oils and fatty acids, proteins and functional peptides and have great potential to be used in several formulations of food products (Saucedo et al., 2018). Abioye and Fumilayo (2015) determined the proximate composition and sensory properties of moringa fortified maize-ogi. Oyeyinka and Oyeyinka (2016) reviewed the application of *Moringa oleifera* in food fortification. Bread fortification has been carried out using moringa seed powder (Bolarinwa et al., 2019). Hayat et al. (2018) reported enrichment of gluten-free bread with *Moringa oleifera* powder. Igbabul et al. (2018) evaluated the proximate, micro nutrient composition, physical and sensory properties of cookies produced with wheat, sweet detar and *moringa* leaf flour blends. Obichili and Ifediba (2019)

studied the sensory acceptability of whole wheat bread fortified with moringa leaf powder.

Biscuits are generally eaten as snacks or used to abate hunger prior to main meal, regardless of age. Increasing supply of refined flour has adversely led to the increase in the supply of sugar used in the production of biscuits. As a result consumption of high sugar brands of biscuits is on the increase among the populace. This predisposes the consumer to high incidence of sugar-related diseases, obesity and other sassociated illness. Considering the numerous potentials of *Moringa oleifera*, this study is anticipated to provide a fortified biscuit in order to address the nutritional, sensorial and health inadequacies of some conventional biscuits.

II. MATERIALS AND METHODS

Source of Raw materials

The *Moringa oleifera* leaves were obtained from a commercial farm in Awgbu Town, Orumba Local Government Area of Anambra State in the South East Nigeria. The whole wheat flour and baking ingredients were procured from dealers at Eke Awka Market in Awka the capital city of Anambra State.

Preparation of moringaleaf powder

The moringa leaf powder was produced using the method described by Robert et al. (2008).

Briefly explained, the freshly harvested moringa leaves were detached from the stalks, washed, shade dried in a thin layer under mosquito net, with regular shuffling of the leaves at regular intervals for even and accelerated dehydration. This drying condition will keep away dust, prevent vitamin loss and retain natural color of moringa leaf. The dried leaves were reduced to powder in a motor driven burr mill and sifted through a fine screen to remove extraneous matters. The powder was packaged in cellophane and stored under room temperature until use.

Production of wheat flour biscuit (WFB)

Production was carried out in the Food Laboratory of Anambra State Polytechnic, Mgbakwu.

Equipment: Two chopping boards, two rolling pins, two large stainless steel bowls, two ceramic plates, two stainless trays, variable shape cutters and a triple deck gas oven.

Recipe: Approximately 1kg of whole wheat flour , appropriate volume of potable water, approximately 250g of fat, 2 cans of milk (148ml/can), 4 eggs, and sugar to taste.

Procedure: The whole wheat flour was sieved into the bowl and premixed with water. Fat was added and intimately incorporated to obtain a relatively coarse crumb before adding milk and eggs to bind and emulsify the mix. This was thoroughly knead to obtain a soft and smooth dough, which was rolled out on a chopping board. The rolling pin was employed to further smoothen and flatten the dough prior to cutting to desired shapes with the variable shape cutters. The cut dough were arranged on cookie sheets and moved into a pre-heated gas oven to bake under a close watch at 150±2 ^{o}C for about 22 min. The biscuits were removed from the oven and placed on a tray to cool before packing in cellophane bags and kept under room temperature until use.

Preparation of moringawheat flour biscuit (MWFB)

Equipment: As provided in the Food Laboratory for the production of the wheat flour biscuit.

Recipe: As in the production of the wheat flour biscuit with the exception of the moringa leaf powder added to fortify product.

Procedure: About 100g of the previously prepared moringa leaf powder was reconstituted in water in a mixing bowl into which 1kg of wheat flour and commensurate quantity of sugar were sieved in to premix. Other ingredients were incorporated and homogenized as in the production of the wheat flour biscuits. Dough working, cutting, baking, cooling, packaging and storage followed the same pattern.

III. PROXIMATE ANALYSIS OF SAMPLES

Moisture content determination

Moisture content of the samples was determined according to the gravimetric methods of AOAC (1995). Exactly 5g of test sample was measured into crucibles that have been earlier washed, dried in an oven at a temperature of 70-80°C for 2 h and weighed. The samples were dried in the oven at 105°C for 4 h. This was cooled in desiccators and weighed. It was returned to the oven for further drying, cooling and weighing at 30 min intervals repeatedly until a constant weight is obtained. The weight of the moisture loss was calculated and expressed as percentage weight:

$$\% \text{ Moisture} = \frac{W_2 - W_3}{W_2 - W_1} \times 100 \ldots \ldots \ldots \ldots \ldots \ldots \ldots (1)$$

Where:

W_1 = initial weight of empty crucible

W_2 = weight of crucible + sample before drying

W_3 = weight of crucible + sample after drying.

Protein determination

The protein content of the test samples was determined by Kjeldahl method as reported by Onwuka (2005). Exactly 2 g of the test samples was weighed into a micro-kjeldahl flask containing a metallic catalyst and 5 ml of concentrated H_2SO_4 added. The same treatment was given to another 5 ml sample. The sample was digested at red hot temperature in a fume cupboard for 2 h and the digest transferred into a volumetric flask each. A clear solution is an indication of complete digestion after 2 h. Each of the transferred digest was diluted to 50 ml with distilled water. Then, 10 ml of each dilution was pipetted into "markham" apparatus with gradual introduction of 10 ml, 40% NaOH and distilled. Exactly 10ml of 4% Boric acid solution containing 3 drops of mixed indicator was used to collect the distillate and 50 ml of distillate from each duplicate titrated with 0.02N H_2SO_4 to a pink color. Percentage protein is calculated by multiplying percentage Nitrogen by a factor, 6.25.

$$\%N = \frac{100 \times N \times 14 \times V_t \times T - B}{W} \times 100 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

Where:

T = Titre value of the sample

B = Blank titre value

V_t = Total volume of digest

N = Normality of acid used
W = weight of sample
% crude protein (cp) = % N × 6.25 Note: The total Nitrogen content is calculated using the relationship 1ml H_2SO_4 =14mg of H_2SO_4.

Fat content determination
Fat content of the test samples was determined by the continuous solvent extraction method using a soxhlet extractor as described by James (1995). Clean boiling flask (250 ml) was dried in an oven at 105°C-110°C for 30 min, allowed to cool in desiccators, and weighed. The flask was filled with 300 ml of petroleum ether. Five grams of the test sample was measured into a fat-free extraction thimble which has been dried in an oven and weighed. The extraction thimble was plugged with cotton wool and the weight taken again. The soxhlet apparatus was assembled and allowed to reflux for 6 h. The thimble was removed and the flask kept briefly for escape of petroleum ether before drying at 105°C-110°C for 1 h. The flask was allowed to cool in desiccators and then the weight taken. The fat content was calculated as:

$$\% \text{ Fat} = \frac{W_2 - W_3}{W_1} \times 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where:
W_3 = weight of empty extraction flask
W_2 = weight of flask and oil extract
W_1 = weight of sample used

Crude fiber determination
The method described by Onwuka (2005) was used for the crude fiber determination. Exactly 2 g of the test sample was measured and defatted with petroleum ether. It was allowed to boil under reflux for 50 min with 200 ml of 1.25% of H2S04 per 100 ml of solution. The hot acid solution was filtered and the residue poured into 200 ml boiling 1.25% NaOH and boiled for 30 min. It was filtered, progressively washed with boiling water, alcohol and petroleum ether after which the drained residue was transferred completely to a porcelain crucible and dried in an oven at 150°C to a constant weight. This was cooled, weighed and incinerated in a muffle furnace at 100°C for 2 h and reweighed after cooling in desiccators. The crude fiber content was calculated gravimetrically as;

$$\% \text{ Crude fiber} = \frac{W_2 - W_3}{\text{Weight of sample}} \times 100 \quad \ldots\ldots\ldots\ldots (4)$$

Where:
W_2 = weight of crucible + boiled dried sample
W_3 = Weight of crucible + ash

Ash content determination
Ash content of the test samples was determined by the method described by Onwuka (2005). Exactly 2 g of the test sample was weighed into a previously weighed porcelain crucible and heated in a muffle furnace at 550°C for 2 h during which the sample has completely turned to ash. This was cooled in desiccators and re-weighed.
The percentage ash was calculated as:

$$\% \text{ Ash} = \frac{W_3 - W_1}{W_2 - W_1} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where:
W_1 = weight of empty crucible
W_2 = weight of crucible + sample
W_3 = weight of crucible + ash

Carbohydrate determination
The carbohydrate content of dried test sample was estimated using the arithmetic difference method as described by Onwuka (2005). This means that when other proximate components have been determined as percentage, the sum of these determinations was subtracted from 100 to give the carbohydrate contents.
% Carbohydrate = 100 - (% Moisture + % Protein + % Fat +% Crude fiber+ % Ash).

IV. SENSORY EVALUATION

The samples were accessed in the Food Laboratory facility of Anambra State Polytechnic Mgbakwu using a 20 member sensory panel drawn from staff and students of the institution adjudged to be very familiar with biscuits. The samples which were disguisedly coded as A or B were presented to the panel members in a similar manner and form in a separated booth to maintain privacy and avoid biased judgment. They were provided with glass of potable water to rinse their mouth between samples tasting. Each panelist was requested to score the samples for color, texture, taste and general acceptability on a 9-point Hedonic scale, where 1 = Dislikes extremely and 9 = Like extremely. The scores for sample A which represents the wheat flour biscuit (WFB), and B which represents moringa wheat flour biscuit (MWFB) were collated accordingly.

V. STATISTICAL ANALYSIS

The samples were analyzed using T-Test Statistics for unpaired observations and difference between means determined at level of significance ($p<0.05$) for two-tailed test.

VI. RESULTS AND DISCUSSION

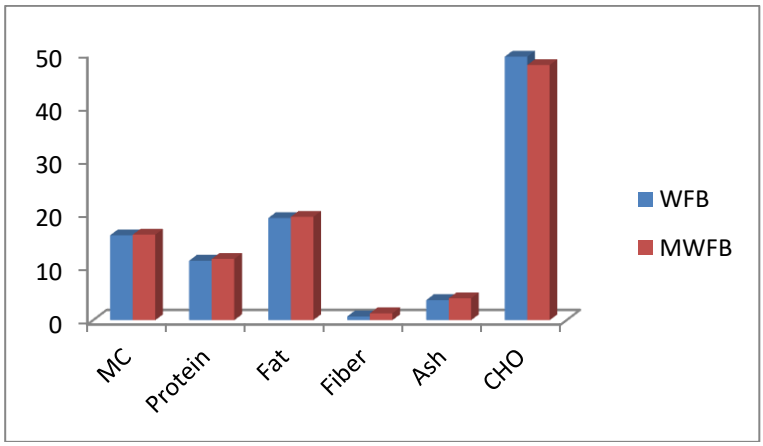

Figure 1: Chart for proximate values of biscuit samples
Key: WFB = Wheat flour biscuit, MWFB = Moringa wheat flour biscuit

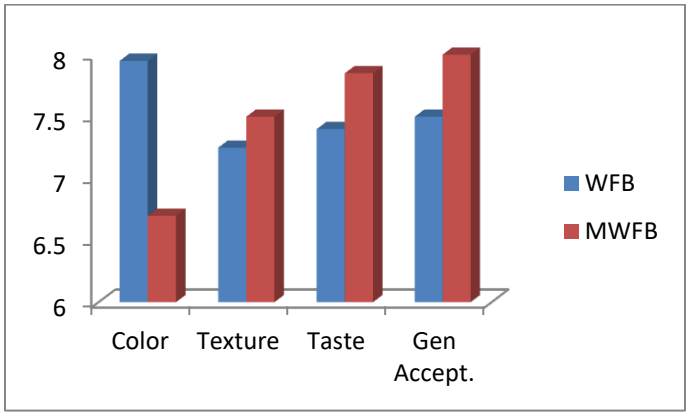

Figure 2: Chart for sensory scores of biscuit samples
Key: WFB = Wheat flour biscuit, MWFB = Moringa wheat flour biscuit

Table 1: Proximate composition of biscuit samples

Parameters	WFB	MWFB
Moisture content	15.90±0.25^{ns}	16.41±0.26^{ns}
Protein	11.42±0.10^{ns}	11.47±0.09^{ns}
Fat	19.13±0.51^{ns}	19.35±0.56^{ns}
Crude fiber	0.70±0.01^{b}	1.28±0.03^{a}
Ash	3.75±0.12^{ns}	4.09±0.11^{ns}
Carbohydrate	49.38±1.00^{ns}	47.80±1.11^{ns}

Means of triplicate samples and their standard deviation within a row followed by different superscripts are significantly (p<0.025) different, ns = no significant difference, WFB (wheat flour biscuit), MWFB (moringa wheat flour biscuit).

Table 2: Sensory scores of biscuit samples

Attributes	WFB	MWFB
Color	7.95±0.87^{a}	6.70±1.92^{b}
Texture	7.25±1.19^{b}	7.50±1.02^{a}
Taste	7.40±0.86^{b}	7.85±1.06^{a}
General acceptability	7.50±0.97^{b}	8.00±1.14^{a}

Means of triplicate samples and their standard deviation within a row followed by different superscripts are significantly (p<0.025) different, ns = no significant difference, WFB (wheat flour biscuit), MWFB (moringa wheat flour biscuit).

The proximate result in Table 1 shows that there was no significant (p>0.05) difference in the 15.90% moisture content of WFB and 16.01% of MWFB. This agrees with Igbabul et al. (2018) who reported increase in moisture content of cookies produced from fermented sweet detar, moringa leaf powder and wheat flour blends. It however varied from the report of Bolarinwa et al. (2019) that the moisture content of moringa seed powder fortified bread dropped from 22.90 to 20.20%. The difference in moisture behavior may be attributed to the higher moisture retention in the moringa leaf powder compared to the seed powder. Moreover the higher surface volume of bread may contribute to higher rate of moisture escape during baking. The higher fat ration in ingredients for biscuits may also retard moisture elimination during baking. There was marginal (p>0.05) increase in protein from 11.42% in the wheat flour biscuit to 11.47% in the moringa wheat flour biscuit. The increase in protein corroborates the reported increase in protein in the moringa fortified cookies (Igbabul et al., 2018) and moringa fortified bread (Bolarinwa et al., 2019). The increase in the protein content may be attributed to the dense nutrient content of *Moringa oleifera* plant, particularly high quality proteins. In this regard the margin of difference may depend on the level of replacement of the wheat flour with the moringa powder. The 19.13% fat content of the wheat flour biscuit was marginally (p>0.05) different from the 19.35% of moringa wheat flour biscuit. The increase is in agreement with the findings of Igbabul et al. (2018) and Bolarinwa et al. (2019). The increase in fat is understandable since fresh moringa leaf has measurable fat deposits which appreciates substantially when dried and converted to powder.

The moringa wheat flour biscuit recorded significant (p<0.05) increase in fiber from 0.70% of the wheat flour biscuit to 1.28%. The increase is concurrent with Bolarinwa et al. (2019) who reported an increase in fiber from 0.08% in conventional wheat bread to 1.76% in moringa fortified sample. It also conforms to the reported increase in fiber of moringa fortified cookies from 2.05 to 3.96% (Igbabul et al., 2018). The increase in fiber can be attributed to the characteristic fibrous network of leaves with expected concentration in the dry powdery form.

There was marginal (p>0.05) increase in ash content of wheat flour biscuit from 3.75 to 4.09% of the fortified sample. Again, the increase is in accord with the reports of Igbabul et al. (2018) and Bolarinwa et al. (2019). The increase in ash might be due to abundance of minerals in moringa leaf, since sufficient ash is indicative of rich mineral elements in a food sample (Ekeh et al., 2007; Olaoye et al., 2007). This was corroborated by Obasi and Ifediba (2018) who reported significant ash increase in biscuit fortified with African breadfruit seeds flour, giving that African breadfruit seed has higher mineral deposits than wheat grain.

There was no significant (p<0.05) difference in carbohydrate decrease from 49.38% in wheat flour biscuit to 47.84% in moringa fortified sample. This is consistent with the reported decrease in carbohydrate of substituted wheat flour baked products (Obasi and ifediba, 2018; Igbabul et al., 2018; Bolarinwa et al., 2019). The decrease can be attributed to substitution of wheat flour with materials lower in carbohydrate. However, since snacks are to provide temporary relief from hunger, flour composition must not compromise energy requirement of end product.

VII. Sensory Evaluation

The result in Table 2 shows significant ($p<0.05$) difference in the 7.95 color rating of wheat flour biscuit from the 6.70 of moringa wheat flour biscuit. Fortification with moringa leaf powder similarly led to decrease in color of gluten-free bread (Hayat et al., 2018) and whole wheat biscuit (Obichili and Ifediba, 2019). The inferior color of fortified sample might be due to dulling effect of moringa leaf powder (obichili and Ifediba, 2019) which is attributable to deep green color which is related to the high chlorophyll content of moringa leaves (Dadamouny, 2009; Karim et al., 2015).

The 7.5 texture rating of moringa wheat flour biscuit was significantly ($p<0.05$) superior to the7.25 of the wheat flour biscuit. Igbabul et al. (2018) reported similar improvement in texture of cookies made from sweet detar, moringa leaf powder and wheat composite flour. The grainy matrix of imbedded moringa leaf powder might have resulted in crispy bake, and crispiness can be complementary to desirable textural property of biscuit.

There was significant ($p<0.05$) difference in the taste of the two biscuit samples with the moringa wheat flour biscuit recording higher score of 7.85 compare to the 7.40 of the wheat flour biscuit. Igbabul et al. (2018) reported a wider increase in taste of cookies from 4.40 of the ordinary sample to 7.60 0f sample fortified with moringa leaf powder. The improved taste of moringa substituted sample may be due to versed phenolic and bioactive compounds in moringa leaf which combine with other substances in the recipe to form aromatic complex with pleasant taste.

The moringa wheat flour biscuit was significantly ($p<0.05$) higher with general acceptability score of 8.0 than the 7.50 of the wheat flour biscuit. Igbabul et al. (2018) similarly reported higher general acceptability of cookies fortified with moringa leaf powder from 4.66 to 8.13. The higher general acceptability of the moringa wheat flour biscuit is expected since it excelled in three out of other attributes considered. It may be surmised that interplay of texture and taste play greater role than color in organoleptic choice of most snacks.

VIII. Conclusion

This work reveals that biscuit derived from moringa wheat flour blend compared favorably with the conventional brand in proximate composition and sensory appeal. There is however need to explore different substitution levels in order to attain significant increase in nutrients without compromising consumer acceptance.

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Effect of Various Phytochemicals for Evaluating Genetic Variability in Parental Lines for Producing F1 Hybrid Rice Seeds Using Modern CMS Breeding Technology

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Abstract- Hybridization, the most potential breeding system, brought about significant qualitative and quantitative changes in the Indian agricultural scenario. The invention of cytoplasmic male sterile (CMS) lines for production of F_1 hybrid rice seeds using modern CMS rice breeding technology has no doubt created a new approach in agricultural sector.

Success and sustenance of hybrid rice technology solely depends on the exploitation of heterosis in F_1 generation. A study was conducted to find out the performance of F_1 hybrid seed production by applying various phytochemicals to ascertain the genetic variability as well as phytochemical effects in parental lines particularly CMS line (A-line) and Restorer line (R-line) on the basis of two agro-botanical traits viz. IR58025A (A-line i.e. CMS line) and KMR3 (R-line) in the Boro season 2011-12. For this purpose, Mean value table and Combined ANOVA table were considered for each and every metrical character separately. All the characters were also taken into account for calculating its analyses of variance, components of all variances δ^2g, δ^2p, δ^2e, genotypic and phenotypic coefficient of variations i.e. GCV and PCV including heritability (h^2) to experiment the genetic variability besides the qualitative and quantitative characters of F_1 hybrid seeds were assessed and explored alternative low cost phytochemicals for emerging the inflorescence of A-line (parent cultivar) other than the costly chemical GA_3. The parental behaviour as well as the application of various phytochemicals towards different treatments were thoroughly analysed to find out genetic variability as well as phytochemical effects in parental lines for producing the best potential F_1 rice hybrid seeds.

Index Terms **-** ANOVA**,** CMS line**,** F_1 hybrid seeds, phytochemicals.

I. INTRODUCTION

Rice is the world's most important food crop and a primary food source for more than one third of global population. In concern over the growing population in India, it needs to increase the productivity of rice (Krishnalatha et al., 2012). As the production of rice in India is not up to the satisfactory level by classical hybridization technique so that the production of hybrid rice seed with positive yield-vigour is an absolute necessity to meet up the consumption of food demand of the people as well as to fall in inflation on benefiting the poor in foreseeable future. Good rice hybrids have potential of yielding 15-20% more than the best inbred variety grown under farmers' field conditions in several countries (Virmani, 1994). A number of rice breeders like (Yuan et al., 1993; Liu et al., 1997; Virmani, 1996; He and Liu, 1998; Virmani et al., 2003) could make the hybrid rice production easier using genetic male sterility. Geetha et al., (1994) stated that various grain characters such as number of panicles, grains per panicle, grain yield, grain weight and shape are useful in identification of rice hybrids.

In India, the Directorate of Rice Research in Rajendranagar, Hyderabad under ICAR is acting as coordinator to look after and monitoring the rice hybrid seed production technology in the country (Paroda and Siddiq 1996). During 2011-12, the special mission mode programme has been undertaken by the Government of India to bring Green Revolution in eastern India, greater emphasis is being given for enhancing rice production and hybrid rice adoption is one of the key components identified, as it is the eastern India, where hybrid rice technology has made an impact. On the plea, application of various phytochemicals for experimenting genetic variability in parental lines has a prominent role for producing best

potential F_1 hybrid seeds. For this purpose, a comparative study of Penicillin and cyclic-AMP induced alpha (α)-amylase formation in rice endosperm was made by Biswas and Mukherjee, 1982. Further, the diversified mechanisms have been evolved for restoring fertility in CMS with the interaction of cytoplasmic factors (now widely identified as mitochondrial genetic factors) and nuclear genes as reported by Chen and Liu (2014).

II. MATERIALS AND METHODS

For the present study, an experimental field like Crop Research Farm under the Department of Botany, the University of Burdwan was taken for experimentation. The seeds were procured from the Rice Research Station, Chinsurah, Hooghly, the Government of West Bengal. The varieties were taken viz. IR58025A (A-line i.e. CMS line) and KMR3 (R-line). The experiment was laid out in a Randomized Block Design having five replications in boro season (2011-2012) with parental A-lines and R-lines as scheduled for the CMS breeding technology. Five treatments viz. **i)** Control set-T_1, **ii)** Penicillin-T_2, **iii)** Sulfonamide-T_3, **iv)** Gentamycin-T_4, **v)** GA_3-T_5 were also undertaken for experimentation. Eight metrical characters viz. **i)** Tillers plant^{-1} (no), **ii)** Total panicle length plant^{-1} (cm) **iii)** Panicle exsertion length plant^{-1} (cm), **iv)** Unexserted panicle length plant^{-1} (cm), **v)** Total grains panicle^{-1} (no), **vi)** Fertile grain Panicle^{-1} (no), **vii)** Total yield t ha^{-1}, **viii)** 1000 Grain wt. (g) were considered to find out the genetic variability as well as phytochemical effects in parental lines. For this purpose, Two-way table and Combined ANOVA table for each metrical character were applied separately. All the characters were also taken into account for calculating its analyses of variance, components of all variances δ^2g, δ^2p, δ^2e, genotypic and phenotypic coefficient of variations i.e. GCV and PCV including heritability (h^2) to assess genetic variability due to phytochemical effects.

III. EXPERIMENTAL RESULTS

Experimental results were obtained from the present study towards the effects of treatments and their interactions on different characters through the mean values of different metrical traits were recorded in (Table I) and combined ANOVA (Table.2) from the 25A (CMS line) population at the time of harvest as furnished below:

Table.I: Mean values of various metrical characters of Boro season (2011-12)

Treatment	**No.of tiller plant^{-1}**	**Total panicle length (cm) plant^{-1}**	**Panicle exsertion length (cm) plant^{-1}**	**Unexerted panicle length (cm) plant^{-1}**	**Total no. of grain panicle^{-1}**	**No. of fertile grain panicle^{-1}**	**Total yield t ha^{-1}**	**1000 grain weight (g)**
T_1	9.26	20.26	16.93	3.32	189.36	71.09	2.07	18.23
T_2	10.33	24.39	21.27	3.12	206.87	77.48	2.48	20.54
T_3	9.36	23.38	19.93	3.45	201.54	72.23	2.24	18.54
T_4	9.90	23.45	20.20	3.25	202.24	73.89	2.29	20.64
T_5	10.14	24.26	21.03	3.23	203.29	75.03	2.40	19.13

At the time of ***harvesting*** the data were collected for the season of Boro (2011-12) and furnished below the same in tabulated form (Table II).

Table II : Combined ANOVA for all metrical characters during the time of harvest

CHARACTER	COMBINED ANOVA							COMPONENTS OF VARIANCES			GENOTYPIC COEFFICIENT OF VARIATIONS, PHENOTYPIC COEFFICIENT OF VARIATIONS AND HERITABILITY		
	Source of variation	**df**	**SS**	**MS**	**F**	**CD Value**	**CV Value**	**δ^2g**	**δ^2p**	**δ^2e**	**GCV**	**PCV**	**h^2**
No. of tiller plant^{-1}	**Treatment**	4	4.44590	1.11147	10.77**	0.26	3.27	0.20	0.30	0.10	4.56	5.58	0.66
	Replication	4	0.33798	0.08449	0.82 NS								
	Error	16	1.65158	0.10322									
Total panicle length (cm) plant^{-1}	**Treatment**	4	56.4000	14.1000	4753.08**	0.007	0.23	2.81	2.813	0.003	7.23	7.24	0.99
	Replication	4	0.0411	0.0103	3.46*	0.005							
	Error	16	0.0475	0.0030									
Panicle exsertion length (cm) plant^{-1}	**Treatment**	4	60.3265	15.0816	4544.71**	0.008	0.28	3.01	3.013	0.003	8.72	8.73	0.99
	Replication	4	0.0555	0.0139	4.18*	0.006							
	Error	16	0.0531	0.0033									
Unexserted panicle length (cm) plant^{-1}	**Treatment**	4	0.311144	0.077786	429.76**	0.0004	0.41	0.01	0.0101	0.0001	3.05	3.06	0.99
	Replication	4	0.003304	0.000826	4.56*	0.0003							
	Error	16	0.002896	0.000181									

Table II (Contd.): Combined ANOVA for all metrical characters during the time of harvest

CHARACTER	COMBINED ANOVA							COMPONENTS OF VARIANCES			GENOTYPIC COEFFICIENT OF VARIATIONS, PHENOTYPIC COEFFICIENT OF VARIATIONS AND HERITABILITY		
	Source of variation	**df**	**SS**	**MS**	**F**	**CD Value**	**CV Value**	**δ^2g**	**δ^2p**	**δ^2e**	**GCV**	**PCV**	**h^2**
Total no. of grain panicle^{-1}	**Treatment**	4	881.72	220.430	32.68**	17.09	1.27	42.77	49.31	6.54	3.25	3.49	0.86
	Replication	4	62.01	15.501	2.37NS								
	Error	16	104.73	6.545									
No. of fertile grain panicle^{-1}	**Treatment**	4	123.860	30.9649	60.68**	1.33	0.96	6.09	6.60	0.51	3.33	3.47	0.92
	Replication	4	3.204	0.8009	1.57NS								
	Error	16	8.165	0.5103									
Total yield ha^{-1} (ton)	**Treatment**	4	0.476064	0.119016	69.56**	0.004	1.79	0.02	0.021	0.001	6.14	6.29	0.95
	Replication	4	0.009624	0.002406	1.41NS								
	Error	16	0.027376	0.001711									
1000 grain weight (g)	**Treatment**	4	25.1111	6.27777	30.26**	2.88	2.34	1.21	1.41	0.20	5.66	6.11	0.85
	Replication	4	0.6399	0.15997	0.77NS								
	Error	16	3.3196	0.20747									

IV. DISCUSSION

While considering the value of variance ratio in each character it appeared that in all cases the 'F' value against treatment source of variation was found to be significant at 5% and 1% level of probability. The 'F' value was found to be significant at 5% level against replication source of variation though it should not be marked in any case of significance against the replication source of variation. That is why it was quite reasonable to assume that this might be due to the soil heterogeneity factors.

The metrical characters of raw data were converted into two-way-mean table for calculating its analyses of variance, components of all variances δ^2g, δ^2p, δ^2e, genotypic and phenotypic coefficient of variations i.e. GCV and PCV including heritability (h^2). These yield components data were exhibited in a Combined ANOVA as presented in Table II. It was critically observed various peculiarities during cropping time till harvesting. The length of panicle exsertion was found to be highest (21.27cm) in treatment- 2 (Penicillin) and lowest length (19.93 cm) of exserted panicle in case of treatment-3 (Sulfonamide). Accordingly the exserted panicle length was observed 20.20 cm and 21.03 cm in case of Gentamycin and GA_3 respectively. A comparative study of Penicillin and cyclic-AMP induced alpha (α)- amylase formation in rice endosperm was made by Biswas and Mukherjee, 1982.

In other major yield characters viz. total no. of grains panicle^{-1}, total yield plant^{-1} and 1000 grain weight were also studied. In all the cases the highest data recorded in treatment- 2 and lowest was in treatment- 3. Evidently treatment-4 and 5 i.e. Gentamycin and GA_3 were in same sequence as good as panicle exsertion length.

The value of heritability in yield components was found to be within the limit of 1.00. That is why a heritability measure close to 1.00 indicates that almost all variation in the population results from variation in genotypes and nearly nothing from environment. High heritability coupled with high genetic advance and Genotypic and Phenotypic Coefficient of Variation are also observed by Sureshbabu et al., (2013).

Different treatments like GA_3, Penicillin and Gentamycin undertaken in this experimentation were considered highest magnitude. All these three might be considered the highest effect for panicle exsertion in CMS ('A'line). Treatment-2 (Penicillin) having low cost reflected more significant and excellent results than other treatments although different treatments used as alternative costly phytochemicals of GA_3 were considered in Boro season (2011-12). Gentamycin was also used as alternative low cost chemical of GA_3. By its nature Gentamycin inhibits protein synthesis by binding to the bacterial ribosome. Gentamycin is an aminoglycoside antibiotic used in Mexico and USA for several agricultural purposes. The rice was most sensitive to sulfonamide. In this experiment, it also strongly affected the growth of rice plant and shown lower yield performance. The effective concentrations of sulfonamide increased soil respiration activity which was reported by Frund et al., 2000, Halling-Sorensen 2003 and Schmitt et al, 2004. Therefore, it is an established fact that the effects of various phytochemicals in different treatments have had more or less genetic variability in parental lines to achieve good yield performance.

V. CONCLUSION

During Boro season 2011-12, it was found that the ranges of value of heritability (h^2) in almost all the cases were lying in between 0.85 to 0.99 i.e. within the value of 1.00. That is why a heritability measure close to 1.00 indicates that almost all variation in the population results from variation in genotypes and nearly nothing from environment. Therefore, it is very clear that every treatment had its specific phytochemical effect causing to generate genetic variability in parental lines. In the present study, Treatment-2 (Penicillin) having low cost reflected more significant and provided excellent results showing highest yield performance than other treatments except GA_3 for its specific chemical properties although different treatments used as alternative phytochemicals of GA_3 were considered in this cropping season. Other treatments were established according to their mode of action having some variation in genotypes due to effect of phytochemicals. Therefore, it may be concluded that the effect of phytochemicals enlarged the considerable genetic variability in most of the plant characters besides high heritability percentage was observed in almost all

characters. High heritability percentages were also reported by Shivani and Reddy (2000), Devi *et al.* (2006) and Yadav *et al*. (2008). Nevertheless, by inter-varietal crossing, a lot of improvement might be achieved in the field of F_1 hybrid seed production.

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Fabrication and Performance Evaluation of Small Scale Wood Gas Stove for House Hold Purpose Using Water Boiling Test Method

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Abstract: A Double drum type inverted down draft gasifier was fabricated in Assela Agricultural Engineering Research Center Metal workshop. The water boiling test version 4.2.3 was used to evaluate thermal and stove characteristic performance indicators of the stoves. Performance result was compared with three stone traditional cook stove. High power and low power performance were compared and reported in this paper. During high power test wood gas stove performed better than three stone cooking method by all thermal performance indicators at tested significance level. While the traditional method numerically performed better than wood gas stove by stove character stick performance indicators though it was statically not significant. During low power test except thermal efficiency and turn down ratio where wood gas performed better than three stone cooking for all tested performance indicators were not significantly different.

Key words: inverted down draft gasifier, wood gas stove thermal performance indicators, stove characteristics indicators, high power test, and low power test.

1. INTRODUCTION

Wood gas is a syngas consisting of nitrogen, carbon mono oxide, hydrogen and traces of methane and other gases used as fuel. During the production process biomass or other carbon-containing materials are gasified within the oxygen-limited environment of a wood gas producer/wood gas generator. **Wood gas stove** is a gasification unit which converts solid biomass into wood gas or syngas through pyrolysis process. The process is preceded by pyrolysis, where the biomass is first converted to char, releasing methane and tar rich in polycyclic aromatic hydrocarbons[1].

The development of micro-gasification is relatively new in the cooking energy sector. Many stakeholders are not yet aware of the potentials and challenges of revolutionizing the way we make fire to cook food. A gasifier cook stove powered by *wood-gas* from dry solid biomass shows great promise for making an important contribution to the goal of reducing the negative health-effects of household air pollution from cooking[2].

There is growing concern about the negative health effects of smoke from open fires and rudimentary cook stoves operated with solid biomass or coal. In the last few decades, since indoor air pollution is understood as chronic health problem, many improved wood

stoves have been developed and promoted to developing world by different organizations. Although, there is improvement in indoor air pollution problems, still there are gaps to be filled. There is an ardent quest to shift to cleaner fuels such as LPG or electricity for the sake of health. However, for billions of poorer households, this will not be a realistic scenario for years to come. We have to accept the fact that solid biomass will be the cooking fuel of choice for many of these households for the future decades. On account of their clean and efficient *combustion* of biomass, gasifiers do have the potential to bridge this gap and offer users the convenience of cooking with gas derived from the solid biomass fuels[2].

Gas cooking is advantageous compared to direct combustion improved cook stoves (ICS) by providing cleaner burning of solid biomass (considerable reduction of soot, black carbon and indoor / outdoor air pollution), fuel efficient due to more complete combustion (less total biomass consumption), use a variety of small-sized biomass residues (no need for stick-wood or charcoal) and easy lighting allows for cooking to commence within minutes[3].

Of the gasifiers available, an inverted (top burning) downdraft gasifier can be used for indoor cooking practice because it can be made in different sizes. The major advantage of the inverted downdraft gasifier is that the rate of gas production depends on the amount of primary air admitted to the bottom and it can be practiced indoor cooking purpose[9].

In Ethiopia, different organization made effort to avail improved gas stoves. Of these, BAERC energy team attempt to modify this technology for Injera baking purpose and the work is underway. And the initiation of this work was adapting double cylinder inverted down draft gasifier and evaluating its performance at local condition to use in household cooking.

2. MATERIALS AND METHODS

2.1 Materials

Materials and apparatus used for this experiment were:

- Wood Gas Stove- fabricated in AAERC work shop from different size and type mild steel materials purchased from local market
- Three stone cooking stove (TSCS)-locally prepared
- Stainless steel Cooking vessel-purchased from local market
- Timer
- Digital balance (7Kg, accuracy ±1 gram)
- Digital thermometer (accuracy ± 0.5)
- K-type thermocouple probe
- Oven
- hygrometer (air relative humidity)
- anemometer (to measure wind speed)
- Fuel wood
- Tape measure

2.2 Site Description

The test was conducted in Asella AERC with the local atmospheric conditions of ambient temperature 20-26.6oc, Air pressure 75.7Pka, Relative humidity 35% and Altitude/elevation 2430m. The test was conducted in one side opened shade where air freely flow and protected from wind blow.

2.3 Description of Stoves

The inverted down draft (double) type of Wood gas stove was fabricated by Asella AERC workshop (***figure 1***). The outer cylinder both end opened and a ring of ventilation holes drilled around the whole of the bottom edge of the cylinder and support rods are run through the drum. These rods supports perforated sheet which forms grate. The inner cylinder both ends opened forms combustion chamber. This cylinder fits inside the outer cylinder. It rests on the perforated sheet or grate which is supported by rods. This cylinder has a ring of ventilation holes drilled around the upper end of the cylinder. The third cylinder which is only slightly smaller than the outer cylinder is cut down to make a cap for the inner cylinder. The cap is not tight-fitting (1cm less than outer cylinder diameter); it effectively closes off the top of the gap between the sides of inner cylinder and the sides of the outer cylinder. The cap has riser (to increase combustion efficiency of producer gas) and circular hole cut in it, and this hole is only slightly smaller than the diameter of the inner cylinder. It is supported by the upper lip of the combustion chamber but the hole is large enough so that it does not obstruct the flow of heat up through the top of the combustion chamber. The pot seat is supported by the cap.

Fuel wood charge is lit on the top, forming a layer of charcoal, the flaming pyrolysis is below charcoal layer and the unburned fuel is at the bottom on the grate. The primary air for the pyrolysis process is entered at bottom through holes drilled at the bottom of outer cylinder and move up forming gases in the flaming pyrolysis zone as shown in the ***figure 2***. The pyrolysis gas is combusted by secondary air entered from the top through clearance of top cover and holes drilled on the top of combustion chamber above the charcoal zone and part of primary air which flow through whole between inner and outer cylinders.

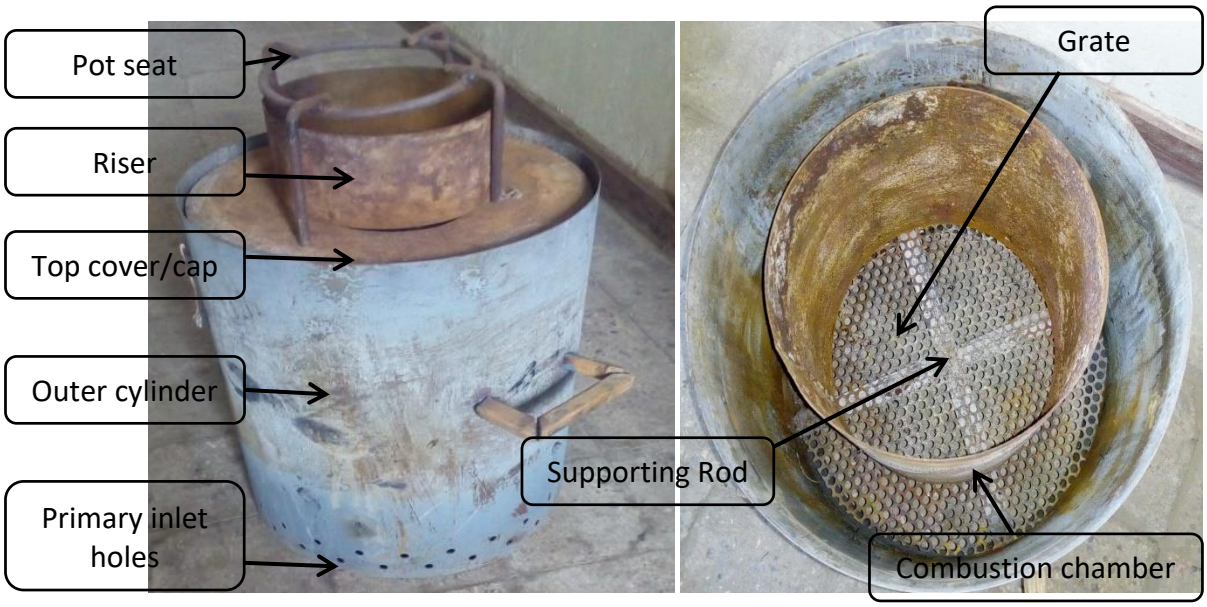

Figure 1: Photo of the fabricated stove showing different parts

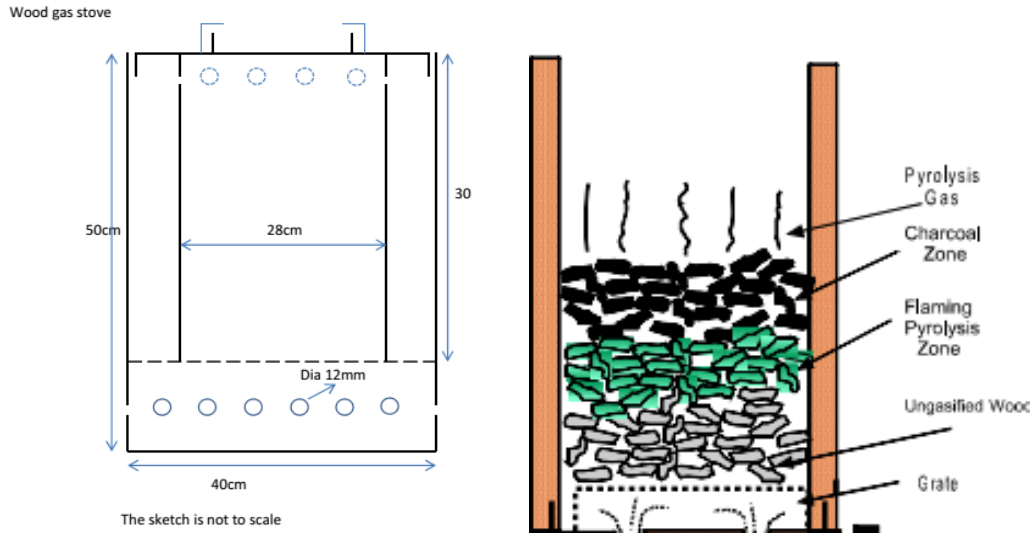

Figure 2: shows 2D schematic drawing (left) and Wood gas stove showing combustion process (right)

2.4 Fuel Characteristics

The wood used for the experiments was Eucalyptus (local names bargamo) obtained from the center as leftover of different activities, split and air-dried. Semi-cylindrical pieces of wood (2-4 cm in diameter and 25-30 cm in length) were used during each experiment.

The moisture content (11.67%) and the calorific value of fuel wood (4090cal/gram) were determined at the end of the entire series of experiments by using oven drying method and bomb calorimeter respectively.

2.5 Performance evaluation

The Water Boiling Test (WBT) is a simplified simulation of the cooking process. It is intended to measure how efficiently a stove uses fuel to heat water in a cooking pot and the quantity of emissions produced while cooking[4]. It measures the quantity of fuel consumed and time required for the simulated cooking and usually employed in investigating the performance of cook stoves under different operating conditions.

The standard WBT consists of three phases that immediately follow each other. The ***cold-start high-power phase***, we begun the test with the stove at room temperature and uses fuel from a pre-weighed bundle of fuel (5kg) to boil a measured quantity of water (5 Kg)in 7cm diameter stainless steel vessel. Then we replaced the boiled water with a fresh water of ambient-temperature to perform the second phase. The ***hot-start high-power phase*** was conducted after the first phase while stove and cooking vessel were still hot. Again, we used fuel from a pre-weighed bundle of fuel to boil measured quantity of water (5 Kg) in the vessel. Repeating the test with a hot stove helps to identify differences in performance between a stove when it is cold and when it is hot. The ***simmer phase*** provides the amount of fuel required to simmer a measured amount of water at just below boiling point for 45 minutes. This step simulates the long cooking of legumes or pulses common throughout much of the world. During this phase, pre-weighed amount of fuel was used to simmer the boiled water for 45 minutes.

As it is quick method of comparing the performance of cook stoves[4], we employed in evaluating the performance of the improved biomass cook stove and compared with the performance of the 3-stone traditional cook stove, which it intends to replace. For each stove, the three phases were repeated three times.

2.5.1 Determination of stove performance parameters

a. **Moisture content of fuel (M):** The moisture content of fuel wood used was determined by the weight loss of sample that was oven-dried at 100°C until the weight of the sample stabilized. The Sample of moist fuel was taken from the fuel wood prepared for the tests and oven dried as stated above. And moisture content was calculated by equation 1 and found 11.67%.

$$M(\%) = \frac{100(W_w - W_d)}{W_d} \quad (1)$$

Where: W_w-is weight of wet fuel sample, W_d-weight of dry fuel (after oven dried)

b. **Fuel consumed (dry base):** The amount of fuel wood used to bring water temperature from room temperature to boil [8]. And it **a**ccount for two factors: (1) the energy that was needed to remove the moisture in the fuel and (2) the amount of char remaining unburned. And given by:

$$\text{Mass of dry fuel} = \text{Fuel mass (wet)}*(1-M) \quad (2)$$

c. **Burning rate**: A measure of the average unit of wood burned per unit of time during the test. Between tests, compares how consistently the user was operating the stove. Between stoves, indicates how rapidly the stove consumes fuel. And it is given by:

$$\text{Burning rate} = \frac{\text{mass of fuel dry base}}{\text{time taken}} \quad (3)$$

d. **Firepower (F_p):** This is a ratio of the wood energy consumed by the stove per unit time. It is a useful measure of the stove's heat output, and an indicator of how consistently the operator ran the stove over multiple tests. And the firepower (Fp) is given by:

$$\text{Fp} = \frac{\text{mass of fuel dry base} * \text{LHV}}{\text{time taken}} \quad (4)$$

Where LHV- is lower heating value of the fuel

e. **Turn-Down Ratio (TDR):** Turn-Down ratio indicates how much the user adjusted the heat between high power and low power phases. A higher value indicates a higher ratio of high power to low power, and could signal a greater range of power control in the stove.

$$\text{TDR} = \frac{\text{cold start fuel consumed dry base} * \text{simmering time}}{\text{simmering fuel consumed dry} * \text{cold start time taken}} \quad (5)$$

f. **Thermal efficiency (η_{th})**: Thermal efficiency is a measure of the fraction of heat produced by the fuel that made it directly to the water in the pot. The remaining energy is lost to the environment. So a higher thermal efficiency indicates a greater ability to transfer the heat produced into the pot. While thermal efficiency is a well-known measure of stove performance, a better indicator may be specific consumption, especially during the low power phase of the WBT. This is because a stove that is very slow to boil may have a very good looking TE because a great deal of water was evaporated. However the fuel used per water remaining may be too high since so much water was evaporated and so much time was taken while bringing the pot to boil[4]. And determined using equation (6).

$$\eta_{th} = \frac{4.186 * \text{mass of water boiled} * \text{change in temp} + \text{LHW} * \text{mass of Vapor}}{\text{fuel consumed dry base} * \text{LHV}} \quad (6)$$

Where LHV-lower heating value of the fuel wood and LHW-is latent heat of vaporization of water.

g. **Specific fuel consumption (SFC):** This is a measure of the amount of fuel required to boil (or simmer) 1 liter of water. It is calculated by the equivalent dry fuel used minus the energy in the remaining charcoal, divided by the liters of water remaining at

the end of the test. In this way, the fuel used to produce a useful liter of "food" and essentially the time taken to do so is accounted for and given by equation (7).

$$\text{SFC} = \frac{\text{fuel consumed dry base}}{\text{Volume of water boiled}} \tag{7}$$

h. ***Specific Energy Consumption (SEC)***- It is a measure of the amount of energy required to boil (or simmer) 1 liter of water and given by:

$$\text{SEC} = \text{SFC} * \text{LHV of dry fuel} \tag{8}$$

i. **Temp-Corrected Specific Fuel Consumption (*$SC^T c$*)** – This corrects specific consumption to account for differences in initial water temperatures. This facilitates comparison of stoves tested on different days or in different environmental conditions. The correction is a simple factor that "normalizes" the temperature change observed in test conditions to a "standard" temperature change of 75 ºC (from 25 to 100)[4]. It is calculated in the following way:

$$SC_c^T = SC_c \cdot \frac{75}{T1_{cf} - T1_{ci}} \tag{9}$$

j. **Temp-Corrected Specific Energy Consumption (*$SE^T{}_c$*)** – Similar to the temperature corrected specific fuel consumption, this metric is a measure of the amount of fuel energy required to produce one liter (or kilo) of boiling water starting with cold stove. It is the temperature corrected specific fuel consumption multiplied by the energy content of the fuel[4]:

$$SE_c^T = SC_c^T \cdot \frac{LHV}{1000} \tag{10}$$

k. **The local boiling point** (**T_b**) of water is the point at which the temperature no longer rises, no matter how much heat is applied. The local boiling temperature is influenced by several factors including altitude, minor inaccuracies in the thermometer, and weather conditions. For these reasons, the local boiling temperature cannot be assumed to be 100^0 C. For a given altitude h (in meters), the boiling point of water may be estimated by the following formula [2]:

$$T_b = \left(100 - \frac{h}{300}\right)^{\circ}C \tag{11}$$

l. **Temperature Corrected Time to Boil** (Δt_c^T)– The time it took for the vessel to reach boiling temperature, corrected to reflect a temperature rise of 75 deg C from start to boil. This measure can be compared across tests and stoves to determine the "speed" of the stove at high power, often an important factor to cooks[4].

$$\Delta t_c^T = \Delta t_c \cdot \frac{75}{T1_{cf} - T1_{ci}} \tag{12}$$

Where $T1_{cf}$ and $T1_{ci}$ are initial and final water temperature of the test, Δt_c -time taken to boil water.

3. RESULT AND DISCUSSION

3.1 Visual observations

Initially, the flames come out of the top of the stove, but after a few minutes, the combustion changes. The wood is slowly converted to charcoal and the gas released by this process burns with higher flame height than the wood would give as well as burning for a much greater length of time. After a while, flames no longer come out of the top of the stove, they come out of the ring of holes around the base of the outer cylinder. The heat flowing out of the bottom gets diverted around the outside of the combustion chamber, flows upwards, is caught by the cap and fed back into the combustion chamber through the ring of holes at the top of the combustion chamber. The result attained was similar with [9].

3.2 Performance indicator parameters determined by the above equations

Both thermal and stove characteristics indicators discussed above under determination of performance parameter part of this paper is summarized and statically discussed below.

***Table 1*: Calculation result summary**

Description	**Cold start**		**Hot start**		**Simmering**	
	WGS	**TSCS**	**WGS**	**TSCS**	**WGS**	**TSCS**
Phase duration (min)	17	44	13.3	40	45	45
Burn rate (g/min)	35	45	23	32	41	49
Thermal efficiency (%)	23.5	11	28.7	14	21	13.4
Specific fuel consumption (g/lit)	117	212	107	203	815	533
Specific energy consumption (KJ/lit)	1998	3543	1827	3393	14171	9261
Fire power (kw)	10.2	7.4	11.7	7.4	11.8	11.3
Turn down ratio					0.9	0.66

Where WGS-is Wood Gas Stove and TSCS is three stone cooking stoves

***Table 2*: Mean comparison of cold start phase for WGS and TSCS**

Parameters	units	WGS			TSCS			Significance test		
		Mean	STD	COV	Mean	STD	COV	%mdf	t-critical	Significance at p<0.05
time to boil	min	17	1	0.059	44	1	0.023	61.36	27.79	**
Tcore- time to boil	min	16.79	1.29	0.077	42.31	0.96	0.023	60.31	19.52	**
fuel consumed (dry)	g	596	40.63	0.068	1119	21	0.019	46.74	9.99	**
Burning rate	g/min	35.19	4.09	0.116	25.44	0.81	0.032	27.7	2.15	ns
η (%)		23.5	0.01	0.038	10.8	0.005	0.045	54.25	11.13	**
SFC	g/liter	116.59	8.42	0.072	212	3.05	0.014	45.01	7.28	**
Temp corrected SFC	g/liter	114.97	5.54	0.048	203.9	2.93	0.014	43.61	12.056	**
Temp-corrected SEC	kJ/liter	1998.15	96.31	0.048	3543	50.94	0.014	43.6	12.06	**
Firepower	watts	10193.6	1183.8	0.116	7369	235.0	0.032	27.8	2.15	ns

From the mean comparison of cold start high power phase (table 2), the Wood Gas Stove performed significantly better than Three stone Cooking stove for most of performance indicators of stoves except for stove characteristic indicators (Burn rate and fire power) where the stoves performance was not significantly different at P<0.05.

***Table 3*: Mean comparison of hot start phase for WGS and TSCS**

Parameters	**units**	**WGS**			**TSCS**			**Significance test**		
		Mean	STD	COV	Mean	STD	COV	%mean diff	t-critical	Significance at p<0.05
time to boil	min	13.3	1.53	0.115	40.3	0.58	0.014	66.9	10.006	**
Tcore- time to boil	min	13.2	1.86	0.141	38.8	0.56	0.014	66	7.588	**
Fuel consumed (dry)	g	535	38	0.071	190.9	298.3	1.562	48	11.085	**
Burning rate	g/min	40.5	6.38	0.157	25.6	0.80	0.031	37	2.070	ns
η	%	28.5	0.02	0.065	14	0.003	0.018	51	4.671	**
SFC	g/liter	107	7.45	0.070	203	10.53	0.052	48	9.264	**
Temp corrected SFC	g/liter	105	6.33	0.060	195.2	10.13	0.052	46	8.438	**
Temp-corrected SEC	kJ/liter	1827	110	0.060	3393	176	0.055	46	8.438	**
Firepower	watts	11742	1848	0.157	7410	232.2	0.031	37	2.070	ns

From Table 3, during hot start high power test Wood Gas Stove (WGS) performs significantly better than Three stone Cooking stove (TSCS) for most of the performance indicators except for stove characteristic (Burn rate and fire power) where stoves performances were not significantly different at P<0.05.

***Table 4*: Mean comparisons during simmering test of the stoves**

Parameters	units	WGS			TSCS			Significance Test		
		Mean	STD	COV	Mean	STD	COV	%Mean diff	t-critical	Sign. at p<0.05
Fuel consumed (dry)	g	1769.8	189.17	0.107	1749	179.9	0.103	1.15	1.527	ns
Burning rate	g/min	39.33	4.21	0.107	38.9	4	0.103	1.15	1.529	ns
Ηj	%	20.4	0.01	0.049	13.4	0.02	0.147	34.10	3.47	**
SFC	g/liter	814.8	202.27	0.248	532.9	59.5	0.112	34.60	1.326	ns
Temp-corrected SEC	kJ/liter	14161.3	3515.4	0.248	9261	1034.6	0.112	34.60	1.326	ns
Firepower	watts	11392	1218.3	0.107	11261	1157.8	0.103	1.15	1.529	ns
Turn down ratio	--	0.895	0.042	0.047	0.659	0.068	0.104	26.36	3.598	**

From Table 4, Most of the performance indicators of the stoves were not significantly different except for thermal efficiency and Turn Down Ratio where WGS performed significantly better than TSCS at p<0.05.

3.3 Comparisons of performance parameters

Both thermal performance and stove characteristic indicators were elaborated.

i. Phase duration (min)

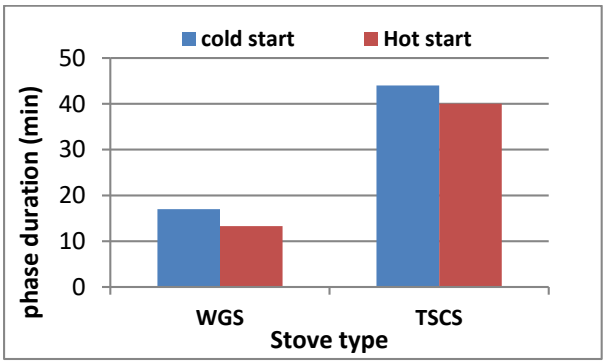

Figure 3: Phase duration comparison of WGS and TSCS

Least boiling time was recorded during high power hot start phase (13.3min and 40min) by WGS and TSCS respectively. The result obtained by the experiment was similar with [6, 7]. The boiling time reduction during high power hot start by the stoves were due to heat absorbed by stove body in this phase. Taking the mean of high power tests, the technology improved cooking time by 67.4%.

ii. Burning rate comparison

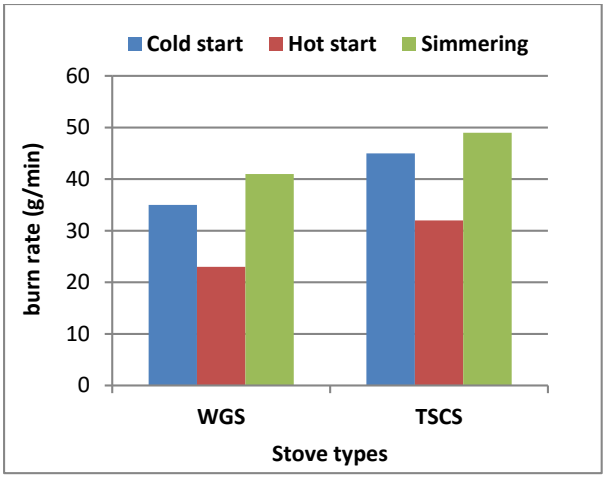

Figure 4: Burning rate comparison

Least burn rate was recorded during hot start by WGS (23g/min) and simmering test by TSCS (32g/min). Highest burn rate was recorded during simmering test by WGS (41g/min) and TSCS (49g/min). Comparing burn rate the WGS performs better than TSCS, but it was not significant at tested significance level as indicated in *Table 4*.

iii. Thermal efficiency comparison

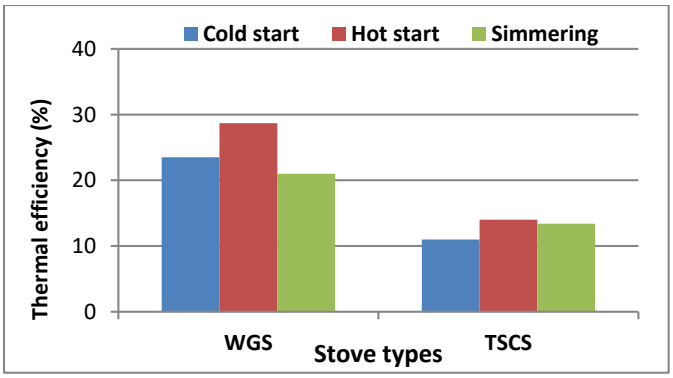

Figure 5: Shows how thermal efficiencies of the stoves compared

The highest thermal efficiency was recorded during hot start and simmering test by WGS and TSCS respectively. Least efficiency was recorded during simmering test and cold start test by WGS and TSCS respectively. The high power thermal efficiency were 26% and 12% for WGS and TSCS respectively and low power efficiency were 21% and 13.5% for WGS and TSCS respectively.

iv. Specific fuel consumption

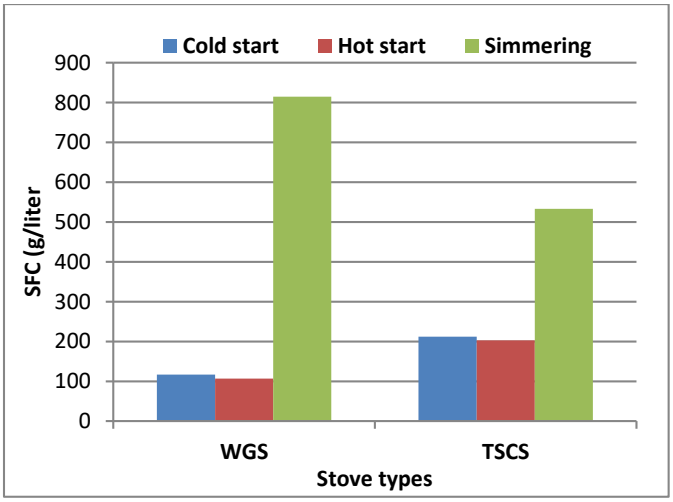

Figure 6: Shows the comparison of specific fuel consumptions

Specific fuel consumption is the measure of stove fuel consumption to boil a unit of water. Least sp. fuel consumption was recorded during hot start and cold start by WGS and TSCS respectively. As indicated, for high power test WGS recorded least SFC and low power test was recorded least SFC by TSCS. Comparing the two stoves during high power test WGS improved SFC by 46.5 while during lower power TSCS performs better than WGS.

v. Turn Down Ratio comparison

Figure 7: Compares the turn down ratio of the stoves

Comparing the mean Turn down ratio (TDR) of the stove Wood Gas Stove performed better than three stone cooking stove by 26%.

4. CONCLUSION AND RECOMMENDATION

4.1 Conclusion

The Wood Gas Stove improved the thermal efficiency by 54% during high power tests and 36% in low power test when compared with Traditional cooking stove (TSCS). It can contribute to indoor air pollution reduction and afforestation in developing countries. Comparing the mean the power controllability of the tested stove WGS performs better than TSCS by 26%. The stove performed better than TSCS for all performance indicators of thermal parameters. The technology performed better than traditional stove by most of thermal performance indicators except specific fuel consumption during low power test, it is important to promote to end users.

4.2 Recommendation

- Since the technology was performed better than traditional cooking by most of thermal indicators, it was recommended to be promoted and collect end users comment for further dissemination.
- Modifying the technology to decrease thermal mass so that it could be easily used in house hold cooking condition and applying insulation on the outer cylinder.
- The evaluation was under taken on hard wood, so it was recommended to further evaluate on different feedstock available in local area

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The Implication of IFRS Convergence on Tax/Earnings Management Behavior of Public Companies in Indonesia

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Abstract- The purpose of this study is to describe whether International Financial Reporting Standards (IFRS) convergence in Indonesia implies the behavior of tax management or earnings management of publicly-listed companies whose corporate income tax is not subject to final tax. This study uses a mixed approach, collecting textual data using document analysis techniques and participant observant, and collecting numerical data from public companies' audited financial statements available on the official website of the Indonesian Stock Exchange. This study uses the Book-Tax Difference (BTD) approach to identify the behavior of tax management or earnings management. Based on 288 sample data (1,152 firm-year observations) for the 2010-2013 period, this study revealed that corporate behavior in the form of tax management or earnings management continues to occur before and after public companies adopt IFRS in their financial statement.

Index Terms- IFRS implication, book-tax difference, earnings management, tax management

I. Introduction

The relationship between accounting and tax is a complex and multidimensional topic. One explanation for this is that shifting in local accounting standards to IFRS poses a particular challenge for the tax laws. Besides, the adoption of IFRS also raises the need to review the theoretical and practical bases for using accounting as the starting point for calculating corporate taxes (Samuel, Samuel, & Obiamaka, 2013, p. 169).

The study of Mulyadi et al. (2012) reveals that the implementation of IFRS will change the financial statements, and it will lead to a change in the tax reports. However, the tax impact is essential and must be analyzed carefully. The tax implications due to changes in the Financial Accounting Standards (FAS) in many countries are very complex and require thorough and careful analysis (Mulyadi, Soepriyanto, & Anwar, 2012, pp. 159-160).

According to the IFRS Foundation (2016), there have been 147 countries in the world, implementing IFRS as a global financial accounting standard issued by the IASB (International Accounting Standard Board). Concerning IFRS implications on taxes, there are many studies found in international scientific journals with various focuses. Some of the studies are: (1) mere international literature studies (Samuel, Samuel, & Obiamaka, 2013); (2) case studies of one country, for example: Belgium (Haverals, 2007), Australia (Goodwin, Cooper, & Johl, 2008), Germany (Knirsch, 2010), Nigeria (Madawaki, 2012; Oseni, 2013), United States (Harper, Leatherbury, Machuca, & Phillips, 2012), Hong Kong (Helen, 2013); (3) comparative studies of two countries, for example: Britain and Italy (Fox & Hannah, 2013); (4) comparative studies among EU member states (De Simone, 2013); and (5) comparative studies among numerous countries in various continents (Mulyadi, Soepriyanto, & Anwar, 2012). From these previous studies, only Mulyadi et al. (2012) discuss the implications of IFRS on tax in Indonesia. However, Mulyadi et al. (2012) do not give examples of companies in Indonesia that have implemented IFRS.

Based on previous studies above, the implications of IFRS on tax vary significantly in many countries. The extent of the implications of IFRS on tax in a country or company depends on three factors (Samuel, Samuel, & Obiamaka, 2013, p. 172). The first factor is to what extent financial accounting relates to tax accounting in a country is. The second factor is whether a country chooses to use the "full IFRS" option for the annual financial statement of companies in a country. The third factor is to what extent national accounting standard setters consider IFRS when setting standards for national Generally Accepted Accounting Practice (GAAP) and what choices of accounting principles companies can make within national GAAP.

For the case of Indonesia, the beginning of IFRS convergence started effectively on 1 June 2012. IFRS converged into Statement of Financial Accounting Standards (SFAS) is mandatory for publicly listed companies for audited financial statements for the book year 2012. Besides, state-owned companies and financial institutions are also obligated to implement SFAS convergent with IFRS. Mulyadi et al. (2012, p. 162) suggest that the implementation of IFRS in Indonesia has an impact on companies whose corporate

income tax is not final, whereas those whose income is subject to final tax is not affected by the implementation of IFRS.

After the literature study of Mulyadi et al. (2012), there are some further investigations of the implication of IFRS convergence using BTD approach and samples from public companies listed on the Indonesia Stock Exchange (IDX). Santy et al. (2016) conclude that IFRS implementation does not result in a change in earnings management practices. The study of Wulandari et al. (2017) with the samples from public companies listed on the IDX as well also reveals the same conclusion as Santy et al. (2016).

As a follow-up of Mulyadi et al. (2012), this study focuses on a research question concerning the comparison of the practice of tax management or earnings management performed by publicly-listed companies whose income is not subject to final tax before and after IFRS implementation in Indonesia. The main issue of the study relates to the continually changing Indonesian SFASs in line with IFRS changes, but no amendment to the Indonesian taxation rules occurs after IFRS implementation in 2012.

II. Conceptual Framework

A. Bookkeeping System & Book-Tax Difference

To answer the research question above, one of the conceptual frameworks useful as a research instrument is the concept of Book-Tax Difference (BTD). In the research literature, BTD is the difference between accounting rules and tax rules. BTD can also be calculated by adding permanent differences and temporary differences (Tang & Firth, 2011, p. 181). BTD results from the bookkeeping system in the literature consisting of two systems, namely the one-book system and the two-book system (Schanz & Schanz, 2010, pp. 311-312). The one-book system will not result in BTD since financial accounting is also applicable for tax accounting. The two bookkeeping system will separate tax accounting and financial accounting so that BTD will arise. After the implementation of IFRS in many countries, there is a new bookkeeping system, namely the three-book system. These three accounting systems are dynamic.

In the two-book or dual accounting system, tax and financial reporting are separate but related, accounting systems with different objectives. Financial statements are designed to provide information to shareholders and others for evaluating firm performance (Plesko, 2000, p. 171). For tax purposes, financial statements are designed to provide information to the tax authority to calculate corporate tax liabilities based on taxable income. This taxable income, whose definition is subject to change by legislative action, provides a measure of income that leaves little room for some managerial discretion that may lead to horizontal differences in tax liabilities (Plesko, 2000, p. 171).

There are two forms of BTDs, namely permanent differences and temporary differences. Permanent differences arise when an item (a) affects book income, but never affects taxable income; or (b) affects taxable income, but never affects book income (Graham, Raedy, & Shackelford, 2012, p. 24). Some of the examples are income subject to final tax, income as a non-tax object, and non-allowable expenses (i.e., donation and tax fines). Temporary differences arise when the tax basis and the book basis of an asset or liabilities differ (Graham, Raedy, & Shackelford, 2012, p. 24). Some of the examples are depreciation expense, amortization expense, and allowance for doubtful accounts.

Several previous studies show that BTD is caused by differences in the objectives of accounting reporting and tax reporting, earnings management, and tax management. Examples of such studies are Tran (1997); Hanlon (2002); Phillips, Pincus, & Rego (2003); Tang (2005); Hanlon & Shevlin (2005); Jeanjean & Stolowy (2008); and Tang & Firth (2011). Tran (1997) noted that the concept of "wherewithal to pay" in taxation has resulted in BTD from temporary differences. Hanlon & Shevlin (2005) examined BTD from the context of earnings management or tax sheltering behavior (p. 107), as shown in Figure 1. Higher accounting profit (book income) indicates the earnings management behavior, while lower taxable profit (taxable income) indicates the tax sheltering behavior.

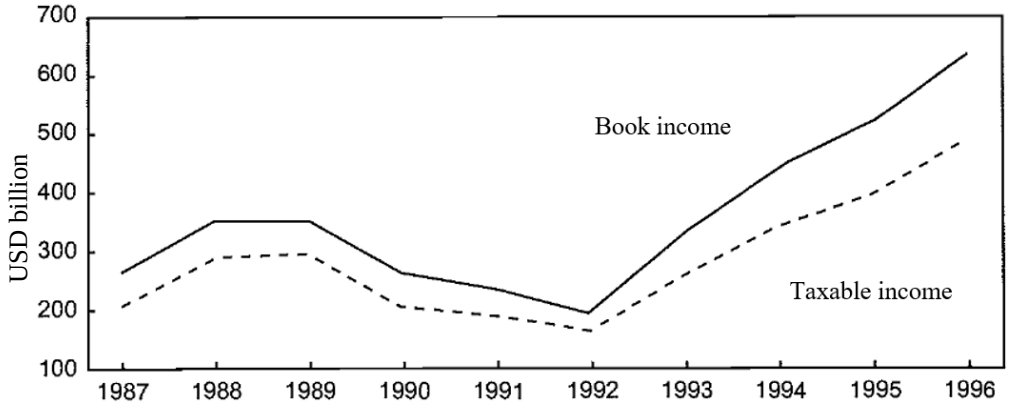

Figure 1: Book Income versus Taxable Income for Corporations with More Than USD1 Billion in Assets. Adapted from the U.S. Department of the Treasury (1999) in "Book-Tax Conformity for Corporate Income: An Introduction to the Issues" by Hanlon & Shevlin (2005, p. 107).

B. Classification of BTD

Companies are required to disclose BTD in their financial statements and tax returns. For tax purposes, tax reconciliation is a part of the tax returns and presents the necessary adjustments (fiscal corrections) for accounting profit to obtain the taxable profit. In the financial statements, BTD is disclosed in the Notes to Financial Statements and is usually divided into temporary differences and permanent differences (Hoepen, 1981, p. 17; Hanlon & Shevlin, 2005, pp. 105-106).

Figure 2 summarizes the types of BTD synthesized from Hoepen (1981, p. 22) and Gallego (2004, p. 805). If the figure is associated with Phillips et al. (2003, p. 30)'s study, BTD with temporary difference type resulting in DTL is beneficial for detecting earnings management practices. It is because the negative fiscal correction of temporary differences results in higher accounting profit than taxable profit, or the book income is higher than the taxable income.

Some researchers discussed BTD more comprehensively. They considered BTD as a result of several behaviors, namely: (1) financial reporting abuses (Plesko, 2004, p. 178); (2) conservatism in determining taxable income (Heltzer, 2006, p. v); (3) earnings management (Tang T. Y., 2006, p. 30; Lee, Vetter, & Williams, 2015, p. 55); (4) tax management (Tang T. Y., 2006, p. 30); (5) tax avoidance (Tang T. Y., 2014, p. 25; Fadilah & Wijayanti, 2017); (6) tax management (Wahab & Holland, 2014, p. 4); (7) tax sheltering (Lee, Vetter, & Williams, 2015, p. 55); and (8) aggressive tax management (Martinez, Souza, & Monte-Mor, 2016, p. 177).

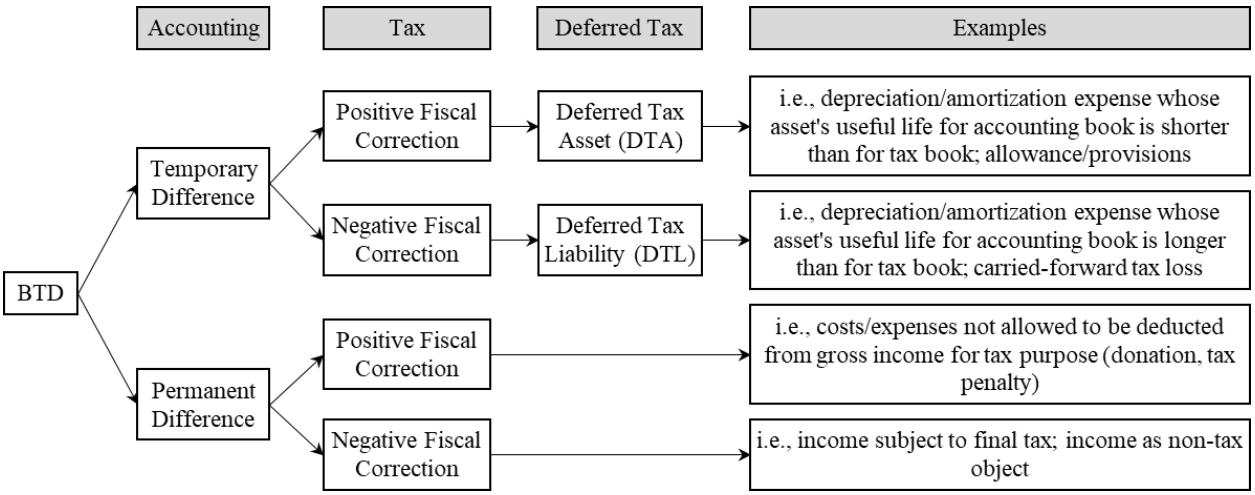

Figure 2: Classification of BTD based on accounting book and tax book,

Notes: This figure is adapted from a synthesis between "Anticipated and Deferred Corporate Income Tax in Companies' Financial Statements" by Hoepen (1981, p. 22) and "The Accounting and Taxation Relationship in Spanish Listed Firms" by Gallego (2004, p. 805).

However, according to Tang (2005, p. 8) and Formigoni et al. (2009, pp. 44-45), BTD does not always derive from opportunistic behaviors. Tang (2005) defines BTD as a function of book and taxable income or a function of prima facie income tax (p. 8). The definition of BTD refers to the logic that BTD is a function of accounting-tax misalignment, earnings management, and tax management. BTD reveals not only the institutional discrepancy between book and tax reporting rules but also the philosophies behind management's strategies or behavior in managing earnings and taxes (Tang T. Y., 2005, p. 8).

There are two drivers of BTD. BTD resulting from the misalignment between the accounting and tax standards constitutes non-discretionary difference or Normal BTD (NBTD), assuming that it is a not-opportunistic application of the law (Formigoni, Antunes, & Paulo, 2009, pp. 44-45). Tang (2005) stipulates that NBTD is because of mechanical differences due to different requirements between book and tax reporting (p. 8).

BTD caused by opportunistic behavior constitutes Abnormal BTD (ABTD). In this case, the administrators have incentives to act opportunistically, concerning the accounting numbers and the taxable result bringing about discretionary differences or ABTD (Formigoni, Antunes, & Paulo, 2009, pp. 44-45). Tang (2005) stipulates that ABTD is because of opportunistic differences attributed to aggressive book and tax reporting (p. 8). Concerning the management of accounting results, Heltzer (2006) mentions ABTD as aggressive book reporting (p. 3), whereas Seidman (2010) calls ABTD earnings management (p. 1). Meanwhile, for management of tax, Heltzer (2006) refers to ABTD as aggressive tax reporting (p. 3), and Seidman (2010) calls ABTD tax sheltering (p. 1).

Concerning the two types of BTD above, Tang (2005) makes a BTD conceptual framework (p. 29), as shown in Figure 3. Based on the figure, there are three types of ABTD (EM, TM, and EM+TM) with a summarized explanation as to the following. Number (1) means that a company applies EM by managing book income while keeping taxable income (taxes) constant ($B'>0$ and $B'<0$, where $T'=0$. Number (2) means a company applies TM by managing taxable income (taxes) while keeping book income constant ($T'<0$ and $T'>0$, where $B'=0$). Number (3) means a company applies EM and TM by managing the book income and taxable income (taxes) simultaneously, either in a different direction or in the same direction ($B'>T'$ and $B'<T'$; where $B'\neq T'$).

According to Tang (2005), accounting rules and tax rules are not able to determine the accounting and tax treatments for each business transaction because business activities are complex and continually changing. Such condition results in uncertainty in the implementation of accounting standards and tax rules (p. 7). Besides, GAAP also makes discretion and flexibility possible, allowing the choice of the accounting treatment for managers in financial reporting practices. As a consequence, uncertainty and discretion allow corporate managers to behave opportunistically according to the choice of accounting policies and available tax rules leading to distorted or abnormal BTD. However, the American Accounting Association (AAA) stated that "*accounting is a behavioral process*" dan "*principle purpose of accounting reports is to influence action: i.e., behavior*" (Cao & Buchanan, 1985, p. 115; Balachandran, 1985, p. 23).

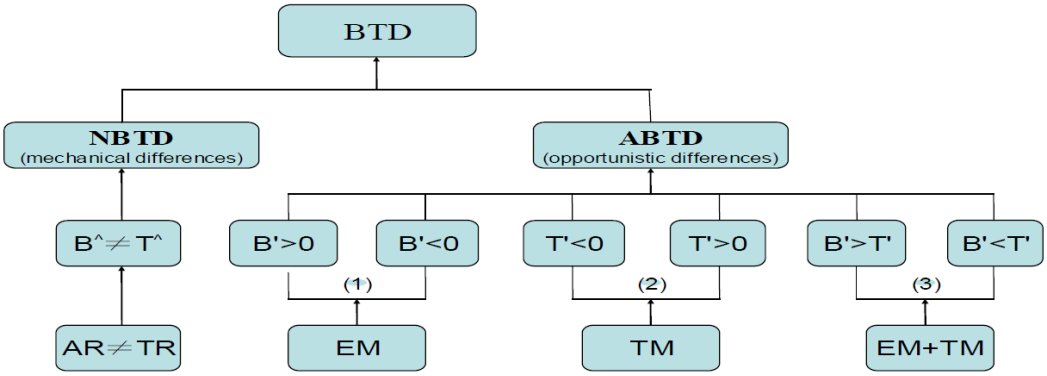

Figure 3: The Conceptual Framework of Book-Tax Difference

Notes: The definition of symbols is as the following. B^ is unplanned book revenue as the basis for calculating tax expense according to accounting standards, before applying earnings management (EM) or tax management (TM). T^ is unmanaged taxable revenue, which is the basis for calculating tax debt according to tax rules, before applying EM or TM. B' is planned book revenue as the basis for calculating tax expense according to accounting standards after applying EM or TM. T' is planned taxable revenue, which is the basis for calculating tax debt according to tax rules, after applying EM or TM. AR is accounting rules under FAS, while TR is tax rules under the applicable tax rules. Adapted from Tang (2005, p. 29)

In terms of literature on taxation principles, Mazur & Plumley (2007) suggests that uncertainty, as mentioned above, arises because many interpretations of the tax laws must be made to match the pattern of taxpayer transactions with rules and the taxpayer has a different interpretation from the tax authority ultimately affecting the tax gap (p. 569). In terms of literature on positive accounting theory, discretion and flexibility, as mentioned above, are parts of the hypothesis that underlies positive accounting theory (PAT) because company managers will determine the choice of available accounting policies. The selection of accounting policies, according to the available options, is part of creative accounting. The goal is for managers to (1) increase their bonuses; (2) increase earnings for the year; and (3) minimize administrative costs, such as regulations and taxes (Watts & Zimmerman, 1990, pp. 138-140).

III. Methodology

This study uses a mixed-method (MM), which combines qualitative approaches and quantitative approaches under the MM scope, according to Tashakkori & Creswell (2007, p. 1). There are two types of data for further analysis (textual data and numerical data). This study exercises textual data by thematic analysis and numerical data through descriptive statistical analysis. By using the notation for mixed research, according to Morse (1991, p. 121-122), this study uses the "QUAL + quan" notion. This notion implies that this study uses the mixed method with priority on the qualitative approach and its additional components in the forms of quantitative data, which are analyzed simultaneously with qualitative data (Creswell, 2010, pp. 98-99; Creswell & Clark, 2011, p. 137).

The textual data collection uses document analysis and participant observant technique, according to the approach of Grady (1998, p. 22). Document analysis is carried out on SFASs published by the Indonesian Institute of Accountants (IAI), textbooks, scientific journals related to research objectives and topics in various countries, and income tax rules relevant to the SFASs. Participant observant is done by socially interacting with informants in a comfortable, close, and open manner to obtain the study data (Taylor, Bogdan, & DeVault, 2016, pp. 54, 64). The numerical data collection technique utilizes the sample data of public companies taken from the official website of the IDX (www.idx.com). As IFRS convergence in Indonesia takes effect from 2012, the sample data of public companies refer to the two-year reporting period before IFRS implementation (2010-2011) and two years after IFRS implementation (2012-2013).

IV. Result & Discussion

A. Selection of Samples and Descriptive Statistics

Table 1 summarizes the stages of selecting the samples of companies listed on the stock exchange. The table shows 521 public companies, as shown on www.idx.com (see no. 1), which uploaded their audited financial statements to the IDX website. Based on the financial statements of each public company, manual checking is carried out for each financial report for the 2010-2013 book year. The purpose of checking is to ensure that the financial statements of the 521 public companies are available for further analysis.

Table 1: Stages of Study Sample Selection

Description	∑	Unit
Observations available on the website www.idx.com (Indonesia Stock Exchange, 2010)	521	Companies
Observations not available for further analysis in this study:		
Observations for which the 2010-2013 financial statements, including information about fiscal reconciliation in notes to financial statements, are not complete	108	Companies
Observations for which the 2010-2013 financial statements use the non-Rupiah for presentation currency	63	Companies
Observations for which the income of the public companies is subject to final tax	60	Companies
Observations for which the public companies make changes to the accounting period so that there are two tax returns based on one fiscal year	2	Companies
Total observations not available for further analysis in this study	233	Companies
Observations available for further analysis for this study:	288	Companies
The final set of firm-year observations for descriptive statistical analysis	1,152	firm-year observations

Note: Processed by the author.
The final set of 1.152 firm-year observations is calculated based on four book year x 288 selected public companies whose 2010-2013 audited financial statements are complete for further analysis.

Based on the 288 selected sample data summarized in Table 1 and determined by adapting from Hanlon et al. (2012)'s study, Table 2 summarizes the sample distribution. According to IDX Fact Book 2010 (Indonesia Stock Exchange, 2010), there are nine business sectors, which are further broken down into sub-sectors or group category. The classification of the group category of listed companies of the IDX refers to the Jakarta Stock Industrial Classification (JASICA).

Table 2: Distribution of Research Samples Based on Industries

Sector & Subsector	Business Category	Σ listed company	Σ N Valid	Σ firm-year	%
A.	**Primary Sector**				
1.	Agriculture				
1.1	Crops	1	1	4	0,35%
1.2	Plantation	16	10	40	3,47%
1.3	Animal Husbandary	-	-	-	0,00%
1.4	Fishery	3	2	8	0,69%
1.5	Forestry	-	-	-	0,00%
1.9	Others	1	1	4	0,35%
	Subtotal Sector 1	21	14	56	4,86%
2.	Mining			-	
2.1	Coal mining	22	6	24	2,08%
2.2	Crude petroleum and natural gas production	7	1	4	0,35%
2.3	Metal and mineral mining	9	6	24	2,08%
2.4	Land/stone Quarrying	2	2	8	0,69%
2.9	Others	-	-	-	0,00%
	Subtotal Sector 2	40	15	60	5,21%
B.	**Secondary Sector (Industry & Manufacturing)**			-	
3.	Basic industry and chemicals			-	
3.1	Cement	5	3	12	1,04%
3.2	Ceramics, Glass, Porcelen	6	6	24	2,08%
3.3	Metal and allied products	16	11	44	3,82%
3.4	Chemicals	10	7	28	2,43%
3.5	Plastics & Packaging	13	8	32	2,78%

Table 2: Distribution of Research Samples Based on Industries

Sector & Subsector	Business Category	Σ listed company	Σ N Valid	Σ firm-year	%
3.6	Animal feed	4	4	16	1,39%
3.7	Wood industries	2	1	4	0,35%
3.8	Pulp & paper	8	4	16	1,39%
3.9	Others	-	-	-	0,00%
	Subtotal Sector 3	64	44	176	15,28%
4.	Miscellaneous industry			-	
4.1	Machinery and heavy equipment	2	-	-	0,00%
4.2	Automotive and components	13	9	36	3,13%
4.3	Textile & garment	17	4	16	1,39%
4.4	Footwear	2	2	8	0,69%
4.5	Cable	6	5	20	1,74%
4.6	Electronics	1	-	-	0,00%
4.9	Others	-	-	-	0,00%
	Subtotal Sector 4	41	20	80	6,94%
5.	Consumer goods industry			-	
5.1	Food & beverages	15	12	48	4,17%
5.2	Tobbaco manufactures	4	3	12	1,04%
5.3	Pharmaceuticals	10	6	24	2,08%
5.4	Cosmetics & Household	5	4	16	1,39%
5.5	Houseware	4	3	12	1,04%
5.9	Others	-	-	-	0,00%
	Subtotal Sector 5	38	28	112	9,72%
C.	**Tertiary Sectors (Service)**			-	
6.	Property, Real Estate, & Building Construction			-	
6.1	Property & real estate	50	2	8	0,69%
6.2	Building construction	10	2	8	0,69%
6.9	Others	-	-	-	0,00%
	Subtotal Sector 6	60	4	16	1,39%
7.	Infrastructure, Utilities, Transportation			-	
7.1	Energy	4	1	4	0,35%
7.2	Toll road, airport, harbor and allied products	3	3	12	1,04%
7.3	Telecommunication	6	5	20	1,74%
7.4	Transportation	33	9	36	3,13%
7.5	Non Building Construction	7	4	16	1,39%
7.9	Others	-	-	-	0,00%
	Subtotal Sector 7	53	22	88	7,64%
8.	Finance			-	
8.1	Bank	42	29	116	10,07%
8.2	Financing institution	15	10	40	3,47%
8.3	Securities Company	12	11	44	3,82%
8.4	Insurance	12	10	40	3,47%
8.9	Others	8	6	24	2,08%
	Subtotal Sector 8	89	66	264	22,92%
9.	Trade, Service, & Investment			-	
9.1	Wholesale (Durable & Non-Durable Goods)	34	19	76	6,60%
9.3	Retail Trade	23	17	68	5,90%
9.4	Tourism, Restaurant & Hotel	19	16	64	5,56%
9.5	Advertising, Printing, & Media	14	9	36	3,13%
9.6	Health Care	4	1	4	0,35%
9.7	Computer Services & Other Devices	6	4	16	1,39%
9.8	Investment Company	10	7	28	2,43%
9.9	Others	5	2	8	0,69%
	Subtotal Sector 9	115	75	300	26,04%
	Total [1+...+9]	521	288	1.152	100,00%

B. Data Analysis Based on the Book-Tax Difference Approach

Analysis of the study sample data refers to the study of Gallego (2004) and BTD calculations (Revsine, Collins, Johnson, Mittelstaedt, & Soffer, 2015, p. 750; Graham, Raedy, & Shackelford, 2012, p. 132). Meanwhile, analysis of the management behavior related to the study sample BTD refers to the behavioral accounting theory initiated by the American Accounting Associated entities (AAA) in 1971.

Textual Data Analysis. For the textual data analysis, from the perspective of Indonesian income tax rules, BTD for corporate taxpayers is under various articles of the Income Tax Laws (Law No. 7/1983; Law No. 36/2008). Income tax rules do not categorize BTD based on temporary differences and permanent differences but slightly based on positive corrections and negative corrections. Meanwhile, in the Notes to Financial Statements, additional explanations about tax reconciliation often divide BTD into permanent differences and temporary differences.

Based on Figure 2 and the descriptive analysis of Indonesian income tax laws, the summary of BTD is in Figure 4, and the relevant explanation is as the following. In Figure 4, ABTD showing accounting income higher than taxable income because of opportunistic management of earnings refers to example B number 1) and 2) as well as example D number 3) and 4). ABTD, which shows nil taxable income because of tax management practice by utilizing carried forward tax loss, refers to example B number (4). ABTD, which shows unreported income for tax book, refers to example C number 3).

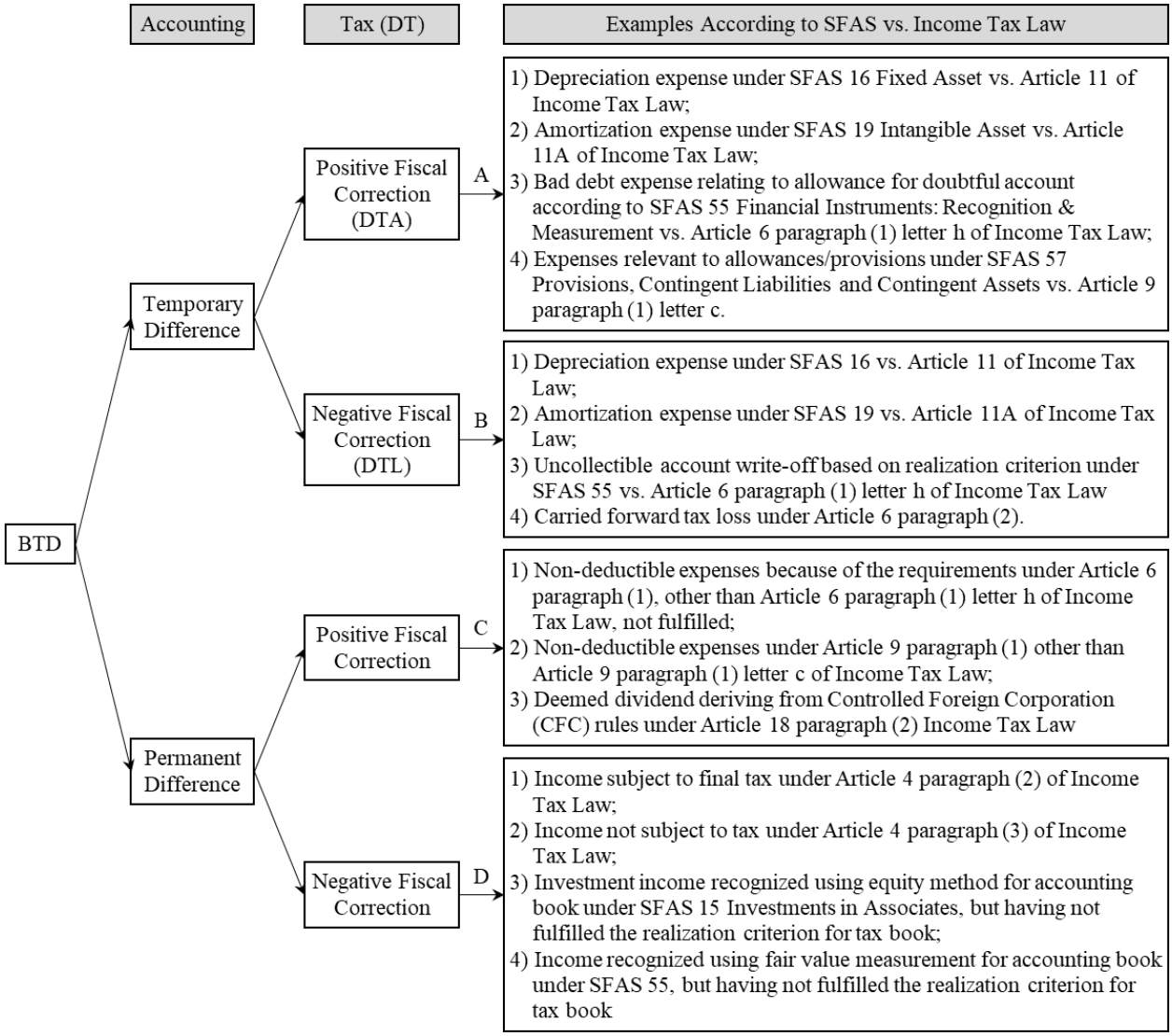

Figure 4: The Summary of BTD Examples under Income Tax Laws.

Examples of tax avoidance implementation according to the tax rules in Indonesia are more challenging to illustrate due to the textual exploitation of the income tax rules (Cunningham & Repetti, 2004, p. 21; Tran, 1997, p. 77). However, by referring to Figure 4,

deemed dividend unreported under CFC rules of Income Tax Laws can be an actual example, and the analysis on the notes to financial statements can reveal the unreported deemed dividend. The practice of tax avoidance is based on the expertise of tax consultants with their tacit knowledge (Dampney, Busch, & Richards, 2002, p. 13).

Numerical Data Analysis. As a result of numerical data analysis, Table 3 summarizes average BTDs for each sector and subsector. As described previously, there are nine sectors, and each sector consists of several sub-sectors. One important thing to underline is that the analysis of ABTD will be far more accurate if being done for each firm-year observation. For simplification purposes in Table 3, we call the BTD exceeding zero value "positive BTD" as the BTD average value derives from the following formula: accounting profit – taxable profit > 0. We call the BTD less than zero value "negative BTD" because of the following formula: accounting profit – taxable profit < 0.

Table 3 reveals that the two most significant positive BTDs are sub-sector 4.2 Automotive and Components as well as sub-sector 7.3 Telecommunications. The listed companies contributing the highest positive BTD for sub-sector 4.2 and sub-sector 7.3 are PT Astra International, Tbk (IDX code: ASII), and PT Telekomunikasi Indonesia Tbk (IDX code: TLKM) respectively.

Table 3 Average 2010-2013 BTD of all Sectors and Subsectors of Listed Companies

Sector & Subsector	Valid N	BTD 2010	BTD 2011	BTD 2012	BTD 2013
1. Agriculture					
1.1 Food Crops	1	-9,744,000	-9,867,000	-7,644,000	-44,945,000
1.2 Plantation	10	203,111,225	313,218,881	110,612,099	-77,085,255
1.4 Fishery	2	-88,483,284	-748,508,175	104,995,125	-214,325,718
1.9 Others	1	-493,382	130,332	897,236	2,247,114
Average per Sector 1	14	-946,055	-16,023,953	26,700,644	51,424,571
2. Mining					
2.1 Coal mining	6	-9,524,555	-17,630,379	-27,141,302	-13,022,060
2.2 Crude petroleum and natural gas production	1	52,945,685	-25,065,433	457,132,950	-81,858,341
2.3 Metal and mineral mining	6	5,466,137	-5,062,741	-4,291,311	-4,863,664
2.4 Land/stone Quarrying	2	20,893,700	-18,286,145	191,151,843	-13,690,134
Average per Sector 2	15	-946,055	-16,023,953	26,700,644	51,424,571
3. Basic Industry & Chemicals					
3.1 Cement	3	25,750,983	-70,269,601	-157,503,920	-81,164,283
3.2 Ceramics, Glass, Porcelain	6	-5,831,901	-7,076,282	-10,504,835	-11,869,770
3.3 Metal and allied products	11	30,715,884	20,375,575	14,371,039	6,083,490
3.4 Chemicals	7	3,506,914	10,921,317	5,208,564	1,991,706
3.5 Plastics and Packaging	8	-1,645,961	4,482,885	-3,931,963	-2,331,589
3.5 Animal feed	4	-69,255,480	-11,340,898	-17,432,110	-44,544,516
3.7 Wood industries	1	47,261,939	-77,042,810	8,977,552	35,937,000
3.8 Pulp and Paper	4	21,421,190	20,027,346	29,004,516	53,680,408
Average per Sector 3	44	5,623,676	929,093	-7,208,816	-4,091,438
4. Miscellaneous industries					
4.2 Automotive and Components	9	583,891,480	956,375,090	866,355,722	1,173,741,765
4.3 Textiles & Garment	4	10,874,413	573,442	-21,893,982	-18,532,816
4.4 Footwear	2	7,098,189	1,364,252	-3,348,246	4,096,237
4.5 Cable	5	-5,907,291	-8,664,218	-6,212,678	-10,894,574
Average per Sector 4	20	264,159,045	428,453,850	383,593,284	522,163,212
5. Consumer Goods Industry					
5.1 Food and Beverages	12	-62,573,445	767,370	-6,970,998	-33,219,588
5.2 Tobacco manufactures	3	-144,063,000	-149,105,333	-189,927,000	-132,195,000
5.3 Pharmaceuticals	6	29,467,104	37,108,680	10,067,224	56,751,680
5.4 Cosmetics & Household	4	7,796,334	6,660,876	32,180,415	35,632,500
5.5 Houseware	3	-1,606,466	-1,927,657	-2,858,653	-1,863,123
Average per Sector 5	28	-34,996,492	-6,949,820	-16,888,712	-11,348,905
6. Property, Real Estate, & Building construction					
6.1 Property & Real Estate	2	35,638,925	40,736,302	465,730,645	642,032,572
6.2 Building Construction	2	78,518,085	82,820,377	118,842,806	123,289,768
Average per Sector 6	4	57,078,505	61,778,340	292,286,726	382,661,170
7. Infrastructure, Utilities, Transportation					
7.1 Energy	1	1,650,078	-425,644	-446,123	-327,409

Table 3 Average 2010-2013 BTD of all Sectors and Subsectors of Listed Companies

Sector & Subsector	Valid N	BTD 2010	BTD 2011	BTD 2012	BTD 2013
7.2 Toll Roads, Airports, ports and allied products	3	134,697,522	244,167,091	86,229,565	60,800,646
7.3 Telecommunications	5	2,299,826,194	1,765,583,598	1,762,332,235	2,248,373,841
7.4 Transportation	9	-113,862,009	622,051,810	32,532,078	-25,348,861
7.5 Non-Building Construction	4	144,160,113	151,383,478	241,520,398	387,000,428
Average per Sector 7	22	520,761,636	716,545,173	469,489,729	579,263,895
8. Finance					
8.1 Bank	29	-39,652,999	186,455,394	103,374,480	-77,582,094
8.2 Financing Institutions	10	38,390,183	41,027,893	-2,526,447	-16,429,400
8.3 Securities Companies	11	26,122,280	9,355,877	-512,642	5,520,624
8.4 Insurance	10	62,022,310	30,089,607	28,304,562	22,381,087
8.5 Others	6	65,621,358	17,863,388	68,106,364	69,661,199
Average per Sector 8	66	8,110,018	95,886,006	55,433,942	-25,934,391
9. Trade, Services, & Investment					
9.1 Wholesale (Durable & Non-Durable Goods)	19	55.839.937	40.639.129	79.558.798	65.187.669
9.3 Retail trade	17	339.989.092	-5.904.907	34.195.846	48.196.809
9.4 Tourism, Restaurant & Hotel	16	8.724.466	9.347.410	14.757.666	16.306.428
9.5 Advertising, Printing, & Media	9	11.267.317	-25.187.308	14.219.579	11.494.312
9.6 Health care	1	-3.881.396	-1.350.708	-6.646.518	-2.105.534
9.7 Computer Services & Other Devices	4	-4.643.501	219.259	4.796.354	51.722.477
9.8 Investment Company	7	0	131.925.368	89.062.054	41.317.501
9.9 Others	2	5.727.163	11.229.516	9.420.025	16.862.319
Average per Sector 9	75	107.259.049	20.534.610	41.491.450	39.333.262
Total [1+...+9]	288				

Note: The amount in the table above is in thousands Rupiah

To identify whether positive BTD derives from ABTD or NBTD, we conducted a descriptive analysis of the tax reconciliation information disclosed in the notes to financial statements of the audit report belonging to ASII and TLKM. Our analysis revealed that the positive NBTD of ASII significantly results from dividend income as a non-tax object. This NBTD does not indicate tax management behavior. For TLKM's fiscal reconciliation information, the positive BTD significantly comes from the share of the net profit of subsidiaries and associated entities. This negative correction relates to the application of the equity method valuing assets in the form of investments in subsidiaries and associated entities. According to Tang & Firth (2011), such an asset valuation can indicate earnings management behavior due to accounting flexibility that allows the management to behave opportunistically to influence the performance of subsidiaries or associates, resulting in asset increase (investments in subsidiaries or associated entity) (p. 178). In turn, the increase of such an asset instrument also increases TLKM's comprehensive income.

Besides the analysis of ASII and TLKM, as described above, we also conducted the same analysis process of tax reconciliation information disclosed in the financial statements to all firm-year observations showing positive BTD. The result reveals that the practice of earnings management or tax management kept occurring before and after IFRS implementation in 2010-2013. IFRS still provides accounting flexibility allowing the management to behave opportunistically to influence financial performance. The positive ABTD found in this study derives from (1) depreciation, (2) amortization, (3) finance leases, (4) sales of subsidiaries in British Virgin Island (BVI), (5) sale of shares of associated entities in the Philippines, (6) the application of equity method, (7) the application of fair value accounting, and (8) unreported deemed dividend in the financial statements.

V. Conclusion

This study concludes that the application of IFRS in Indonesia does not have implications on changes in earnings management and tax management behavior of listed companies whose income is not subject to final tax. Both corporate behaviors continue to occur before and after the implementation of IFRS in Indonesia. The result of this study is in line with the result of Santy et al. (2016) and Wulandari et al. (2017).

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Secondary Schools Principals' Management Styles and Teacher Performance in The Western Region of Kenya

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Abstract- This paper is based on an on-going postgraduate research study which is aimed at investigating the effect of different management styles of principals on teacher performance in secondary schools. The objectives of the study included establishing secondary school principals' management styles and how they relate to a teacher's performance in relation to teachers' perception and students' academic performance. The study adopted exploratory survey, descriptive survey and correlation designs. Random and stratified sampling techniques were used to identify the respondents. The study area was the Western Region of Kenya with a representation from the 4 different counties; stratified depending on size to give a good representation for the whole area of Kakamega, Bungoma, Vihiga and Busia with; 134,214,112 and 92 secondary schools respectively. The target population consisted of 34 Quality Assurance Standards Officers, 552 school principals and 7,728 teachers of public secondary schools in the Western Region of Kenya. The sample size consisted of 368 respondents: 4 Quality Assurance and Standards Officers, 24 school principals and 340 teachers drawn from the accessible population of 8,314 using purposeful and proportionate random sampling at 95% level of confidence. The sample size was determined by sampling the Nth. The general response rate was 89.20%. Data was collected using questionnaires, an interview schedule and an observation check list. The data collected was collated and analyzed using frequencies, means and chi-square. The analyzed data was presented using tables. Statistical Package for Social Sciences version 21 aided the data analysis. The study revealed that most principals in the study decided on their own what was best for the school and were the main source of information. In most cases the management styles used were a combination of autocratic, paternalistic, democratic, persuasive and *laissez-faire* styles in the area to influence the performance of teachers. Teachers did not score highly in their subjects when compared to schools in other regions and there had not been a continuous improvement in academic performance of secondary school students in the study area over the last three years. However, the schools had teachers promoted due to their good performance annually. Generally, the performance of teachers under the dominant autocratic management style was below average. The study recommended the use of democratic management style by secondary school principals for better results in teachers' performance following qualitative responses.

Index Terms- Management styles, Teacher performance, Autocratic, paternalistic, Persuasive, Democratic, Laissez- Faire, Transactional and Transformational.

I. Introduction

Teachers' performance has persistently been a major concern in Kenya. The Ministry of Education, Department for International Development (DFID) (2010) reported that 'The Teachers Service Commission of Kenya was aware of the challenge regarding standards in teaching and was taking a step to address this through the Teacher Appraisal and Development system.' These challenges could however be emanating from way in which principals manage teachers. Management styles can either be paternalistic, autocratic, persuasive, *Laissez-faire* and/or democratic. Each style has evolved independently through distinct development and research paths, coupled with an increase in both theoretical and practical application and acceptance (Egbu, 2004). There is, however, no proposed management style that has been strictly recommended for specific disciplines. It might be essential to establish the best management style to be employed on the teachers in secondary schools because they were the basic 'manufacturers' of employees in all other disciplines. This can be established by considering the teachers' performance in and out of class. When studied singly, management styles have received substantial theoretical and empirical evidence support but, due to the parallel nature of their development and the almost similar claims on the ideal and optimal organization's leader, follower and organizational outcomes, questions are always arising on how each theory could uniquely contribute to management theory and practice (Hipp, 1996 as quoted by Adam & Nati, 2006)

This notwithstanding, despite years of research and reporting on each of the management styles supporting their distinctiveness, there remains a need to establish whether this distinction could hold through an empirical study that examines each style simultaneously in an organizational setting and if it's really helping to solve societal problems. This gave this study a strong standing in its positive contribution to research. Several writers have given their views on the pros and cons of various management styles (Ahmet, 2015).

Getting to know the most appropriate management style to be employed on specific groups of people however has not been discussed. Although there could be other factors affecting

teachers' performance, this study opted to focus on the principals' management styles. The education sector needs to meet its set objectives and the teachers were the people on the ground to ensure that these objectives were met. The study would add a lot of value to the existing literature on management styles and how these styles affect employees' performance giving recommendations regarding the most appropriate and ideal management style that school principals can apply in order to ensure there is improved teacher performance.

Autocratic Management Style and teachers' perception

Kerwin (2017) affirms that, in a learning environment, there were those school principals who employ the autocratic style of management while executing their duties and teachers 39 happen to be the immediate affected and may end up affecting their performance in school. Allen and Meyer (1996) explain that the autocratic style of management applies especially, when a manager is seen to make decisions alone. Unilaterally, the manager makes a decision and conveys it to staff who are expected to work as decided, within that decision's scope. The manager makes the decision without considering the views, opinions and feeling of the subordinates.

Autocratic management style is also refered to as authoritarian style. Majority of power and control is put in the hands of the manager. Ideas and suggestions of the subordinates are not taken into consideration in such a style. The superiors, leaders and managers have the sole responsibility of doing things without thinking much about the employees who are their subordinates. The employees depend totally on their seniors and do not have the liberty to decide on their own on what is to be done and what is not. In this kind of style, workers as it is simply adhere to the guidelines and policies formulated by their bosses. They do not have a say in the organization's decisions. Whatever the senior management feels is right for the organization, simply becomes the policy. This emanates to the employees lacking motivation (Juneja, 2011).

In circumstances where the manager knows more than the team members in matters concerning a certain project and has to oversee the implementation by the employees following strict time schedules, this management style is very useful. However, an authoritarian style can be stressing over used (Atwater & Yammarino, 1992).

This management style is characterised by having the manager with complete authority and the subordinates obeying the instructions without questioning and without receiving an explanation or rationale for that kind of instructions. This style of management anchors itself on Douglas McGregor's Theory X that looks at employees as being inherently lazy and disliking work. It assumes that employees seek to avoid work as much as possible. This theory advocates for close supervision as well as comprehensive control of workers and the whole system reinforced by the hyrachical stracture calling for protocol with a norrow span of control (Sahin, 2012).

Autocratic managers get work done by issuing threats, evoking fear and issuing punishments. The major concern of autocratic managers is not much on developmental activities but dealing with the work at hand. Autocratic managers assume full responsibility and take up full credit for the work done. Managers therefore assume full charge of the organization. However, there are some areas where this style of management can be appreciated: Autocratic management forms a chain of command that is centralized with a heavy involvement of the manager in all systems of operations.

Paternalistic Management Style and teachers' perception

The other style of management is the consultative style which is affiliated to the autocratic style and it is also refered to as paternalistic. In this style, the manager has the powers of decision making in many aspects of work, however the manager gives a high regard to the well-being of the subordnates. The manager therefore takes time to consult the other workers before making the final decision for the organization. However, in such a style of management, the managers do not regard the suggestions made by the subordinates. The workers totally depend on their bosses to know what they are expected to execute. (Atwater &Yammarino, 1992).

Paternalistic Management Style and Teachers' Perception It is possible that some school principals employ the paternalistic style of management while executing their duties and teachers who work under their jurisdiction could be the immediate affected and may end up affecting their performance in school. Atwater and Yammarino (1992) said that the paternalistic style of management is almost similar to the authoritarian or autocratic management in the bulk of power is in the hands of the managers although this style allows for some consultation with the staff.

This style of management enables employees to feel loyal and attached towards their organizations. The employees remain motivated and enjoy their work rather than looking at it as a burden (Juneja, 2011).

The employees also feel like their needs are being met since good behavior is compensated by the management, often, with goods, money or food; tendencies of absenteeism and high staff turnover will decrease as emphasis is placed on the needs of the employee. Most decisions are made with the employees' best interests being taken into consideration. Feedback is encouraged and invited, which improves the employees' morale and makes them feel important. There is an open line of communication between the manager and employees which leaves the employees feeling important and satisfied. Managers are very involved in the employees' personal lives which makes the employees feel more connected to work. (Lombardo, 2016).

In such a style of management, the employees feel loyal and attached to their work. The employees enjoyed and stayed motivated as they worked.

Persuasive Management Style and teachers' perception

Persuasive Management Style and Teachers' Perception According to Kerwin (2017) in a learning environment, there were those school principals who employed the persuasive style of management while executing their duties and teachers happened to be the immediate affected and might end up affecting their performance in school.

Allen and Meyer (1996) pointed out that the persuasive management style has some similarity with the autocratic style of management, the major difference is that the persuasive manager spent more time working with his subordinates so as to try and convince them of the benefits of the decision that has been made, despite the manager holding the entire power of decision making.

The persuasive style of management is also quite similar with other management styles where decisions are made entirely by the managers. The only difference is that managers try to persuade their employees to understand why certain decisions are important for the organization. This is somehow relevant in an organization because it allows the employees to work towards achieving the same goal. It also prevents conflicts to arise because all employees know what is expected of them.and what to expect (Woodman, et al., 2001).

In this style of working and management, the managers welcomes the feedback of the employees. Subordinates are invited on an open forum to discuss the pros and cons of ideas and plans. A persuasive manager still wants to make all the decisions on their own, but there is an element of acceptance and agreement that is required for each decisions and the time spent trying to convince employees that the decision was both good and correct. Persuasive managers made the decisions and spent time buying the approval of the subordinates by working with the subordinates and mapping out the benefits of the decisions. This is an extremely effective management style in complex situations where the manager is an expert who needs to have cooperation from the employees, but asking for employee input is not part of the process. The act and art of persuasion is a powerful tool needed to ensure cooperation from employees. It could help a manager to acquire new clients, hire the best employees and form fresh and new business relationships. Persuasive managers are influential and likeable because they place the needs of others above their own. When one genuinely tries to understand another person's motivation and backgroung, they will be in a position to more effectively persuade them (Kirby, et al., 2004) .

Other traits of a persuasive manager include: being confident, ability to tell the story well, ability to address concerns, ability to vary one's voice in terms of pitch and intonation, being empathetic and finding a familiar ground (Woodman, et al., 2001).

Democratic/ Participative/ Consultative Management Style and teachers' perception Kerwin (2017) explains that in a learning situation, there were those school principals who employed the democratic or participative style of management while executing their duties and teachers happened to be the immediate affected and could end up affecting their performance in school.

Atwater and Yammarino (1992) discussed that in consultative style of management; the manager engages the subordinates efficaciously in the problem solving and decision making processes. The consultative management style endorses the concept of empowerment. In this style, communication is always downwards, but feedback to the management is encouraged to maintain the morale of the employees.

Democratic/participative/consultative style of management relies on the input and participation of every one of the manager's team members, but allowed for the manager to withhold major decision-making and delegating responsibilities. When a manager employs democratic management, he/she encourages the subordinates to think for themselves, act on their own behalf and be accountable for their duties. This promotes independence in the work place, and it leads to high employee productivity and morale. (Allen and Meyer, 1996).

A democratic manager listens to what the subordinates have to say before the manager comes up with the most appropriate decision. It is very useful when a delicate decision has to be mad. The only drawback is that it can take longer time before coming up with the final decision because the possibility of considering views of different people in the organization could take a longer process and considerations.

According to Woodman, et al. (2001) the democratic management style, the managers welcome the feedback from the subordinates. Employees are invited on an open forum to discuss the pros and cons of plans and ideas. Democratic management style ensured healthy and effective communication between the management and the employees. The managers listened to what the subordinate has to say before finalizing on something. Principals who made use of this style effectively were likely to have high productivity from their teachers. The democratic style of working and management is based on mutual respect and trust. It is often combined with the participatory management style because it requires collaboration between managers and the people who were working under them.

Allen and Meyer, (1996) discussed that participatory/democratic management style placed significant responsibility on managers and their workers. This is true for all organizations from government agencies and private enterprises to educational institutions and nonprofit entities or agencies. It is difficult to think about democratic managers accomplishing their goals without direct participation from their staff. Participation is key in all successful democratic enterprises. This includes: Attentive constituents in a congregational district, concern from parents of students in a school, active members from a nonprofit organization, engaged employees at a prospering company. Democratic management is conceptually distinct from positions of authority. It is distributing responsibility among members of a team and aiding the decision making process of the group. However, if people feel that their input is being ignored, the democratic style can actually lead to lower employee satisfaction and productivity. The key to letting subordinates to participate in decision making is to build mature teams with cooperative and experienced people. Democratic teams are not only capable of making good decisions but they also support their organizational objectives; even when their own suggestions are not adopted. (Juneja, 2011).

Considerably, participative/democratic approach to working increases the level of ownership by the employees. This style of management is potential at yielding, increase in productivity, job satisfaction, employee motivation, improved quality and reduced costs (Allen and Meyer, 1996). Different organizations have different cultures as well as different human resources, it may take a manager to make a critical analysis if the staff before instituting this management style. A deep understanding of both the culture and the human resources is required in order for one to ascertain a management style and adopt the same (Juneja, 2011).

In conclusion, democratic style of management and working ensures healthy and effective communication between the management and the employees and the managers listen to what the employees have to say before finalizing on something (Juneja, 2011).

***Laissez- Faire* Management Style and teachers' perception**

Another style of management discussed extensively by Gottfredson and Steve (2008) was the Delegative/*laissez-faire*/ free-reign management. *Laissez-Faire* as defined means refusal to interfere. In *Laissez – Faire* style, the role of the manager is more like a mentor and stimulator, and the employees manage their respective areas of business.

This style of management only works if the workers are task oriented and self-motivated This method of relies on the competency of each and every team member, as it implies little to no managerial participation and involvement and totally complete employee autonomy. There are those school principals who employ the *Laissez- faire* style of management while executing their duties and teachers happen to be the immediate affected and could end up affecting their performance in school (Kerwin, 2017).

In the Laissez-faire style of management, managers are employed just for the sake of it since they rarely contribute much to the organization. The employees take decisions and manage work on their own. People who have dreamt of making it big in the organization and desired to do something that is innovative every time to outshine others who could be attending to work for fun and not dependent of the managers and know what is right or wrong for them (Juneja, 2011).

Delegative or *Laissez-faire* management is ideal when a knowledgeable and efficient team has already been instituted and established and also proven to work together effectively in order to accomplish the organization's tasks. It is critical and important with this approach that the manager knows that they are still responsible for the end product, and that they are expected to be accountable to the employees to assist them to accomplish the tasks (Allen and Meyer, 1996).

Summary of the Management Styles

Considering the Literature reviewed on the different management styles used by school principals, it was evident that teachers perceived their effectiveness differently especially when it concerns the teachers' own performance. The principal's different management styles can either be favorable or unfavorable to teachers' performance in line with achieving the overall school objective. These styles can fall into two broad classes; transactional and transformational.

Transactional Leadership Styles

According to Hackman (2009), transactional leaders establish criteria for rewarding followers in terms of performance, behavior, and creativity. Leaders that exhibit transactional leadership provide rewards for the followers' effort in recognition of their performance. They intervene when employees do not perform as expected. Transactional leaders empress good performance of workers or learners. Ahmet (1992) said that leaders look forward to the future. They become creative and come up with what is uniquely possible that can make a difference for the organization or school. To make a difference, transactional leaders use rewards to motivate workers. Northhouse (2007) explained that transactional leaders exchange rewards for the specific outcome. This leadership style improves interaction between a leader and workers at the same time improving performance and the quality of products.

Transformational Leadership Styles

Some time in Kenya, the Ministry of Education availed financial resources for painting schools so that they could look new. That was away of transforming the image of schools' physical facilities. School principals in that case, were seen as transformers who had changed the appearing of schools' physical facilities. Northhouse (1987) defined transformational leaders as a process whereby a leader engages with workers and creates a connection that raises the level of motivation and morality in both of them. Koh, et al. (1995) linked transformational leadership to three phenomenon acts. The first act is that transformational leader recognizes the need for revitalization. The leader puts an effort on the challenges which might affect the organization. The second act is that the leader has to create a new vision. The leader focuses the attention on a vision of the future, and the third act is institutionalization of change. The leader puts an effort to transform the organization. Hackman and Johnson (2009) saw transformational leaders as innovative and foresighted, interactive, visionary, empowering, and passionate.

Research Hypothesis

H_01: Principals' management styles do not have a statistically significant effect on teachers' perception in secondary schools in the Western Region of Kenya.

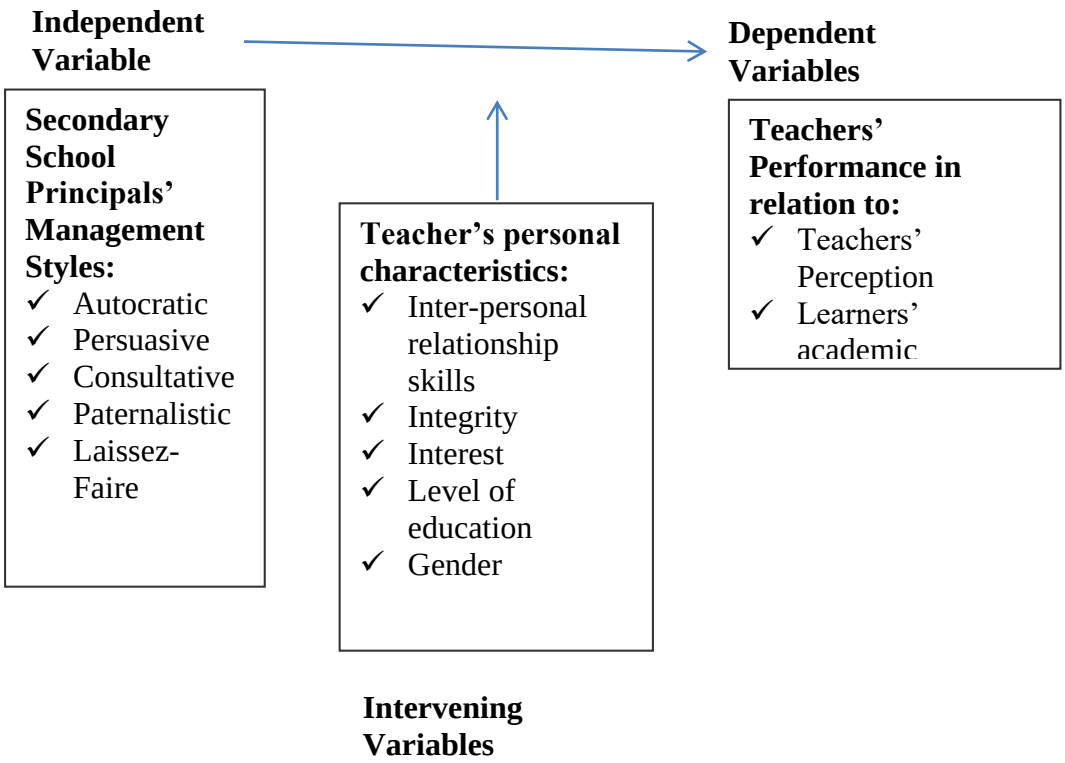
Research Questions

What is the relationship between principals' management styles and teachers' performance in relation to students' academic performance in the Western Region of Kenya?

Conceptual Framework

The study was guided by a conceptual framework which depicts the relationship between the key variables in the study. The independent variable was Secondary School Principals' Management Styles and the dependent variable was teachers' performance which had a sequence of several pointers. Considering the variables involved in this study there was a relationship between investigated management styles and performance of teachers in and out of class considering teachers' preparation to teach and the teaching itself. Teachers' perception, preparation of lesson plans, lesson notes, records of work and lesson attendance, teachers' activities, motivation, professional growth in line with further studies, workshops, in-servicing, and collaboration as well as the learners' performance in KCSE. This therefore meant that a principal's management styles could impact on a teacher's performance positively or negatively and their performance could on the other hand influence the kind of management style that a principal employ. However, there were intervening variables such as the teacher's personal characteristics that could affect how different management styles relate to teachers' performance which were held constant. The intervening variables were seen to control the effect of the independent variable on the dependent variable and vice-versa. For the sake of getting valid results the intervening variables were controlled by use of randomization to reduce systematic errors. Figure 1.1 shows the interplay between variables that were investigated in the study.

Figure 1.1 shows the interplay between variables that were investigated in the study.



Target Population

According to De Vos (2002), Target population refers to the totality of persons, events, organization units, case records or other units which a specific research is concerned with. Thus the target population for this study comprised of 134, 214, 112 and 92 secondary schools in Kakamega, Bungoma, Busia and Vihiga Counties respectively with 34 QASOs, 552 school principals and 7,728 teachers of secondary schools. The population consisted of individuals of different characteristics brought together by a common curriculum and who were in charge of the Kenyan learners. The target population was calculated using a total of 4 counties and 552 schools from within the four counties and a total of 552 schools.

Sample Size and Sampling Technique

3.5.1 Sample Size

The researcher sampled with confidence considering that there was a high probability that the study was accurate statistically, with the correct sample size. Usually, the confidence level is a constant value needed for the equation, referred to as a Z-score. For this study, the Z-score from a Z score table was 1.96 corresponding to 95% level of confidence. The study considered using .5 standard deviation and +/- 5% as a margin of error (confidence interval) to mathematically calculate the sample size using the formula provided below:

*Sample Size = (Z-score)2 * Std. Dev*(1-StdDev) / (margin of error)2*

((1.96)2 x .5(.5)) / (.05)2

(3.8416 x .25) / .0025.9604 / .0025

384.16

385 respondents were needed

However, using the online sample size calculator, given the known population of the study to be 8, 314; the sample size output was 368. A sample of 4 QASOs sampled purposefully, 24 principals and 340 teachers sampled proportionately from stratified sampled schools; giving a total sample size of 368 respondents was used for this study.

Table 1: Sample Size of the Study

Category	QASO	Principals	Teachers	TOTAL
Target Population	34	552	7,728	8,314
Sample Size	4	24	340	368

Methodology

This study utilized the exploratory survey research design, descriptive survey research design and correlation designs. Exploratory- descriptive survey research design is used when there is limited knowledge on the topic under study (Nieswiadomy, 2008). It is also used in situations where data may lead to initial ideas and suggestions for further research.

Descriptive survey research design was chosen because it had the ability to allow rapid collection of data from a representative sample population (Mugenda & Mugenda, 1999). This study involved collecting data to test hypothesis and respond to questions regarding the status of the subject of the study at that time of conducting the study.

Kothari (2003) explains that descriptive survey is basically concerned with describing, recording, analyzing and interpreting conditions and relationships just as they exist at present without manipulating the existing variables.

The Correlation design was also employed in this study to illustrate in numerical terms the degree to which variables were related which could not be achieved by descriptive survey. Correlational research is described as a form of non- experimental research in which the researcher measures two variables and assesses the statistical relationship between then with little or no effort to control extraneous variables.

The researcher collected data on secondary schools' principals' styles of management and the performance of teachers which was both qualitative and quantitative. These designs were suitable for the research problem because they could be used to explore and explain the existing status of the management styles in secondary schools. These designs would enable the study to relate management styles of secondary school principals to teacher performance.

Questionnaires

The questionnaire items were both closed and open-ended so as to give the respondents freedom of response. There was one questionnaire with a section that could distinguish one group of respondents from another, whether principal or teacher for easy coding and analysis of data. The responses gave an insight into the respondents' background feelings, hidden motivation, interests and suggestions. Respondents were given adequate time to give well thought out answers.

Result and Discussion

Research Hypothesis

H_{01}: Principals' management styles do not have a statistically significant effect on teachers' perception in secondary schools in the Western Region of Kenya.

Test Statistics

	SA	*AG*	*UD*	*DIS*	*SD*
Chi-Square	2.217[a]	1.652[b]	2.435[c]	2.609[d]	2.609[d]
df	19	20	12	18	18
Asymp. Sig.	1.000	1.000	.998	1.000	1.000

A Chi-Square test was conducted to determine the perception of teachers on different management styles employed by principals of secondary schools in the Western Region of Kenya. The results of the test were not statistically significant, $x^2(19, N=23)=2.22$, $p=1.00$. The overall results showed that secondary school principals' management styles have no effect on teachers' perceptions.

Relationship between Secondary School Principals' Management Styles and Teachers' Performance in Relation to Students' Academic Performance

The second objective of the study aimed at establishing the relationship between secondary school principals' management styles and teachers' performance in relation to students' academic performance in the Former Western Province of Kenya. The outcome of data analysis was presented in table 2.

Table 2: Principals' management styles and teachers' performance in relation to students' academic performance

Variables	*Strongly Agree*	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
Teachers score highly in subjects when compared with other schools in the region	28.6%(83)	13.4%(39)	6.2%(18)	38.6%(112)	13.1%(38)
KCSE results have continuously improved over the last three years	23.1%(67)	10.7%(31)	6.2%(18)	39.7%(115)	20.3%(59)
Teachers get promoted following improved learners' academic performance in their subjects.	30.0%(87)	21.7%(63)	4.1%(12)	35.2%(102)	9.0%(26)

Table 2 shows that majority 150(51.7%) of the respondents disagreed that teachers in their school score highly in subjects when compared with other schools in the region, however, 123(42.1%) agreed. This indicates majority of the schools in the study do not score highly in subjects when compared with other schools in the region.

Findings in Table 2 show that (60%) of the respondents disagreed that academic performance of KCSE students had continuously improved over the last three years, while (33.8%) agreed. This implies that there had not been continuous

improvement in academic performance of KCSE in most of the schools under study, for a period three years prior to the study.

The table shows that majority (51.7%) of the respondents agreed that teachers in their schools were promoted due to good performance, while (44.2%) disagreed. This implies that in majority of schools under study teachers were promoted due to their good performance. This shows that good performance was rewarded among teachers in the study area and which positively contributes to their performance.

Discussion

The results and the presentation of data have shown that although principals' management styles were many most principals employ the authoritarian management style which was mostly detested by teachers which they claimed to be insensitive to their needs. They indicated that principals who have been given a lot of autonomy by the Teachers' Service Commission and bares the final word for the school do not treat them with respect and with the required professional approaches but were mainly authoritative.

Qualitative responses indicated that teacher's viewed their principals as harsh and with low regard to protocol when handling them, evinced by the practice of principals dealing with them directly instead of acting through the Heads of Department (HOD). Majority of the respondent's views indicated that principals use coercion to ensure that teachers give in to their demand without questioning. This implies that most principals use the autocratic management style more than any other management styles. They also think that if their principals employed the democratic and transactional management styles, their overall performance could improve.

Conclusion

Educational leadership or management has drastically changed to match the technological advancement and the nature of learners and their parents. Effective school principals are knowledgeable and skilled in the way they discharge their leadership duties. Outstanding principals study the nature of their school environments, previous and current students' academic performance, and prioritize what to be improved in their schools. Such principals combine leadership styles that include: transformational and transactional styles which are discussed singly as authoritarian, paternalistic, persuasive, democratic and *laissez-faire* that may be relevant in improving the school environment, discipline, and academic performance. Transformational leadership plays a key role in offering proper orientation of teachers who play a major role in establishing a positive organizational culture.

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Finding a better variant of the CSMA/CD

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Abstract- This paper is focused on finding a more efficient version of the Carrier Sense Multiple Access with Collision Detection Networking protocol. It analyses where CSMA/CD falls short and provides two possible solutions to better it. These potential solutions are then compared with the Carrier Sense Multiple Access with Collision Avoidance protocol.

I. Introduction to CSMA

Carrier Sense Multiple Access is a media access control method widely used in Ethernet technology/LANs. It falls under the Random-Access Protocols where no station is considered superior to the others. Now, CSMA was designed to minimize the collision between data sent by various stations using the same medium. CSMA has many variants using the persistence methods. In CSMA, the station senses the channel before accessing the medium. However, the possibility of collision still exists because of propagation delay.

II. CSMA/CD

In CSMA/CD, a collision detection mechanism comes into play. Suppose a station has some data to send. It uses one of the persistence methods (1-persistent, p-persistent or non-persistent) to detect if the channel is idle. Sending station has to keep on checking if the transmission link is idle. For this, it continuously detects transmissions from other nodes. Sending station sends dummy data on the link. If it does not receive any collision signal, this means the link is idle at the moment. If it senses that the carrier is free and there are no collisions, it sends the data. Otherwise it refrains from sending data. If no collision occurs with data from another station then it is a success. But, if a collision is detected, a jamming signal is sent and transmission is aborted. It then waits a random amount of time and then tries again, with the assumption that no other station has started transmitting in the meantime.
On a network that uses CSMA/CD method, every node/station has equal access to the network media.

III. Advantages and disadvantages of CSMA/CD

The advantage of CSMA/CD is that it has relatively low overhead, meaning that not much is involved in the workings of the system. The disadvantage is that as more systems are added to the network, there are more collisions, and the network as a whole becomes slower. The performance of a network that uses CSMA/CD method degrades exponentially as more systems/stations are added to it. Its low overhead means that CSMA/CD systems theoretically can achieve greater speeds than high-overhead systems, such as token passing. However, because collisions take place, the chances of all that speed translating into usable bandwidth are relatively low.

Now, as we can see, even though CSMA/CD is an efficient process, there are a few problems associated with it. Firstly, collision degrades the network performance and secondly priorities cannot be assigned to certain nodes. Also, performance degrades exponentially as more devices are added. The basis of these problems lies in the “random” wait time when collision is detected. As more devices are added, the chance of two or more devices ending up taking the same wait time increases. Also, since this is a random-access protocol, so assigning priorities becomes an issue.

IV. Variant of CSMA/CD

Firstly, we need to assign a registration (or token) number to each station. This will help resolve conflict when two stations end up with same “random” time. Now, there are two methods that we can use to benefit from the situation:

A. Putting p-persistence on collision detection

In this method, when a station detects a possibility of collision, it waits for a random amount of time then has ‘p’ probability to send the data, and 1-p probability to wait another random amount of time before sending.

This method will further decrease the chance of two stations ending up with same moment of data sending. But it still suffers from the drawback of increase in chance of collision upon increasing the number of stations.

B. Using a queue

In this method, whenever two stations have a collision chance, they will be given two options. Either they can continue using the random wait system (the normal CSMA/CD approach) otherwise they can enter the waiting queue.

Now, there will be certain “queue clearing times” in the channel timeframe where no station will be allowed to transmit and the queued stations will be allowed to send data. Queue will follow FIFO (First In First Out) policy and if two stations enter the queue at the same moment, the station with lower token number will be considered first. The “queue clearing time” will depend on number of elements(stations) in the queue, propagation delay, propagation time, etc. If there are too many elements in the queue, the stations may again be prompted to use the random wait time.

The advantage of this method is that it clears a lot of collision chance. But, then again, if the “queue clearing time” is

not generated in a proper manner, it can cause a lot of difficulty for the remaining stations as they would have to wait for the channel to be idle.

V. Comparison with CSMA/CA

CSMA/CA was developed as a better variant of CSMA/CD, to be used in wireless networks specially. It uses interframe space (IFS), contention window and acknowledgements to give a better collision avoidance probability as compared to CSMA/CD. Now, IFS can be used to determine the priority of a station which is similar to my idea of assigning token numbers. The contention window divides the timeframe into slots which makes the system more efficient with respect to time consumption as both of my techniques do not consider how much data is being sent by the station. Lastly, acknowledgements also make CSMA/CA superior.

VI. Conclusion

My model shows some of the weaknesses of the CSMA/CD method and how to overcome them. Through further research, this model can be tested to get an accurate analysis of its strengths and weaknesses.

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Implementation of Inclusive Education Policy for Children with Special Needs in Inclusive Junior High Schools in Magetan Regency

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Abstract- This study aimed at describing the overall analysis of inclusive education policy in Magetan Regency which included 1) describing the implementation of the Magetan Regent Regulations number 35 of 2014 in inclusive Junior High Schools in Magetan Regency; 2) describing the obstacles in the implementation of Magetan Regent Regulations number 35 of 2014 in inclusive junior high schools in Magetan Regency and 3) describing the solutions carried out in supporting the implementation of Magetan Regent Regulations number 35 of 2014 in inclusive junior high schools in Magetan Regency. The design of this research was descriptive qualitative research with a policy research design. The objects in this study were SMPN 1 Sidorejo Magetan and SMPN 4 Magetan. Research methods or techniques were interview, observation, and documentation. This study used Content Analysis which was carried out through 3 stages, namely (1) data reduction, (2) data display or data presentation, (3) drawing conclusions or data verification. The results of this study indicated that the implementation of Magetan Regent Regulations inclusive education was carried out with the aim of providing opportunities for children with special needs to obtain education in the regular class, there were several obstacles that arose in implementation activities related to students, educators, curriculum, infrastructure and funding. Nevertheless the local government as the spearhead of implementing inclusive education is making various efforts to minimize the obstacles that occur by carrying out several activities that support the competence of teachers in serving children with special needs.

Index Terms- Inclusive Education, Magetan Regent Regulations, Children with Special Needs.

I. Introduction

There is a need for treatment and a system to overcome the obstacles of disabilities as well as social barriers accepted by the child. One education system that demands the creation of an open and flexible education system to remove barriers that prevent the optimal development of the potential of all children, including children with disabilities is through inclusive education [1]. Inclusive education must be a generally accepted policy and practice, and not just individual interventions related to one or another vulnerable group (most often, children with developmental disabilities and physical disabilities or members of certain ethnic minorities) [2]. In the implementation of inclusive education, children without exception can jointly study in the same class without any preparation in special classes first. Apart from being a teacher that plays a central role in promoting and supporting inclusiveness in the classroom [3], to create this, flexibility in policies, creativity and sensitivity is needed [4].

One of the priorities of Sustainable Development Goals (SDGs) in the macro scale is that no one should be left behind for any reason such as because of ethnicity, gender, geographical conditions, disability, or other status in economic opportunities, or human rights including education. These rights are also protected and guaranteed by the Law [5]. The implementation of inclusive education policy is under the umbrella of Article 31 paragraph 1 of the 1945 Constitution and Law Number 20 of 2003 concerning the National Education System showing that the state provides full guarantees to all children including children with special needs in obtaining quality educational opportunities and services. Law Number 20 of 2003, chapter IV article 5 paragraph 1 states that every citizen has the same right to obtain qualified education. Furthermore, paragraph 2 states that citizens who have physical, emotional, mental, intellectual and social disabilities are entitled to education. In Minister of Education Regulation No. 70 of 2009, article 2, it is stated that government embodies the implementation of education that respects diversity and is not discriminatory for all students.

Education for children with special needs is available through the special school that is by classifying children with same special needs to the one room. In recent years, inclusive education has become an interesting issue in the development of national education because for some reasons the education of children with special needs is always considered less important in both developed and developing countries [6]. Inclusive education is seen as a more flexible education system for students with special needs that allows them to study in regular classes with peers without having to be specialized in their class [7]. Inclusive education is an evolution that is the process of changing the educational paradigm for children with special needs [8]. The spirit of the implementation of inclusive education should make the difference of each individual student as profit framed in challenges and not as obstacles or problems in learning.

Magetan Regency is one of the implementers of inclusive education that has declared as an inclusive regency/city [9]. The results of studies at Magetan regency education office show that 17% (118,341) are people with disabilities that are scattered in various sub-districts in Magetan regency. The birth of Magetan Regent Regulation (Regent Regulations) number 35 of 2014 concerning the implementation of inclusive education in Magetan Regency is one form of Magetan Regency's commitment in supporting inclusive education as mandated in the East Java Province inclusive education implementation policy as stipulated in Pergub number 06 of 2011.

Currently the implementation of inclusive education policy in Magetan Regency is faced with several problems, namely: (1) lack of resources and the role of the implementer in the implementation of inclusive education based on national education standards are not maximal, (2) lack of teaching staff and educators, (3) curriculum used in inclusive schools in Magetan still have not adapted to the special needs of children with special needs, (4) the educational background of special tutors is not in accordance with the specialization they take, namely the special education of special children, (5) the bureaucracy and the principal do not fully understand the vision, mission, goals and management of inclusive education systems.

Referring to the real condition of the field and the problems in Magetan Regency related to inclusive education for children with special disabilities, researchers consider that this phenomenon is important and interesting to study so that research that can describe how the implementation of Magetan Regent Regulations number 35 of 2014 in Magetan Regency inclusive junior high school can be done

II. METHODS

This research was a qualitative descriptive study. Researchers used a policy research design in an effort to obtain a picture, explain, and analyze what was hidden behind the implementation of the Inclusive Education policy for children with special needs in Inclusive Junior High Schools in Magetan Regency based on East Java Governor Regulation number 6 of 2011 concerning the Implementation of East Java Province Inclusive Education, Magetan Regent Regulation number 35 of 2014 concerning organizing inclusive education in Magetan Regency.

The objects of this research were inclusive junior high schools in Magetan which were used as the objects of this research, namely SMPN 1 Sidorejo Magetan and SMPN 4 Magetan, by examining the implementation of inclusive education in the inclusive Junior High Schools. The selection of Magetan Regency as a research location was with the consideration that Magetan Regency, in addition to mountain topography, was also one of the regencies that had declared itself to proclaim inclusive education in 2014, so that there were many problems that needed to be solved in efforts to equalize access to education for all and improve the quality of education for children Special Needs to get educational services in the environment closest to where children lived (inclusive schools) [10].

Techniques used in collecting this research data included in-depth interviews, observation, and documentation. Checking the validity of the data to ensure the credibility of the data obtained, the criteria used to check the validity of the data in this study included: 1) Credibility; 2) Transferability; 3) Dependability criteria and 5) Confirmability [11]. The researchers made an agreement with the data source so that the data obtained was objective. Data validity checking was carried out using the method of triangulation technique. Triangulation was done by comparing observation on the implementation of the development policy of inclusive education for children with special needs in schools surveyed and interview result and other test equipment to the informant related in the different time. Research data analysis was carried out using Content Analysis which was carried out through 3 stages, namely (1) Data reduction, (2) Data display or data presentation, (3) Drawing conclusions or data verification.

III. FINDINGS AND DISCUSSIONS

A. Implementation of Magetan Regent Regulations Number 35 of 2014 at SMPN 1 Sidorejo Magetan

In the process of policy implementation, four elements were needed, including resources, communication, bureaucratic structure and disposition [12]. The four aspects had to be fulfilled in the implementation of Magetan Regent Regulations number 35 of 2014 at SMPN 1 Sidorejo Magetan.

1. Implementation of Resource Aspect

Resource was a vital aspect in the implementation of inclusive education. The resource included human resource, infrastructure and financial resource. The implementation of Magetan Regent Regulations KSS explained:

> "*So far, the existing resources to carry out inclusion according to Regent Regulations are teachers as human resources, then we are also trying to complete the infrastructure and sources of school finance for the inclusion program according to the Regent Regulations that is ordered. The official duty has given SK to several teachers in our school to become GPK in school*"

In the effort to prepare for inclusive education, the government of Magetan Regency had provided teaching staff, fostered inclusive school administrators, developed the competencies of class teachers, subject teachers or special tutors in efforts to improve the quality of inclusive education services.

The interview with the special tutor is as follows:

> *"The Official duty (dinas) encourages the optimization of teacher performance in MKKS/ KKKs, MMP, KKg for SLB and inclusive teachers in one umbrella namely the inclusive Pokja in Magetan regency. In this forum, various activities are formed, not only as a means of preparing lesson plans, semester program, prota or other learning tools but also sharing knowledge from whom had been sent on a training or comparative study basis with other institutions.*

Financial resources in the implementation of inclusive education at SMPN 1 Sidorejo came from BOS and BOSDA through the Magetan Regency education office. In the implementation of inclusive education, it was necessary to have

a resource for infrastructure to support the implementation of inclusive education to achieve the goals of inclusive education for children with special needs.

Apart from government assistance, schools had also helped in the maintenance of infrastructure as a form of school services in order to provide a good picture of school services for the general public. This was stated by the KS that:

> *"Infrastructure is a major part of our service. For example, maintenance of school buildings, because the condition of the building can provide a clear picture for the community about the good and bad of service. A well-maintained school building will give the public a picture of an orderly and correct educational service."*

2. Implementation of Bureaucratic Structure Aspect

If it was observed closely at the bureaucratic structure at SMPN 1 Sidorejo Magetan, for the implementation of Magetan Regent Regulations number 35 of 2014 concerning inclusive education, there was a clear bureaucratic structure and responsibilities in each section according to their respective duties and functions. KS revealed:

> *"I am here as the new headmaster, the old one has been transferred. The coordinator of inclusive education has not had the chance to be discussed again. We just follow the old one. So there is no change in the inclusive coordinator here. "(KS / KN)*

From the observation of the bureaucratic structure at SMPN 1 Sidorejo Magetan, besides having an inclusive coordinator, there were also coordinators of curriculum, students, public relations, infrastructure, and student council coaches at this school. Based on the above opinion, it can be interpreted that the bureaucratic structure for inclusive education at SMPN 1 Sidorejo Magetan was in accordance with Permendiknas number 70 of 2009 and Magetan Regent Regulations number 35 of 2014.

3. Implementation of Communication Aspect

Communication is a process of delivering policy information from policy makers to the policy implementer. The communicative policy of inclusive education must contain 2 dimensions, namely transformation and clarity. From the results of observation and documentation, it is found data that the transformation of inclusive education policy began with the appointment of inclusive schools through the SK of the Regent or official duty (dinas) head of Magetan Regency. Furthermore, the education office appoints a special tutor to help the process of inclusive learning in schools.

From the results of the interview there was already effective communication about components in inclusive education at SMPN 1 Sidorejo Magetan, IRW stated:

> *"The implementation process starts from the appointment of official duty to our school. Then we were ordered by the official duty to propose special tutors who helped in our school. Directly at that time finance was also allocated for the launch of inclusive education as well as for workshops for designated GPK teachers." (IRW)*

The observation result of the implementation of Magetan Regent Regulations number 35 of 2014 at SMPN 1 Sidorejo in terms of communication in terms of transmission required that inclusive education policies for students with special needs was conveyed not only to the implementers of the policy, but also to other parties with interest either directly or indirectly towards the inclusive education policy and the target group for the implementation of inclusive education policy as stipulated in the Magetan Regent Regulations No. 35 of 2014.

Based on the results of the interview above, it can be interpreted that the transformation of inclusive education policy from the East Java Provincial Education Office was carried out by appointment of institution as the inclusive organizer school by regent head of Magetan. And in the learning implementation, the education official duty appointed GPK to help solve the problem of education services for children with special needs at SMPN 1 Sidorejo Magetan.

4. Implementation of Disposition Aspect

In the implementation of Magetan Regent Regulations number 35 of 2014 at SMPN 1 Sidorejo Magetan, it has already seen the school's strong commitment, dedication and willingness to provide services for children with special needs. Disposition was defined as a tendency, desire or agreement between policy implementers to carry out the policy. In an interview with KSKN it was revealed that:

> *"So far, all the teachers and residents of this school just enjoy receiving the presence of children with special needs here. We all have a commitment to serve them as much as we can. Although we have very little funds, we still enthusiastic about educating children and implementing inclusion. "(KS / KN,)*

From the results of research at SMPN 1 Sidorejo, it seemed that there was a strong commitment as an implementation of the disposition in the implementation of Regent Regulations number 35 of 2014 related to aspects: students, identification and assessment, curriculum, workforce, classroom management and learning activities, grade promotion system and reports on learning outcomes, infrastructure, school management, funding, awards and sanctions, community empowerment.

The success of policy implementation is not only determined by the extent to which policy actors know what needs to be done and are able to do it, but it also determined whether the policy actors have a strong disposition to the policy being implemented [13].

There were three elements of response that can influence desires and wishes, namely understanding, knowledge, and deepening. From the results of the interview at SMPN 1 Sidorejo above it seemed that the three elements were rooted in themselves.

B. Implementation of Magetan Regent Regulations Number 35 of 2014 at SMPN 4 Magetan

In the process of policy implementation, four elements are needed, including resources, communication, bureaucratic structure and disposition [12]. These four aspects must be fulfilled in the implementation of Magetan Regent Regulations number 35 of 2014 at SMPN 4 Magetan.

1. Implementation of Resource Aspect

Related to resources in the implementation of Magetan Regent Regulations number 35 of 2014 at SMPN 4 Magetan, the headmaster of SMPN 4 Magetan further explained:

"Educational staff in inclusive schools include: education unit manager, librarian, laboratory assistant, and learning resource technician. In this case the participation of the Magetan regency education office is to provide ease of recommendations to inclusive school organizers to appoint new workers needed to handle children with special needs, through training either at the sub-district/cluster or regency level"

Financial resources also played a vital role in the successful implementation of Magetan Regent Regulations number 35 of 2014 concerning the implementation of inclusive education in Magetan Regency. It was as the result of our interview as follows:

"The school financial component is one of the determinants of the success rate of implementing teaching and learning activities or services in inclusive education."

The implementation of Magetan Regent Regulations number 35 of 2014 at SMPN 4 Magetan has been supported by existing resources both natural and human resources. Human resources intended included students, teachers/educators. Similar opinions were also expressed by the curriculum representative as follows:

> *"The attitude of normal/regular students are friendly and have high awareness of their friends who have special needs. It makes children with special needs more able to get their rights in learning and follow learning in school. The implementation of the identification and assessment is carried out by special tutor who is assisted by curriculum, teacher of guidance counseling and other personnel section. From the results of the assessment, they are then grouped / put into one class to take part in learning according to the child's condition or needs. "(WK)*

School management that was friendly to all students made children with special needs more able to get their rights in learning and following learning in school.

2. Implementation of Bureaucratic Structure Aspect

The bureaucratic structure was the cause of the implementation of inclusive education policy gaps in Magetan regency, which was contained in Regulation No. 35 of 2014. The bureaucratic structure covered aspects such as organizational structure, division of authority, relations between organizational units and relations with external units. The bureaucratic structure in inclusive education schools was in accordance with Permendiknas number 70 of 2009, East Java Governor Regulation number 6 of 2011 and Magetan Regend Regulation No. 35 of 2014 by adding the coordinator of inclusive education. The result of observations at SMPN 4 Magetan obtained information through JN's statement that:

"There is no clear bureaucratic structure for implementing an inclusive program. It still overlaps and all responsibilities of students with special needs are left to GPK. From the observation At SMPN 4 Magetan, it seems that there is no standardized standard operating procedure for the implementation of Magetan Regional Regent Regulations number 35 of 2014 concerning the delivery of inclusive education in Magetan Regency.

Bureaucratic structure in policy implementation played an important role besides the factors of communication, resources, and implementing behavior. ASN stated:

> *"The results of interviews and observations in the implementation of Magetan Regent Regulations number 35 of 2014 at SMPN 4 Magetan have a clear bureaucratic structure. There is already a coordinator in the implementation of inclusive education from GPK appointed by the education office through the submission of the principal. "*

If observed from the bureaucracy structure aspect at SMPN 4 Magetan, for the implementation of Magetan Regent Regulations No. 35 of 2014 concerning inclusive education, there was a clear bureaucratic structure and responsibilities in each section according to their respective duties and functions. It was in line with the opinion of the curriculum section of SMPN 4 Magetan, that:

> *"The headmaster gave a mandate to the inclusive coordinator in collaboration with the curriculum to carry out the distribution of tasks related to inclusive education programs namely students, identification and assessment, curriculum, workforce, classroom management and learning activities, class promotion systems and reports on learning outcomes, infrastructure, school management, funding, awards and sanctions, community empowerment to achieve the goals of inclusive education at SMPN 4 Magetan". (WKK / PD /)*

The result of the observation of the bureaucratic structure at SMPN 4 Magetan showed that it was the same as at SMPN 1 Sidorejo. Besides there was an inclusive coordinator, there were also curriculum coordinator, students, public relations, infrastructure facilities. Based on the results of the interview above, it can be interpreted that the bureaucratic structure for inclusive education at SMPN 4 Magetan was in accordance with the Ministry of Education Regulation (permendiknas) number 70 of 2009 and Magetan Regent Regulations No. 35 of 2014.

3. Implementation of Communication Aspect

In the implementation of Magetan Regent Regulations number 35 of 2014, it could be seen from the results of the study that there was a good communication between Magetan regency government, education office, inclusive working groups (pokja), headmasters of inclusive schools, coordinators of implementing inclusive education in each school in discussing the components of inclusive education like on the aspects of students, identification and assessment, curriculum, workforce, classroom management and learning activities, class ascension systems and reports on learning outcomes, infrastructure, school management, funding, awards and sanctions, community empowerment.

This communication was carried out in the form of seminars, the formation of joint working groups, bringing resource persons in socialization with students' parents or

school committees. It is like the result of the interview with WKPD below:

> *"For inclusive education programs, this communication is carried out in the form of seminars conducted by the regency Inclusion Working Group and group of MGMPs, then there has also been the formation of a joint working group and a WhatsApp group. In addition to that, resource persons are also invited in socialization with students' parents and school committee administrators appointed (WKPD)".*

From the result of the interview above it can be concluded that the communication aspect of the implementation of Magetan Regent Regulations number 35 of 2014 concerning the implementation of inclusive education in Magetan Regency had also been carried out at SMPN 4 Magetan.

4. Implementation of Disposition Aspect

In aspect of disposition as a form of implementation of Regent Regulations number 35 of 2014, SMPN 4 Magetan was active in forming networks with related institutions or expert teams in the aspects of students, identification and assessment, curriculum, workforce, classroom management and learning activities, grade promotion system and learning outcomes report, infrastructure, school management, funding, awards and sanctions, community empowerment.

The school principal worked together with the inclusion coordinator and special tutor and socializes to all school members to help each other and develop mutual respect, not discriminating against their special friends.

In the aspect of disposition in the implementation of Magetan Regent Regulations number 35 of 2014 in schools was also shown in the recruitment of new students as the results of an interview with SG that:

> *"A form of commitment also appears in the process of registering new students. Identification and assessment are always carried out by the team shown by the school and curriculum. From the results of the assessment and identification, the curriculum will make a curriculum that is suitable to the needs of the children or curriculum to differentiate and modify the curriculum."*

A proportional behavior of educators was needed like providing teachers who gave assistance or help to students without profit attached, and also provided encouragement to students to further improve their learning in order to improve academic and social achievement. This was in accordance with the inclusive policy carried out at SMPN 4 Magetan in the implementation of Magetan Regent Regulations number 35 of 2014 concerning the implementation of inclusive education in terms of disposition.

SMP 4 Magetan is one of the Magetan urban schools that accepts children with special needs to learn together with regular friends within the scope of inclusive school which was also the appointment of Magetan regency government through the education office in 2014. Long before inclusive education in Magetan was declared, SMP 4 was a school that was open to the presence of children with special needs who wanted to study in school.

IV. CONCLUCION

Based on the study results of Regent Regulations implementation study No. 35 of 2014 in Magetan Regency, it can be concluded that the Implementation of Magetan Regent Regulations number 35 of 2014 in Magetan Regency inclusive SMP is carried out with the aim of providing the widest possible opportunity for all students who have physical, emotional, social, social and / or potential special intelligence and / or talent to obtain qualified education in accordance with their needs and abilities. The implementation of inclusive education in Magetan Regency is currently found in schools that are still exclusive rather than inclusive because they receive students conditionally. By implementing this regulation it is hoped that the implementation of education for children with special needs can be obtained optimally even in the conditions of regular classes.

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A Critical Analysis On Ethno Centrism in North Eastern India and The Idea of Nationalism

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Abstract: In order to respond to the emerging problems from the strengthening of ethnic identities– we need to look into the various factors which are responsible for the particular phenomenon. The state is an important player– which needs to be taken into account when we look into the emergence and strengthening of ethnic identities. And it is not easy to directly term this as something which is anti-developmentalist or which is dangerous for national integration (especially in regards to North East India). To understand the ethnic movements better we need to understand the external factors which are responsible for creating a sense of insecurity among different ethnic groups. The idea of development should be critically looked into– as the idea of development is always defined by the majority—Idea of development might differ among different ethnic groups. There should be some questions asked like– Are the ethnic movements a threat to national integration? And if it is– then how should we respond? What is development and how it effects different ethnic groups differently? And finally we should try to know that if a homogeneous society really desirable and will this help in sustaining peace? In answering these questions we need to look into nationalism and the various ways in which it shapes the ethnic movements. This paper captures the various dynamics which are responsible in shaping ethnic movements and the possible ways to answer these problems.

Keywords – ethno-centrism, phenomenon, dynamics, homogeneous

Introduction

The rise of ethno centrism in North eastern India can be attributed to many factors –it is very important to analyze these factors, without proper analysis we cannot term ethno centrism as a contributor of anti developmentalist ideas. The existing literature might suggest that the rise of ethno centrism in north eastern India is hampering development and progress of the region–and very often it is seen as a major problem for integration of north eastern India with rest of India. The idea of nationalism has made development the core idea of progress –but is this the only way of looking at progress ? Is development same for everyone and what do we mean by development? Finally – what are the problems of looking at the ethnic movements as being threatening to national integration. In this paper I would try to answer these questions and I will try to explain –how to respond to the ethnic movements in a proper manner so as to promote sustainable peace.

Developmental activities and the state

Very often it is found that we see the rise in ethnic movements –or mobilization in the name of ethnic identities as being detrimental to national security and national integration. Most of the times these movements are suppressed by heavy use of force by the state–the best example is of AFSPA—an act which has been used by the security forces to suppress various movements and commit heinous crimes. There has been a lot of protest against AFSPA –but the state is not responding –clearly suggesting that the state view the north

eastern India as being a troubled zone, but the irony is that the state itself is responsible for creating many of the troubles. The very idea of development represents the elitist mindset–it was a goal desirable to elite section of the society. It could be seen when Nehru called the dams as "temples of modern India" –this idea emerged from the bourgeoisie section of the society.

What we see in the contemporary period is that–the idea of development, that has originated and developed in a different context is being imposed on another context–which has resulted in– in-coherence. This process has accelerated in the recent times–due to the proliferation of the idea of nationalism —which has resulted in the aggressive developmentalist activities by the state. Any kind of resistance to these activities is being seen as a threat to national integration and for the progress of the nation–from here the problem emerges, the idea of development is based on heavy industrialization, better roads, building of dams, urbanization etc.–all of which affects the environment in some or the other way. The development activities has resulted in the degradation of the environment –we can see it from the rise in pollution of air and water resources in north eastern India. It is widely recognized –all over the world that—development activities should go together with the protection of the environment –but what we see in north eastern India is clearly the opposite. Development which destroys the ecology–is clearly not sustainable, unfortunately this hasn't forced the state to rethink it's developmentalist ideas.

Tribals and development

I am not suggesting that the state and the developmentalist activities being carried out by the state as being solely responsible for strengthening of ethnic identities –there are various intra and inter group conflicts due to fundamentalism and various other reasons , which is prevalent amongst all the ethnic groups in north eastern India. What I am trying to argue is that– the state itself has been responsible for alienating the north eastern people from the rest of India –and one of the major reasons for this alienation is the developmentalist activities being carried out by the state. It is important to understand that the tribals are the worst sufferers of development activities–they are the most important stakeholders, they are the most vulnerable section of the society. We know that the north eastern region of India except Assam–has a predominantly higher percentage of tribal population, due to higher concentration of tribals in north east India –the issue becomes more sensitive.

It is very important to understand these sensitivities –without which we will not be able to understand the dynamics of the separatist movements and the paradoxical situations–which shapes the ethnic movements. Also it is very important to know where to locate yourself –when one is trying to analyze these factors of ethnic movements –depending on which, the way of interpreting these movements can differ. One cannot deny that the lives of the tribals are directly linked with the natural resources –it may be forest, water bodies, land and other mineral resources. They are dependent on these natural resources –very often the state led developmentalist activities has resulted in turning of the tribal population into "ecological refugees". The tribals are being seen as a hindrance for progress of the nation –their lands are being taken away with impunity by the means of legislation. The tribals are being increasingly subjugated to extreme forms of alienation, also there has been a considerable effort of mainstreaming the tribal population –which has been responsible for the emergence of the idea of "self determination" among the tribal population.

The sense of insecurity that is being created amongst the tribal population has forced them to reclaim their lost status–self assertion has become a common phenomenon. This can be seen in the separatist movements of the Nagas–led by NSCN (IM) and other extremist groups. The state has failed to identify the various problems being faced by the Nagas and it has responded to the separatist movements by use of brutal force–sometimes even targeting the civilians –the AFSPA has become one of the major reasons for the growing sense of separatism in north eastern India. The popular discontent of this act is mainly because of the atrocities committed by the Armed Forces on the civilians–the Armed Forces are protected from the law, and the people have no way of getting justice—a

clear example when justice and law doesn't go together. This law has been responsible for creating lots of unrest in north eastern India and it must be repelled immediately–the factors for ethnic mobilizations should be studied properly, and I am quite sure that there is a significant discontent with the state led development among the people of this region.

There is another aspect of the concept of development –we are basically asking a group of people to sacrifice their way of life for the larger good of the society. There is a serious problem with this logic of development, it is obvious that there will be resistance from the people who are likely to be affected –this resistance is very much natural, and to term this as a major threat to national integration is very wrong in many different ways. The best way to move forward is by identifying the vulnerabilities of the people who are likely to be affected by any kind of activities by the state–the priorities should be based on the needs of the people of the particular region. If development is carried out by keeping these in mind–then the people are more likely to cooperate, it doesn't mean that everyone would be willing to be part of the Indian state–it is very utopian to dream of it. The positives of such an approach is likely to pacify the people and the level of resistance will decrease –which might be helpful ,in the long run—for moving forward with dialogue with the extremist groups. Dialogue is the best way of responding to the ethnic mobilizations –rather than suppression by heavy use of force.

Historical factors

It is important to understand the historical dynamics of north eastern India –there has to be proper studies done on this region, but what I feel personally is that–north eastern India is still being neglected in the national curriculum, there is basically nothing about north east India in the CBSE school syllabus. These things also contribute to the growing sense of alienation among the people of this region. There has been many mistakes made by the state–the green revolution, which required intensive irrigation and water rich region to be successful—would have been best suited for north eastern India, unfortunately it was diverted to north western India. The people of this region didn't benefit from that revolution–the same model was not replicated in this region, but that event destroyed the agricultural sector in this region. Cheap rice began to be poured in from Punjab and Haryana–which was produced by heavy use of machinery and technology–the north eastern people who still depended on subsistence methods of agriculture–lost the incentive for growing rice. I have seen this transition very closely –these events didn't take shape in vacuum –but the state had an important role in this transition.

Agricultural development should have been the priority of the state–this would have given an economic boost to this region–we can link this to socio-economic development of the people of this region. The development model that the state followed was quite different–it went ahead with the exploitation of the natural resources, heavy industrialization, and it also came up with draconian laws–which alienated the tribal people from their way of life. The state became the owner of the natural resources, these kind of development that impacted the very existence of the people was never going to be successful. Even the recent development of the roads and infrastructure in north east should be looked critically–it can be attributed to the strategic dimension for containing China, rather than being directed toward the human resource development in north east. It is urgent for the state to change its attitude–rather than thinking north east as being strategically important, and acting with strategic policies–there should be a paradigm shift in the social policies. The policies needs to more oriented towards human development rather then infrastructure development. The strategic location of this place should have contributed to flourishing trade and commerce–mainly with the south Asian economies—but the "act east policy" of the government of India has failed in improving the way of life of the people.

Role of the media

The constant socio-economic deprivation of the people has led towards ethno centrism in many ways–they have been forced to take up arms against the state in order to raise their voices. It should be noted that in most of the ethnic movements or conflicts–one party remains constant —which is the state, the conflicts are between the state and the ethnic groups, if we set aside the intra group conflicts –which are lower in intensity. The ethnic mobilizations and movements are seen as a major threat to national integration–and the media plays and important role in this, the national media is biased towards north east India. Any kind of ethno centric movement is directly played by the media as an anti-national activity–and rarely the role of the state is questioned. The vast majority of the population of north India has developed a gruesome image of north east–which can be seen from the discriminatory practices that the north eastern students or people face in the rest of India. The national media has been largely responsible for shaping this kind of attitude, and the same media has an important role to play in this regard. It should strive to bring out the sensitivities of the people and question the state for carrying out activities which might become an important factor for ethnic mobilizations.

Conclusion

Finally, there is a need for a paradigm shift in the way of looking at the ethnic movements–these movements should not be seen as being anti-developmentalist or even as anti-national. The deployment of forces should be minimized–as it leads towards growing sense of insecurity among the people. The AFSPA must be repelled immediately–it doesn't mean stopping the ongoing operations, the socio-economic development of the people must become the priority of the state. Steps should be taken to ensure economic opportunities and for the development of trade. Decentralization is another way of giving the people more freedom–which is likely to reduce the separatism feelings and anger against the state. All these coupled with the change in attitude from the government of India–and giving the people control over the natural resources, might be some of the ways in which these ethno centric movements should be responded to. Force should be the last resort –but unfortunately it is being used as first. On a concluding note , in my opinion –every critical problem can be solved by peaceful means, and it depends on us–how far we can go for finding that peaceful way.

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Growth and Chemical Composition of the Body of Mud Crab (*Scylla olivacea*) Cultured with Silvofishery Systems at Several Genera of Mangrove Vegetation

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ABSTRACT

Mud crab is one of aquatic organisms occupying mangrove ecosystem that has high economic value and potential for cultivation with Silvofishery system. The current study was conducted in the mangrove areas of Mandalle Village, Pangkep Regency, South Sulawesi Province. This study was aimed to compare the growth rate and the chemical composition of the body of mud crab (*Scylla olivacea*) that cultured with Silvofishery system on a variety of mangrove vegetation. The experimental container used an embedded cage made from bamboo with length, width and height of 1.5 x 1.5 x 1.5 m each. Tested animal used was mud crab (*S. olivacea*) collected from Pallime Village, Cenrana Subdistrict, Bone Regency, South Sulawesi Province with weight of 155±10 gram and cultured for 40 days. The study consisted of three treatments with five replications each. The three genera of mangrove vegetation used were *Avicennia*, *Rhizophora*, and *Sonneratia*. The collected data were analyzed using non-parametric statistics (Kruskal Wallis and Mann Withney U Test). The results of the analysis of Kruskal-Wallis and Mann Whitney U test showed that different genera of mangrove had a significant difference ($p < 0.01$) to the production of the mangrove litter, the growth rate and chemical composition of the crab's body. However, it was not significant ($p > 0.05$) in the survival of mangrove crabs. The best litter productivity, growth rate, and the chemical composition of the body of mud crab (protein, fat, Ca, P, and energy) were contributed by *Rhizophora*.

Keywords: mud crabs, body chemical composition, growth rate, silvofishery

I. INTRODUCTION

Silvofishery is one model of aquaculture activity in the mangrove area. The basic principle of this cultivation system is the multiple uses of the existing mangroves without eliminating the natural function of the ecosystem, so that fishery products are resulted and mangrove are still sustainable in playing a biological, ecological and economic function (Takashima, 2000; Karim *et al.*, 2017). Various species of important economic biota that can be cultivated in mangrove areas with *silvofishery* systems, one of them is mud crab (David, 2009; Karim *et al.*, 2019).

Mangrove crab known as mud crab is one commodity from crustacean genera which have important economic value. This type of crab has been commercially cultivated in several tropical countries including Indonesia. Mangrove crabs are well known both in the domestic and foreign markets because of the delicious taste of meat and high nutritional values. Based on the results of proximate analysis it is known that mangrove crab meat contains 44.85-50.58% protein, 10.52-13.08% of fat and 3579-3.724 kcal/g of energy. In addition, the crab meat contains a variety of important nutrients such as minerals and fatty acids ω-3 (EPA and DHA). The crabs are also a source of protein, niacin, folate, potassium, vitamin B12, phosphorus, zinc, copper and selenium (Brown, 2008; Mirera, 2014; Karim, 2013).

Mangrove ecosystem consists of various species of vegetation, and every species of mangrove vegetation produce different litter that contribute different nutrient contribution in aquatic environment (Zamroni and Rohyani, 2008; Asriani *et al.*, 2019). Therefore, the different types of mangrove vegetation as location of mud crab cultivation with silvofishery system is predicted

would produce different growth and quality of crabs. Therefore, in order to generate the rapid growth and high quality of crabs cultured with Silvofishery system, it is necessary to conduct studies on the proper mangrove vegetation types.

This study was aimed to compare the growth rate and chemical composition of the body of mud crabs that are cultured by the silvofishery system in various mangrove vegetation.

II. RESEARCH METHODS

Study Sites

The study was conducted in the mangrove areas of Mandalle Village, Mandalle District, Pangkajene Islands Regency, South Sulawesi Province, Indonesia. Mangrove litter measurements and proximate crab analyzes were carried out at the Nutrition and Feed Laboratory, Faculty of Animal Husbandry, Hasanuddin University, Makassar, Indonesia.

Study Materials

Bamboo cages with length, width, and height respectively 1.0 m x 1.0 m x 1.0 m were embedded in mangrove areas. The outer part of the cage was covered with *waring* (plastic nets) which aimed to protect the cage from the garbage and dirt carried by the waves. Feed used was a trash fish in the form of minced *Tilapia* fish. Feeding was done once a day i.e. in the afternoon at 5 pm with a dose of 10% of crab biomass. To maintain the water circulation in the cage running smoothly, the bamboo cleavage between one and the other was given a distance of approximately 1 cm.

Test animals used were male mangrove crabs (*Scylla olivacea*) with weight of 155 ± 1.0 g. The crabs were obtained from a crab collector in Pallime Village, Cenrana District, Bone Regency, South Sulawesi, which was kept for 40 days. Before being stocked to the study containers, the crabs were adapted to the environmental conditions for two days and then the weight was selected by weighing on a digital balance with accuracy of 1.0 g.

Samples of mangrove litter were collected using a litter-trap with a size of 100 cm x 100 cm made of nylon net. These litter traps were placed in the line transect plot in each 10 m x 10 m mangrove measurement plot with a height of 1.5 m above the ground level to avoid tides. Collection of mangrove litter was done once a week for six weeks, and as replicates, sampling was started from day 7, 14, 21, 28, 35, and 42. This was intended to obtain data or results that are accurate and have a diversity of data. The litter that has been collected was weighed to get the value of the wet weight. Wet weight of the litter was obtained after being weighed before being put within the oven. The dry weight of the litter was obtained after dried within an oven at 80° C until reaching a constant weight, (Soeroyo, 2003; Zamroni and Rohyani 2008). The parameters measured at this stage was the mangrove litter productivity.

Survival rate was calculated using the following formula:

$$SR = N_t / N_o$$

Where: S is survival rate (%), N_t is the number of live crabs at the end of the study, and N_o is the number of crabs at the beginning of the study.

Daily crab growth rate is calculated using the following formula:

$$SGR = 100 \times (\ln W_t - \ln W_0)/t$$

Where: SGR = daily growth rate of the crabs (%/day), W_o is the average weight of crab at the baseline (g), and W_t is average weight of crab at the end of the study (g).

The chemical composition of the body measured was protein, fat, and energy. Protein was analyzed using the kjedal method, fat with the soxlet method, and energy using a calorimeter bomb. Analysis was performed following the AOAC (1990) procedure.

As the supporting data during the study, several physical and chemical parameters were measured i.e. temperature, salinity, pH, dissolved oxygen, ammonia and nitrite. Temperature, salinity, pH and dissolved oxygen were measured two times a day i.e. morning (at 7 am) and afternoon (at 5 pm). The ammonia and nitrite were measured three times during the study, namely at the beginning, middle, and end of the study.

Data gathered from this study were analyzed using non-parametric statistics (Kruskal Wallis and Mann Withney U-Test).

III. RESULTS AND DISCUSSION

Results

Production of the Mangrove Litter

Production of litter in different genera of mangrove vegetation is presented in Table 1.

Table 1. The average value of the litter production in several genera of mangrove vegetation

Vegetation Genera	Litter production ($g/m^2/day$)
Avicennia	1.67 ± 0.08 [b]
Rhizophora	2.47 ± 0.07 [a]

Sonneratia	1.33 ± 0.05 [c]

Remarks: different letters on the same column show the significant differences (P <0.05) of litter productivity among mangrove genera

The results of the non-parametric analysis of Kruskal Wallis showed that the genera of mangrove vegetation had a very significant effect (P <0.01) on litter productivity. Furthermore, with Mann Withney Analysis, it was found that there were significant differences (P <0.05) of litter productivity among mangrove vegetation. The value of litter production, N and P produced are significantly different among the three vegetation, while for organic C in *Rhizophora* is not significantly diferrent (p > 0.05) with *Sonneratia* but diferrent from *Avicennia*.

Crab Survival and Growth Rates

Average daily growth rates of mangrove crabs that cultured on some mangrove vegetation are presented in Table 2.

Table 2. Average value of mangrove crab survival and growth rate

Vegetation Genera	Survival Rate (%)	Growth Rate (%/day)
Avicennia	94.00 ± 5.48	0.8 6 ± 0.01 [b]
Rhizophora	96.00 ± 5.48	0.9 6 ± 0.04 [a]
Sonneratia	96.00 ± 5.48	0.8 5 ± 0.03 [b]

Remarks: Different letters in the same column indicate a significant difference (P < 0.05) between mangrove vegetation types

The results of the analysis of non-parametric Kruskal Wallis test showed that the mangrove vegetation genera had no significant effect on the survival rate (p> 0.05), but was highly significant (P <0.01) to the growth rate of mud crabs. Furthermore, the results of the analysis of Mann Withney U Test revealed that there were significant differences (P <0.05) between mangrove vegetation on the growth rate of mangrove crabs. The growth rate of mangrove crabs that cultured in *Rhizophora* vegetation is significantly different from those cultured in *Avicennia* and *Sonneratia*.

Chemical Composition of Crab Body

The chemical composition of the body of mangrove crabs that are cultured by the silvofishery system in various genera of mangrove vegetation is presented in Table 3.

Table 3. The chemical composition of the body of mangrove crabs that are cultured by the Silvofishery system on various genera of mangrove vegetation

Mangrove Vegetation	Body Chemical Composition (%)				Energy (Kcal/g)
	Protein	Fat	Ca	P.	
Avicennia	42.76 ± 0.33[b]	11.50 ± 0.63[b]	1.81 ± 0.0 [b]	2.17 ± 0.08[b]	3,777 ± 77.64[b]
Rhizophora	45.61 ± 0.29[a]	12.82 ± 0.41[a]	1.93 ± 0.03[a]	2.48 ± 0.11[a]	3,878 ± 34.05[a]
Sonneratia	43.22 ± 0.28[b]	11.33 ± 0.38[b]	1.89 ± 0.02[b]	2.12 ± 0.04[b]	3,791 ± 18.92[b]

Remarks: different letters indicate significant differences among treatments at 5% level (p <0.05)

The results of the Kruskal Wallis Analysis showed that the difference in mangrove vegetation had a very significant effect (p <0.01) on protein, fat and crab energy. Content of protein, fat, and energy of mangrove crab are the best cultured in vegetation of *Rhizophora* than crabs reared on *Avicennia* and *Sonneratia* vegetation.

Water quality

Ranges of water quality in the mangrove crab environment during the study are presented in Table 4.

Table 4. Range of environmental water quality values for crabs cultivation during the study

Parameter	Value Range		
	Avicennia	*Rhizophora*	*Sonneratia*
Temperature (°C)	25 - 30	25 - 30	25 - 30
pH	7.06 – 7.95	7, 08 - 7, 95	7.08 – 7.96
Salinity (ppt)	17 - 29	17 - 29	17 - 29

DO (ppm)	3.12 – 4.45	3.11 – 4.46	3.12 – 4.45
Ammonia (ppm)	0.00 5 - 0.011	0.005 - 0.011	0.005 - 0.012
Nitrite (ppm)	0.22 – 0.42	0.22 – 0.4 1	0.23 – 0.42

Discussion

Based on Table 1 above, the highest productivity of litter is performed by *Rhizophora*, with a value of litter production, N, P, and organic C consecutive succession is 2.47 g/m^2 /day higher than *Avicennia* 1.67 and *Sonneratia* 1.33 g/m^2 /day.

The high litter productivity in *Rhizophora* vegetation shows that this vegetation has a high fertility rate that is able to support the life and growth of the fauna that live within it. High litter productivity in the *Rhizophora* vegetation is influenced by the density of the vegetation. Zamroni and Rohyani (2008) which found that the litter production in *Rhizophora* is higher because its density is higher than other genera. In addition to the density, the different genera of mangrove and tree diameter is also considered to influence production of litter per day. Difference in mangrove litter production was also caused by differences in geographic location, variation of vegetation conditions, and forest composition structure and the high and low densities in the mangrove forest.

Several research results show that *Rhizophora* vegetation has higher litter production than other genera (Day *et.al.*, 1987 and 1996; Amarasinghe and Balasubramaniam, 1992; Hossain and Hoque, 2008; Zamroni and Rohyani, 2008). Litter production in each genera of mangrove vegetation was found to be dominated by leaf components with a percentage of 62-78%, This was reported by Ake-Castillo *et.al.* (2006), Mahmudi *et al.* (2008), Ulqodry (2008), Bernini and Rezende (2010), and Abib and Appado (2012) that the main components of mangrove litter are leaves (> 50%). This is one form of adaptation of mangrove plant itself more abort the leaves to adapt to the saline environmental conditions, because salt is absorbed by the mangrove plants will be stored in the leaves (Zamroni and Rohyani, 2008).

The average survival rate obtained in this study was quite high, ranging from 94-96%, indicating that the three genera of mangrove vegetation were able to support the life of mangrove crabs. This is due to the mangrove vegetation is typical inhabitant of coastal ecosystems is the original habitat of the mangrove crab, where mud crabs live, breed and forage in this ecosystem. The mangrove crab population is typically associated with mangrove vegetation when its conditions is still good (Wijaya *et al.*, 2010).

Based on Table 2 above, it is known that the highest daily growth rate is produced by *Rhizophora* vegetation, with an average growth rate of 0.96 %/day. The high rate of growth of mangrove crabs in *Rhizophora* vegetation is due to this vegetation having higher litter productivity compared to other vegetation. Litter productivity is one indicators of the quality of the mangrove ecosystem. The research findings are in aggreement with the opinion of Tahmid *et al.* (2015) which states that there is a relationship (positive correlation) between the quality of mangrove ecosystems as mangrove crab habitat with the weight and width of mangrove crab carapace found.

The protein content of mangrove crab maintained in *Rhizophora* vegetation averaged 5.61%, while in *Avicennia* and *Sonneratia* are 42.76 and 43.22%, respectively (Table 3). This shows that the maintenance environment provides an anabolic effect in the form of increased protein synthesis in the body of the test crab. The high content of protein is one indicator of increased growth (Whiteley et al. 2001).

Table 3 also shows that crabs cultured in different mangrove vegetation have different fat, Ca and P contents. The change in the percentage of fat in each vegetation culture shows the use of fat, as an energy source and the formation of body fat. The fat content of crabs maintained at *Rhizophora* averaged 12.82%, while those of crabs cultured at *Avicennia* and *Sonneratia* were 11.50 and 11.33%, respectively. Piliang and Djojosoebagia (2006) stated that the main function of fat as a component of the cell membrane that functions as an energy source and is a factor in cholesterol synthesis and acts as body fat as an insulator and protector of important organs. The fat content of mangrove crabs maintained on *Rhizophora* vegetation is higher than the crabs cultured at *Avicennia* and *Sonneratia*. Likewise, the highest Ca and P contents of mangrove crabs is produced in crabs that are kept in *Rhizophora*.

The difference in protein and fat content influences the crab energy content. Based on Table 3, it appears that the higher the protein content and crab fat, the higher the energy content, and vice versa. The results of this study show that the average energy content of mangrove crabs maintained in *Rhizophora* vegetation is 3,878 kcal/g which is higher than *Avicennia* and *Sonneratia* which is 3,777 and 3,791 kcal/g.

The difference in crab body chemical composition in the form of protein, fat, and energy influences the absolute growth of mangrove crabs. The higher the body's nutrient content, the faster its growth. This can be observed from the crab growth rate (Table 2) where the crab growth rate is highest in the crabs that are cultured in *Rhizophora*. Growth is described as an increase in body protein (Kim and Lall, 2001). According to Rosa and Nunes (2003), organisms tend to have a composition of optimum biochemical depending on their adaptation strategy. Carbohydrate and fat contents of the crab body is the expression of an adaptive characteristics of animals.

In general, the results of this study illustrate that higher protein, fat, Ca, P, and energy content is generated in crabs that are cultured in *Rhizophora* compared to *Avicennia* and *Sonneratia*. This is caused by higher productivity of *Rhizophora* compared to *Avicennia* and *Sonneratia* (Table 1). High productivity affects the level of water fertility and abundance of nutrients and feed. With abundant food availability, the chance of crabs to consume feed is higher. The more feed consumed, the greater the chance of being deposited. The abundance of nutrients and feed in mangrove areas provides an opportunity for mangrove crabs to grow and breed (Carpenter and Niem, 1998; Keenan, 1999).

Based on Table 4 above, it can be seen that the environmental temperature of crab rearing during the study ranges from 25-30 °C, pH 7.08 - 7.95, salinity 17 - 29 ppt, dissolved oxygen 3.12-4.45 ppm, ammonia 0.005-0.012 ppm, and nitrite 0.22 – 0.40 ppm. These value range are appropriate to support the life of mangrove crabs. The optimum temperature for growth of mangrove crabs is 26 - 32 °C, salinity 15-30 ppt, pH range 7,0 - 8,5; dissolved oxygen > 3 ppm, ammonia < 0.1 ppm and nitrite < 0.5 ppm (Christensen *et al.*, 2005; Karim, 2013).

CONCLUSION

Based on this study, it can be concluded that the best litter production, survival, and growth rate of mangrove crabs are produced by vegetation of *Rhizophora* each of 2.47 g /m^2 /day, 96%, 0.96%/day. Likewise, the chemical composition of the body of mangrove crabs (protein, fat, Ca, P and energy) is best produced in crabs that are cultured on *Rhizophora* vegetation by 45.61; 12.82; 1.93; 2.48% and 3,878 kcal/g, respectively.

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The Impacts of Religion and Ethnicity on Voting Behavior of Electorates in Nigeria Since 2011

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Abstract: The structure and substance of politics in Nigeria revolves largely around the factors of religion and ethnicity. Since independence, the voting behavior of Nigerians has reflected both ethnic and religious bias. In the 2011 and 2015 Presidential elections, the two leading candidates, one a Christian from South, and the other a Muslim from North, practically pitched the religious and ethnic cleavages of the electorate against each other. This study examines the impacts of religion and ethnicity on voting behavior of electorate in the 2011, 2015 and 2019 presidential elections in Nigeria. The study also sought to know which of these factors had the most dominant effect on the voting behavior of the electorate during these periods. The ex-post factor research design was adopted, while data was collected from secondary sources. We adopted the Rational Choice Theory. We found that ethnic and religious sentiments played a significant role in the outcomes of the elections within the period of study. However, religion had the most dominant influence on the voting behavior of the electorate. We recommend: massive re-orientation of the political leadership and the electorates through extensive political education; reducing the incentives for hostile political competition; checking the abuse of religion and ethnic differences in the electoral process.

Key Words: Ethnicity; Political leadership; Religion; Voting Behavior

I. INTRODUCTION

Election has been the most acceptable means of changing political leadership in democratic systems. There are factors that make electorates to vote or not to vote in an election. These are different and dependent on the socio-cultural, economic, and political background of the nation and the voters at one point or the other. In Nigeria, this is rampant, not necessarily because the electorates are apolitical, but the circumstances and the ways in which the context are fixed forced them to accommodate other considerations. However, it is the voting behavior of the electorates that builds or mars the elections to produce credible or unacceptable candidates. Due to the voter's socio-economic conditions, ethnicity and religious inclination, voting behavior runs inline in order to satisfy those religious and ethnic interest and personal immediate economic needs. They accept gratifications from politicians to vote for them even when they know that such persons are not credible.

Religion and ethnicity have both had great impact on the voting pattern in Nigerian elections. They have become the medium through which the electorates choose and vote for their chosen candidates. They are also medium through which elections and election results can be predicted. These factors in Nigerian politics have nevertheless brought both ethnic and religious divide, hence competition for national resources among the various ethnic and religious groups which has led to intractable power struggle.

British colonial rule in Nigeria amassed a mass of people that were previously largely autonomous from one another to some extent, only sometimes associating one with another, through trade, with the politics of these largely independent and autonomous ethnic groups localized. With the progress of time, the emerging working class and their peasant counterparts began to look more like threats to British colonial interests in the territory. Consequently, Britain initiated policies to emasculate the revolutionary potentials of the emerging working class and the consciousness that they were spreading (Ayatse & Iorhen, 2013). To achieve this, they began to favour and reward loyalty and to punish dissent with the pattern of involvement of locals in the administration of the polity. The pattern of involvement of locals in the polity and the level of the involvement as a reward for loyalty and punishment for loyalty not seen to have been delivered in adequate measure, began to tow ethnic and religious dimensions. The configuration of ethnic groups in Nigeria is such that the major religions seem distinctly embedded. The

major ethnic group in the north was predominantly Muslim while the major ethnic groups in the south are predominantly Christian.

In the first republic, a pattern of politicization of ethnicity and religion began to emerge as the manner in which they regions were carved placed the north in seeming perpetual advantage. This orientation also largely informed the character of political parties that emerged at the time. The Action Group (AG) evolved from 'Egbe Omo Odua', a Yoruba socio-cultural group, while Northern Peoples' Congress (NPC) evolved from 'Jamiyyar Arewa'. The National Council of Nigeria Citizens (NCNC), though did not metamorphose from any Igbo socio-cultural group, was ultimately linked with and dominated by Igbo Union and Igbos. The composition of the leadership of these parties also mirrored their ethnic cleavages (Babatola, 2015).

From that moment up to the fourth republic, the politics in Nigeria has always mirrored ethnic and religious bias. In the second republic, efforts were made by political leadership assuage ethnic and religious fears as parties fielded candidates with a calculation that took into consideration the reality of ethnic and political divide. The politics of the second and third republic made significant efforts to manage the sensitive cleavages of ethnicity and religion by not abusing it in the struggle for power. In the fourth republic however, particularly in the 2011, 2015 and 2019 elections, ethnicity and religious consciousness emerged as a rallying theme for galvanizing voters and support base.

There is, therefore, no gainsaying the relationship between religion, ethnicity and the voting behavior in Nigeria. Religion and ethnicity has emerged as major factors that influence the electorate to vote or not to vote in an election, and the pattern of their voting behavior. it is the voting behavior of the electorate that shape the election and to a large extend, determine its outcome. This study is thus saddled with the task of determining the role of religion and ethnicity in shaping voting behavior in Nigerian elections with specific focus on the 2011, 2015 and 2019 Presidential election and the import of that on democratic consolidation in the country.

II. LITERATURE REVIEW

Every ethnic nationality has got its own culture and cultural attributes by which the ethnic nationality is known and identified. The inter-play of these cultural attributes as ethnicity, religion, norms, language and history etc., gives rise to politics and determine the nature of the political process in the society. (Akwara, 1998; Leeds, 1978). Politics, ethnicity and religion are therefore so interwoven that their separation in any given society is always difficult. The Nigerian case is unique, though not an aberration, as it is a relatively general phenomenon in third world countries to see religious affiliations and ethnic inclination play dominant role in the choice of candidacy. Posner (2007) rightly observed that the need for a share of the national resources influence the voting behavior of members of a given ethnic group. Ifemesia, 1965; Aderibigbe, 1965; Tamuno, 1965; Mangut, 2012 noted that ethnic, political and religious conflicts in Nigeria are generally caused by struggles for power, natural and economic resources and religious dominance by all the ethnic groups.

a. Religion and Politics in Nigeria

Religion means different things to different people. Hence Egwu (2001) argued that religion is a difficult subject of inquiry including attempts at its definition and conceptualization. Religion is thus defined in many ways and the definitions usually vary among scholars.

Igwe (2005, p.379) defines religion as 'belief in the supernatural and practices sustaining that belief, the ultimate superstition and thus, a level of consciousness mostly centering on God and Satan, gods, spirit or deities. Adeniyi (1993) defined religion as a body of truths, laws and rites by which man is subordinated to the transcendent being. This implies that religion deals with norms and rules that emanated from God and which must be followed by the believers.

This definition is corroborated by Ejizu (1993) According to him; religion is man's intuition of the sacred and ultimate reality and his expression of that awareness in concrete life. Egwu (2001) views religion as a system of symbols which act to establish powerful, pervasive and long lasting moods and motivations in men by formulating conceptions of a general order of existence and clothing these conceptions with such an aura of factuality that the moods and motivations seem uniquely realistic. He further explained that religion can be understood in two ways. First, in a material sense, by which it refers to religious establishments (that is institutions and officials) as well as to social groups and movement whose primary interests are found within religious concerns. Secondly, there is also the spiritual sense which deals with models of social and individual behavior that help believers to organize their everyday lives. In this sense religion has to do with the idea of transcendent, supernatural realities and the sacred; as a system of language and practice that organizes the world in terms of what is deemed holy and the ultimate conditions of existence. From the foregoing discussion, one will not be faulted in viewing religion as a system of relation which linked man to an ultimate being or ultimate value epitomized in God.

What could be rightly said of Religion and politics in Nigeria as noted by Aderonmu (2006) is that religion has become a mere tool in the hands of politicians who seek to influence political outcome and in the process destroy the electoral process. He concludes that one of the most disturbing issues of religion is its application to politics, and noted that the removal of religion from politics will create less room for national or federal tension, thus Nigeria will not be a modern nation until it calls "a spade a spade", by separating religion and politics. Okungbowa (2006) also agrees with Aderonmu, but was more interested in the way religion is being used to influence politics; he opines that the political engagement of religious groups and their provision of services in areas where the state has failed to deliver practical and ideological solution to the problems of the masses have brought challenge to the state. Hence religion if it must be utilized should help as a force of unification at every level.

Anogurin (1984, p.118) opines that religion and politics are two inseparable institutions in the human social psyche and structure. He equally asserts that earthly governments are mere agents of God's theocratic governance of the physical and spiritual world. Furthermore, African societies are commonly depicted as very religious, which is evident among other things in the vast number of various Muslim, Christian and other faith groups that exist in most African countries (e.g. Chabal. 2009; Uzodike & Whetho 2008; Haynes 2004). It is frequently mentioned that religion is an important and pervasive force in African societies: Ellis &TerHaar (1998) for instance claimed that "religious belief operates at every level of society in Africa". It has been observed that politicians openly espouse religious sectarian sentiments in campaigning for public support. In addition, it was observed that "no one can aspire to, or hold political office in Nigeria without pretending to be religious" (Kukah, 1993).

b. Ethnicity and Politics in Nigeria

The concise oxford dictionary defines ethnicity as how the aspirations and interest of ethnic groups are pursued in relation to other groups. Ethnicity as a concept is an immensely complex phenomenon that portrays different perceptions. In the pre-colonial era and since the independence of Nigeria, ethnicity played and is still playing manifest and latent roles in the body politics of Nigeria.

According to Osaghae (1992), ethnicity refers to a social formation resting upon culturally specific practices and a unique set of symbols and cosmology. A belief in common organs and a broadly agreed common history, an inheritance of symbols, heroes, values and hierarchies, and conform to social identities of both insiders and outsiders. Ethnic culture is one of the important ways people conceive of themselves and identity are closely intertwined. As a social construct, ethnicity can be regarded as the employment of ethnic identity and differences to gain advantage in situations of competition, conflict and cooperation. Mudasiru (2015) has also argued that ethnicity constitutes the foundations of the African society, for it shapes the communities, cultures, economic and political structure of the people. More importantly it shapes the perceptions of the African, defines his universe and provides him with meaning, understanding and the power to interpret the world around them. Nnoli (1978) defined ethnicity as a "social phenomenon associated with interactions among members of different ethnic groups". He further explained that ethnic groups are social formation distinguished by the communal character of their boundaries and that an ethnic group may not necessarily be linguistically or culturally homogenous. Azeez (2004) views ethnicity as a sense of people-hood that has its foundation in the combined remembrance of past experience and common aspiration. Nigeria is a plural society and it is made up of over 250 ethnic groups with many sub-groups, three major ethnic groups- Yoruba, Hausa and Igbo-dominate the political landscape.

In Nigeria, several authors suggest that voting behavior in Nigeria is predominantly influenced by some form of identity factor such as ethnicity, family lineages, religion etc. (Bratton and Vann de Walle 1997; Ferree 2004, 2008; Lindberg et al, 2008). Substantial empirical evidence supports the view that Africans at large and Nigerians in particular are primarily-identity voters. In essence, voting in Nigeria is in many cases nothing more than an ethnic census. An individual voter uses ethnicity as the proxy for the expected benefits for voting for a particular candidate. Simply put, voting in Nigeria is considered to be largely dependent on ethnic identification. Erdmann (2007) equally finds that voter alignment and party affiliation are largely influenced by ethnicity. Thus, although not exclusively, political parties in Nigeria tend to be dominated by particular ethnic groups rather than being on the basis of ideology. Therefore, in Nigeria, there is high level of ethnic politics and competition where most voters vote based on ethnic affiliation rather than competence. Hence Nnoli (1978) wrote that ethnicity has heightened political competition in electoral contest.

III. METHODOLOGY

a. Theoretical Framework

This study is anchored on the Rational Choice theory. Rational choice is a theory that assumes that an individual has preference among the available choices and alternatives that allows them to state which option they prefer. It is also a framework of analysis which assumes that individuals always make prudent logical

decisions that provide them with the greatest benefit or satisfaction and that are in their highest self-interest (Tullock, 1976). The theory makes the following specific assumptions:

- The individuals always make prudent logical decisions that provide them with the greatest benefit or satisfaction and that are in their highest self-interest.
- Individuals choose their actions optimally, given their individual preferences as well as the opportunities or constraints with which the individual is faced.

Tullock (1976) remarks that Rational choice theory sees the interplay between politicians and electorates, political parties and voters or consumers and producers as players with a democratic environment and each has an interest which he tries to achieve. According to this theory, a political party wants to maximize supports by defining its manifesto and programs in order to gain support. While electorates or voters expect political utility, this is the satisfaction of their needs. Voters will go for a political party or a candidate that will provide such utility for them.

Rational choice economic theory of ethnic voting behavior postulates that a voter tends to vote for a party candidate who is a member of the same ethnic group because of the higher possibility that the candidate will keep his/her political promises to members of their own ethnic community, and because of the lower cost of communicating with a candidate of one's own community, more effective representation of the community's interests in the parliament will likely result (Janet 1993). By extension, the same theory can be used to postulate that a voter will likely vote for a candidate with whom he/she share common religious beliefs. Rational choice theory best explains age long voting behavioral patterns in Nigeria. Just like during the independence era, ethno-religious affiliations continue to reflect in voting behavior of Nigerian electorate.

b. Method of data collection and Analysis

The consciousness for systemic and empirical research in behavioral science has led to the proliferation of methodologies that engender endless but needless controversies. In this connection, this study will adopt the documentary method of data collection. Data will be collected from secondary sources such as Textbooks, journals, official documents, Newspapers, Articles, Online documents, INEC result materials and other written works dealing or related to this study. The secondary data source is chosen to enable us save time and money. Purposive and random selection of materials will be applied in order to investigate the problem and also test hypothesis.

Qualitative descriptive method will be used in analyzing the data collected. This method was carefully chosen because it has to do with human behavior, non-statistical, normative, and multidimensional issues that deal with deduction which has to do with making inference of some issues or phenomena that occurred during the 2011, 2015 and 2019 presidential elections in Nigeria.

IV. THE IMPACTS OF RELIGION AND ETHNICITY ON VOTING BEHAVIOUR OF THE ELECTORATE IN THE 2011, 2015 AND 2019 PRESIDENTIAL ELECTIONS IN NIGERIA

a. Religion and Voting Behavior

Religion generally supports social norms, reassuring the people that their ways are right and their cause is just; for religion has become part and parcel of society and has been reported to be the focal point of cultures. In the Nigerian context for instance, one cannot doubt the seriousness of the faith and the commitment of most Nigerians in their religious beliefs. One cannot equally doubt the richness of the cultural heritage which Nigerians find in religion and in its significant role in their historical experience. More importantly, one cannot doubt that Islam, Christianity and African Traditional Religion contain fundamental moral principles on which aspects of our society and culture have operated (Adamolekun, 2012). Nigeria is one of the most religious countries in the world. According to the Pew Research Center, Nigeria is at the top of the charts in terms of intense religiosity. Both Christianity and Islam have experienced very dramatic growth in their competitive nature towards politics especially in the 2011, 2015 and 2019 Presidential elections in Nigeria. They have not just undergone quantitative growth, but they have experienced very important qualitative changes-changes in denominational affiliation, changes in theology, changes in attitudes towards one another (Kukah, 2007). Religion and politics in Nigeria have to do with two spheres of activities in life of the same persons; Citizens who belong to religious group are also members of the secular society, and this dual association gets complicated. Religious beliefs have moral and social implications, and it is common for people of faith to

express these through their activities as citizens in the political arena.

The fact that ethical convictions are rooted in religious belief does not disqualify them from the political realm. However, they do not have secular validity merely because they are thought by their exponents to be religiously authorized. They must be argued for in appropriate social and political terms in harmony with national values (Cauthen, 1997). The complex interaction between religion and politics is most visible in a heterogeneous society like Nigeria where majority in the country openly and fervently identify with either Christianity or Islam. Today, Nigeria's population is divided nearly equally between Christianity and Islam. The important of that divide is well illustrated by the fact that religion- not nationality – is the way in which most Nigerians choose to identify themselves. In May-June 2006 survey conducted by the Pew Forum on the Religion & Public life, 76% of Christians says that religion is more important to them than their identity as Africans, Nigerians or member of an ethnic group. Among Muslims, the number identifying religion as the most important factor stood at 91 %. (Ruby & Shah, 2007).

In other words, majority of political office holders who would have impacted positively on the national integration when given the genuine teaching by their religious leaders have failed to do so because the truth has not been preached. Secondly, the manipulation of religion by some powerful individuals who hide under the guise of religion to pursue selfish interest, and the greediness of some religious leaders who patronize corrupt rulers remains part of the negative effects of religion on the political system of the country. In other words, the relationship between religion and politics in Nigeria are so close to the point that, a candidate's alignment with the former is the very yard stick for measuring his success or failure towards achieving the later. For instance, during the 2011 Presidential election campaign in the Muslim North, Gen. Muhammadu Buhari organized his Northern Muslim 'brotherhood' against Jonathan's campaign. That's why in 2011, Buhari won most of the Northern states even though that Goodluck Jonathan won the Presidential election in 2011. In reaction to Jonathan's victory, there was religious violence in the North which killed most Southern Christians. And also in 2015, there were many cases heating up the political atmosphere before the election as a result of activities involving religious faction to either support a particular candidate of the same religious groups or disrupt the other candidate from another religion. For instance, the purported message on 'social media' being circulated and alleged to have originated from CAN leadership, warning Christians not to vote for Muslim candidates, stating that 'it is tantamount to Islamization of Nigeria. Similarly, in 2019 Presidential election, there was 'social media' campaign by the APC members and some core Muslim fanatics, saying that Atiku cannot travel to America; therefore, this gesture disrupted and discouraged some voters to a large extent.

b. **Ethnicity and Voting Behavior**

It has been estimated that Nigeria has as much as three hundred and fifty (350) ethnic groups based on lingual classification (United Nations, 2006). However, the '' United Nations also says there are two hundred and fifty (250) ethnic groups in Nigeria, many consider this as underestimated. A federal government demography survey in 1976 identified 394 language groups; one estimate put it as high as 400 with the highest density of languages in Taraba and Adamawa States '' (www.thenation.onlineng.net). The above statement clearly depicts that Nigeria is multi-lingual in nature. The diverse nature of Nigeria state as a result of tribal differences lays the foundation for the exploitation of what goes on in the country. This is further precipitated on the fact that these ethnic groups though housed in one country, they do not have the same needs, objectives, and aspirations. Based on these ethnic inclinations, it seems cumbersome as it were to treat the Nigeria project without considering the ethnic formation of the country.

Ethnicity therefore has become a strong factor in the political life of Nigeria. Most often ethnic sentiment is used to replace merit and skills, such that round pegs are no longer found in round holes. This chauvinistic behavior has affected the efficiency and credibility of most elections conducted in the country,

specifically the 2011, 2015 and 2019 Presidential elections in Nigeria. Ekeh (1973) argued that ethnicity has flourished because the Nigerian elite who inherited the colonial state have conceptualized development as transferring resources from the civil public to the primordial public. Nigeria electoral choice is largely based on ethnic considerations as successive elections from the colonial era through the post-independence period to the present day elections which have been seriously undermined by ethno-religious cleavages. According to Osaghae (1995), the colonial urban context in Nigeria constitutes the context for ethnicity. It was within the colonial urban context that ethnic groups acquired a common consciousness. Ethnicity is therefore a product of the colonial and post-colonial state in Nigeria. The proliferation of communal association which attracted a large proportion of urban dwellers triggered intra-class and inter-individual socio-economic competition especially among the various town unions. Nnoli (1980) opines that, the pervasive scarcity and inequality of the peripheral capitalist state challenged and stretched the resources of the unions. The failure of the state to provide employment and other services to the citizenry boosted the importance of the unions. Therefore, different ethnic nationalities are now seen in a direct opposition to each other, For instance, prior to the presidential pools in 2011, the letter written by some Northern politicians and Northern Elders Forum to the PDP National Chairman on 17 September 2010 requesting the party leadership to restrain President Goodluck Jonathan from contesting the 2011 elections under the party's platform. In the letter, the group argued that eight-years two term presidency ceded to the North in line with the PDP, which began with former President Umaru Musa Yar'Adua in 2007, must continue through another Northerner following Yar'Adua's death. The group warned that the failure of the ruling PDP to apply the principle of zoning would threaten the stability of Nigeria (Alubo, 2011).

Therefore, looking at the 'contextual' meaning of the above statements by the Northern politicians and Northern Elders Forum, one would not be faulted if he tries to align the post-election violence in the Northern part of the country immediately Goodluck Jonathan's victory was announced to the threat issued by this group. Thus, the 2011 post-election violence in the Northern part of the country targeted at mostly Southerners was a psychological reaction against Goodluck Jonathan's victory. In other words, during the 2015 and 2019 presidential election, they were strong campaign against Jonathan candidacy by most Yoruba (Afenifere) ethnic group who feel marginalized by Jonathan's administration, and the result was their quick alliance with the opposition party that adopted their own son as the vice Presidential candidate. In 2019 Presidential election, it was characterized more by ethnic tension and resentment among the three major ethnic groups in Nigeria towards leadership ascendancy.

For instance, In 2011 Presidential election, PDP won twenty four(24) states alongside FCT with Seventeen Million, Nine Hundred and Five Thousand, Eighty votes (17,905,080) based on ethno-religious affiliation, these 24 states won by PDP have Southern Christians in majority, CPC won twelve states (12) with Ten Million, One Hundred and Twenty Eight thousand and Five Hundred and Nine votes (10,128,509) based on ethno-religious affiliation, and these 12 states won by CPC in 2011 Presidential election is dominated by Northern Muslims respectively. Just like the 2011 Presidential election, the 2015 Presidential election also replicated the same thing. During the 2015 Presidential election, PDP won fifteen states (15) and FCT with Eight Million, Six Hundred and forty Seven Thousand, One Hundred and seventy votes (8,647,170) based on ethno-religious affiliation, Just like in 2011, these states won by PDP are Christian dominated Southern states, APC in 2015 won twenty one (21) states with Thirteen Million, Six Hundred and Thirty Four Thousand, Forty Seven votes (13,634,047) based on ethno-religious affiliation, and these states won by APC have Northern Muslims in majority. In like manner, the 2019 Presidential election also showed religious and ethnic affiliation. For instance, in 2019 presidential election, APC won nineteen (19) states with fifteen million, one hundred and ninety-one thousand and eight hundred and forty-seven votes (15,191,847) based on ethno-religious affiliation and these 19 states won by APC are

Muslim dominated Northern states with a handful of South-western states. In like manner, PDP in 2019 presidential election won seventeen (17) states with eleven million, two hundred and sixty-two thousand and nine hundred and seventy-eight votes (11,262,978) based on ethno-religious affiliation and these 17 states won by PDP have Southern Christians in majority. Comparatively, the 2011, 2015 and 2019 Presidential elections in Nigeria based on the above results, shows the impacts of religion and ethnicity on the voting behavior of the electorate during the 2011, 2015 and 2019 Presidential elections in Nigeria.

V. THE DOMINANCE OF RELIGION IN INFLUENCING VOTING BEHAVIOUR IN NIGERIA SINCE 2011

There is incessant religious conflict occasioned by religious pluralism in the country. Religious politics takes place in a situation where there are diverse religious beliefs and cultural practices. It gives rise to intense religious competition which makes peaceful co-existence elusive (Friday, 2018). Religious beliefs and practices indeed have influence the activities of the Globe with a particular reference to the 2011, 2015 and 2019 presidential elections in Nigeria. Apart from their diverse and extreme force, they have determined to a large extent and exerted much influence on other socio-cultural institutions of human society. The competitive nature of Christianity and Islam in Nigeria and the apparent differences in their beliefs and practices are responsible for all these bloodshed, hatred, persecution discrimination, wars, suicide, bombing, terrorism (Nnadi, 2018). However, in Nigeria, religion is not the only factor that can prompt the above occurrences, meanwhile as a pluralist state; there are other factors like ethnicity which also help in heightening the tension amongst different groups. For instance, Nnoli (1978) stated that, ethnicity is a group's consciousness of being one in relation to other ethnic groups. Emezi (1997) says that, ethnicity means having group consciousness of identifying with larger community. It also means being ethnic centered which entails discriminating against members of other ethnic groups. Ethnicity is the tendency of fighting for one's ethnic group's interest at the expense of other ethnic groups.

However, the results of 2011, 2015 and 2019 Presidential elections in Nigeria showed that electorates voted along different religious lines. For instance, in the 2011 Presidential election, the Muslim candidate Gen. Mohammadu Buhari won almost all the Northern states, regardless of the fact that his main opponent Dr. Goodluck Jonathan a South-South Christian was the then incumbent President. Gen Buhari also rallied round himself his ''Muslim Brotherhood'' against Jonathans candidacy. At the end of the election Jonathan won the election. Therefore, the psychological reactions from Buhari's Muslim supporters caused the three days rioting in some Northern states. As a matter of fact, the riot first started among Muslims, attacking those that supported Jonathan before it now resulted into full scale inter-religious conflict between Muslims and Christians, which killed most Southern Christians living in the Muslim dominated north. In other words, Dr. Goodluck Jonathan also rallied himself with his South-South Christians against the interest of the Muslim candidates with the inscription that '' a vote for a Muslim candidate is tantamount to Islamization of the country''. Therefore, the 2011 and 2015 Presidential elections in Nigeria was a battle field for Christians and Muslims for who controls the state power which has undermined the quest for democratic consolidation in the country. In other words, during the 2019 Presidential election, the two major candidates Alhaji Atiku Abubarkar and Gen. Mohammadu Buhari where both Muslims, this time around, the Nigerian electorate were face with unusual ideological battle whether to support the failed socialist APC government or support the corrupt capitalist PDP opposition, this led to the religious assessment of the candidates by the electorate which was the only means of alignment.

a. Religious Identity and Political Leadership Ascendancy

Religious issues are often closely linked with power politics. Various actors use religion to enhance their own political power. Elites in Nigeria gather their legitimacy from a variety of occupational and identity-based affiliation. In the public sector, there are military, political and bureaucratic elites whose

positions of authority provide access to government resources. These elites distribute state resources both legally and illegally, often developing patron-client relations based on ethnic, religious or regional commonalities. Ideally, religion should not be a matter of any importance in politics and distribution of power in a modern state, more so in a multicultural one like Nigeria. If religion were left at the level of spiritual interaction between individuals and whatever represents God for them, it should not matter to voters and candidates who are interested in solving socio-economic and political problem facing the country. Conversely, religious identity in Nigeria has always been used to predict one's political leadership ascendancy. In most cases in Nigeria, it has been used as a yard stick in measuring candidate's success or failure in an election.

For instance, during the 1999 Presidential election, Pentecostals supported Olusegun Obasanjo of People's Democratic Party. For many Pentecostal leaders, he symbolized the restoration of Christian control over government. In 1995, while in prison, Obasanjo claimed that he was ''born again.'' Once elected, Obasanjo called for national prayer and fasting to assure a successful transition (Freston 2001; Ojo, 2004). In 2012, with presidential election approaching, Obasanjo claimed a divine mandate to win a second term. One of his opponents, Chris Okotie of Justice Party, also claimed a divine mandate to lead Nigeria. In other words, according to Hoffmann (2014), Jonathan's appeal to Northern Christian voters ahead of the 2011 Presidential election, which was powerfully represented by a photo of him kneeling before a popular Pentecostal Christian preacher, served to alienate him from many sections of the Northern Muslim community. Therefore, these religious manipulations by the Nigerian politicians to attain political positions are the negative effect of religion on the development and democratic consolidation in Nigeria.

Most times in Nigeria, the infiltration of religion into the electoral process is consummated with thanksgiving by politicians in churches and Mosques to acknowledge God's sovereignty and faithfulness; and for granting them victory no matter how fraudulent the election might be. It has not been recorded, in recent time that such people were prevented, by religious leaders, who 'ideally' should not be part of any fraud (Familusi, 2008). Today, Nigeria is more polarized along sectional and religious lines than at any time in its history. We are seeing a government and ruling party that has shown every readiness to use religion to divide the country in order to rule over it. However, these incessant portrays of religion by the Nigerian politician before the electorate, have had a negative effect on the voting behavior of the electorates during and after elections in Nigeria. The electorate votes alongside different religious lines, thereby increasing the level of incompetence and incredibility in the country's elections.

b. Religious affiliation as a dominant factor in the 2011 and 2015 Presidential elections in Nigeria

The Nigerian politicians have always appealed to the people's emotions to pursue their hidden agenda. Their understanding of governance can be viewed from the narrow prism of religious sentiments just to attain or retain power. Yet, in any of their political permutation, they care less about fraudster-fraudster ticket, looter-looter ticket or murderer-murderer ticket! In fact, Heads of State who professed either of these religions are culpable for the underdevelopment, pervasive corruption and criminality that characterize the Nigerian state. Religious politics had been used in the past to undermine the unity and integrative efforts of Nigeria. Commenting on the impact religious politics have played on national politics of Nigeria, Senator BabafemiOjudu points to the fact that because of religion politics and others, Nigeria is becoming ''field for suicide bombers''. He maintains ''we are becoming another Iraq and Afghanistan. You know, today it is bomb blast, tomorrow, it is people are killed in Maiduguri, bomb factory is discovered in Yobe'' (Vanguard February 09, 2014).

In Nigerian electoral context, the religious affiliations of persons running for public office are important to most Nigerian voters and are always known to them; indeed, the 2011 and 2015

Presidential election results, shows that religion was the most important bases on which people voted. For instance, in the 2011 and 2015 Presidential elections, the Muslim candidate Gen. Buhari won almost all the states in the Northern part of the country which are mostly Muslim, while the Christian candidates Dr. Jonathan did well in the Southern regions which are mostly dominated by Christians. As a matter of fact, the results of the two elections (2011 and 2015) are clear evidence that Nigerian politician has successfully divided the Nigerian electorates along religious lines. It's no longer one candidate against the other candidate; rather it is Christians against Muslims. The above expression is clear evidence why in recent time the Nigerian state has been in a 'constant religious conflict' which has undermined the country's development agenda.

However, in this part of the study we are faced with determining which of these factors (Religion and Ethnicity) had dominant effect on the electorate during the 2011, 2015 and 2019 Presidential elections in Nigeria. Comparatively, looking at the results gotten from the 2011, 2015 Presidential elections, it shows that religion not ethnicity had dominant effect on the voting behavior of the electorate. For instance, during the 2011 presidential election, those Northern Christians undermined ethnicity and voted for their Christian candidate Dr. Goodluck Jonathan because of religious affiliation which they share in common with Jonathan not minding that he is from another ethnic group. That was why the 2011 post-election violence started by first killing those '' Northern Christians '' who had supported Jonathan's candidacy. For instance, in 2011 Presidential election Dr. Goodluck Jonathan won in some Northern and middle Belt states which includes, Adamawa, Taraba, Benue, Kogi, Kwara, Nasarawa, Plateau, and FCT. However, looking at these above mentioned states, you will find out that these states even though Dr. Goodluck Jonathan is not from any of these zones, but yet they voted for him because of their religious affiliation with Jonathan. Therefore, from the analysis of the results gotten, religion had dominant effect on the voting behavior of the electorates during the 2011 Presidential election in Nigeria. However, in 2015 Presidential election, we can also see the dominance of religion in that particular election. During the 2015 Presidential election, even though that the Muslim candidate Gen. Buhari won most of the Northern states, Dr. Jonathan also won in Taraba state which is outside his ethnic Group, he won in some Middle Belt states like; Nasarawa and Plateau. Nevertheless, Dr. Jonathan did well in some of the Northern and Middle Belt states like Adamawa, Benue, and Kogi, even though that Gen. Buhari won him with little margin. However, during the 2011 and 2015 Presidential elections in Nigeria, there are evidences that show that a candidate from one ethnic group also gets votes from outside his ethnic group based on religious affiliation. Therefore, the results of 2011 and 2015 Presidential elections as expressed above has showed that religious affiliation had dominant effect on the voting behavior of the electorate.In other words, in 2019 Presidential election, religion also played significant role on the two Muslim candidates Atiku and Buhari, as a matter of fact, this time it was more on religious ideological bases between the core Muslim fanatics and the liberated Muslims in the Northern part of the country. The former voted massively for Gen. Buhari while the latter voted for Alhaji Atiku Abubarkar alongside most Christians who believe that Atiku is more liberal compared to Buhari whom most Christians see as a 'Muslim fanatic' and a dictator.

VI. CONCLUSION

Ethnic politics and religion have impacted negatively on the development of the nation in many fronts; namely, socially, politically and economically. It is a cancer requiring sincere commitment with sacrifice from all Nigerians. In order to proffer lasting solution that grins about peace and engender proper national integration, the opinion leaders vis-à-vis religious and political leaders must begin to emphasize the need to embrace peace at all cost. As the country remains multi-religious and ethno-linguistically plural, secularity is the best option that can uphold peace and harmony. It is possible that if Nigeria was not colonized the entrenchment of ethnic sentiment among the different ethnic groups would have been very minimal or

impossible. The federal government should strongly discourage the spirit of indigene-settler phenomenon in the country. Federal Character principle must be strictly implemented both at the state and local levels of government. Fanaticism in religion must be de-emphasized in order to pave way for redesigning Nigerian society towards achieving her development agenda.

RECOMMENDATIONS

- Ethno-religious sentiments must be discouraged among Nigerian politicians. Anti-ethnic/religious sentiments bill should be passed into law in Nigeria. Politicians that sponsor or incite the voters under the umbrella of ethnicity and religion should be either disqualified or face jail terms.
- The practice of plurality of religion in Nigeria should be geared towards attaining sustainable development and political stability. This is essential in being a developed country. Also, the basis of gaining political power must be based on the stability to perform with good moral standards. It should not be based on religious identity.
- It recommends extensive political education, good political leadership and transparent elections for Nigeria to overcome the influence of religion and ethnicity on her electoral process.
- Finally, government across all levels should put more effort in fostering inter-religious dialogue in Nigeria. Closer ties among religious leaders and followers will bring about better understanding and co-operation in areas of national life.

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Analysis Validation Results of Learning Material with POE (Predict-Observe-Explain) Model Based Work Laboratory to Enhance Basic Science Process Skills

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The aim of this research is to analyse material learning instrument with Predict-Observe-Explain based work laboratory to train basic science process skills on the topic of straight motion. Learning tool/instrument is developed by using 4D model. This developmet method is used to generate learning instrument, then its validity and reliability are verified. Data of this study was obtained in the form of validation result from two experts. All of experts are lecturer in Science Post Gradute Program of Universitas Negeri Surabaya. The product of this study is the result of analysis of validation. Based on the result, the validation of learning instrument are very valid and reliable to use.

Index Terms- material learing instrument, POE model, basic science process skills

I. Introduction

Indonesia has developed itself to make educational new in a planned, directed, and sustainable. Renewal of Education in Indonesia is more focused after the issuance of Government Regulation No.32 of 2013 which is a change of government regulation No.19 of 2005 on National Education Standards.
Physics as one of the disciplines of science has a scope of study of natural phenomena that occur in everyday life. Science consists of four components, namely the scientific process, scientific products, scientific attitude, and application of scientific products in everyday life. Described by Chiapetta & Koballa (2010: 15) that there are four dimensions that should be there in science learning, namely (1) science as a way of thinking (2) science as a way of investigating scientific), (3) science as a body of knowledge, and (4) science and its interactions with technology and society (the application of scientific products in everyday life.

Based on the observations and interviews with teachers in SMA Negeri 4 Sidoarjo we get information that in physics learning is still teacher centered. The students didn't get laboratory activity, using material to experiment.
Every physics teacher wants competence to be achieved in every learning outcomes. One such form of competence is the skill of the process of science. Through the science process skills, students are expected to grow a sense of couriousity towards physics so that in the end students will be trained science process skill and ultimately impact on achievement of learning outcomes.

Now, many learning models have been developed. One of the learning models is the POE model. POE model in physics learning is defined as teacher guidance in planning and carrying out learning activities that aim to learners can find concept, principle, theory, principle, rule, and / or physics law by itself through scientific activities that can cultivate scientific attitude. This activity can be done individually or in groups. In the learning model of scientific activities, learners are trained to find their own scientific products through scientific activities that can cultivate a scientific attitude.

The use of learning models will have an impact on student learning outcomes. Student learning outcomes are not only limited to cognitive aspect only, but also psychomotor and affective. Students learning outcomes in this school focus more on cognitive learning outcomes, especially on cognitive products. In addition to product cognitive, cognitive processes (science process skills) also need to be considered to obtain a more optimal learning outcomes. In fact, not all schools teach their students about basic science process skills. The basic science process skills are not the primary demands of learning

competencies in schools, but the basic science process skills become one of the competency standard demands of the curriculum used as described Regulation of the Minister of Education and Culture no. 20 year 2016.

Based on the description, it is necessary to analysis developing learning tools using a laboratory-based POE (Predict-Observe-Explain) learning model to train the skills of the basic science process skills of senior high school students.

II. RESEARCH AND COLLECT IDEA

1. Types of Research

This research is a development research using Predict – Observe – Explain model's to enhance science process skill of grade X senior high school.

2. Subject Research

Research subjects are learning tools POE (Predict, Observe, Explain) -based laboratory work.

3. Procedure Research

Model of learning device development using 4D model. The 4D stages are definitions, design, development, and dissemination.

a. Definition

Need analysis consist of front and analysis, learner analysis, task analysis, concept analysis, and Specifying instructional objectives.

b. Design

Thiagarajan divides the design phase into four activities, namely: 1. Preparation of test standard (constructing criterion-referenced test), 2. Media selection, appropriate with material characteristics and learning objectives, 3. Format selection, namely to study the format of teaching materials that will be developed, 4. Making the initial design (initial design)

c. Development

Consist of *expert appraisal* with following revision, and development testing

d. Dissemination

This research disseminate in international conference and international journal.

4. Design of Research

The design of this research using *randomized control group pretest post test design*.

This design has fulfilled the three basic principles of experimental design namely replication, randomization, and control.

5. Instrument of Research

a. Learning device

Consist of syllaby, lesson plan, student work sheet, test science process skills

b. Instrument to collect data

Consist of product mark from expert

6. Data Analysis Technique

a. Data analysis of Learning tools validation

Data analysis of validation of learning devices includes syllabus, lesson plan, learning materials for students, students work sheet, and test of basic science process skills. Analysis of the results of validation is done by averaging the scores of each component based on instrument of assessment of materials instrument. The average score is obtained by comparing scores from the results of collecting data from all validators with scores.

Data from the validation results were analyzed using qualitative descriptive analysis techniques. Percentage of appraisal match of two validators of physics products based on the inter observer agreement obtained from statistical analysis of percentage of agreement (R) (Borich, 1994):

$$R = \left[1 - \left\{\frac{A - B}{A + B}\right\}\right] \times 100\%$$

Information:
R = percentage of agreement
A = the highest score of 2 validator
B = lowest score of 2 validator

III. RESULTS AD DISCUSSIONS

Learning tools developed using the POE model are declared valid based on the assessment by two validators. According to Sugiyono (2013) the validity assessment is carried out at least by three experts who hold doctoral degrees. According to (Nieven, 2007) the validity of the contents of the learning device relates to the needs and reliability of the theoretical foundation that builds learning devices. Construct validity relates to the consistency of the learning device components with supporting theories and is logically designed.

Based on the Regulation of the Minister of Education and Culture No. 22 of 2016 (2016: 5), the syllabus is a reference for the learning framework for each material study material. He also explained according to (Suyono & Hariyanto, 2015) syllabus is a reference in the preparation of learning plans, management of learning activities, and development of learning outcomes assessment. Syllabus contains: (a) the identity of the subject; (b) school identity; (c) core competencies; (d) basic competencies; (e) subject matter; (f) learning; (g) assessment; (h) time allocation; (i) learning resources.
Based on the assessment of the validity of the syllabus which refers to Table 4.1 shows that the average validity of all components is 3.875 with very valid criteria. So the syllabus can be used in learning. The description of the syllabus is in the RPP scenario.

The Learning Implementation Plan is guided by a copy of the attachment to the Minister of Education and Culture Regulation Number 22 of 2016 (2016: 22). Lesson plan is a plan for face-to-face learning activities for one or more meetings. Lesson plan is a development of the syllabus. RPP is prepared based on basic competencies. The components assessed in the Lesson plan include the format, content, and language used in making lesson plans. The results of the validity of all components were 3.83 with very good criteria. Based on the results of the validator's assessment, Lesson plan is worthy of use. Achievement of good quality is due to the preparation of the Lesson plan after referring to the Minister of Education and Culture Regulation No. 22 of 2016 (2016: 22). The Lesson plan component contains: (a) school identity; (b) the identity of the subject; (c) class / semester; (d) subject matter; (e) time allocation; (f) learning objectives; (g) basic competencies and indicators of competency achievement; (h) learning material that contains relevant facts, concepts, principles and procedures; (i) learning methods; (j) learning media; (k) learning resources; (l) learning steps, and (m) assessment of learning outcomes.

The Student Worksheet compiled by researchers includes straight-motion material. Student work sheet ucontains work steps for students in each one-time face-to-face learning. Student work shhet was developed to support teaching plans. There are two student work sheet, namely for sub-material with uniform linear motion and non uniform linear motion. Student worksheet is prepared by identifying the types of process skills that will be developed when studying the material, as presented by Suyono & Hariyanto (2015). The process skills developed in this Student work sheet are the skills of basic science processes. Matters needed in the preparation of the student work sheet include: a) the title of the student work sheet must be in accordance with the material; (b) Material in accordance with children's development; (c) Material is presented systemically and logically; (d) the material is presented simply and clearly; and (d) support the involvement and willingness of students to actively engage in learning. Validation results from three validators obtained an average of 3.75 with very valid criteria. This shows that student work sheet is suitable for use in learning.
Teaching material developed using the POE model has been validated by two validators with an average value of 3.52 with very valid criteria. Criteria for aspects of assessment by two validators include aspects of content / material, presentation of material, language, and physical. According to (Akbar, 2015) states that good teaching materials include accuracy criteria in presenting, material relevance, communicative, complete and systematic, student centered oriented, correct language rules, and high readability.

The assessment sheet used in this development research in the form of an assessment of science process skills was measured to determine the achievement of basic competencies derived from the indicator provisions. Based on the Regulation of the Minister of Education and Culture No. 23 of 2016 (2016: 2) states that assessment is the process of gathering and processing information to measure student achievement. The assessment was viewed from two aspects, namely through the pretest posttest and the assessment of the LKPD. The assessment of basic science process skills that are measured is the skill of predicting, observing, explaining, and concluding in accordance with the syntax of the POE learning model. The item in the form of a description of 14 items. Content and language aspects determine whether or not the item is valid.

IV. CONCLUSION

Based on the results of research and discussion, the conclusion is POE model learning tool based on laboratory work to train students' basic science process skills that have been developed is very valid and can be used in physics learning activities. The value of validity obtained from the two validators is obtained as follows.

a. The value of the syllabus validity is 3.875 with very good criteria.
b. The value of lesson plan validity is 3.83 with very good criteria.
c. The value of the student work sheet validity is 3.75 with very good criteria.
d. The validity value of teaching material is 3.52 with very good criteria.
e. The value of the validity test cognitive is 3.73 with very good criteria.

V. Acknowledgements

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Modified CSMA/CD protocol using a time slot allocation device

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Abstract- The Carrier Sense Multiple Access with Collision Detection works on the basis of the back-off algorithm which gives a range of time slots for a particular device and a particular packet, once a collision is detected. The node selects a random time slot to retransmit and each time if collision occurs, the probability of success keeps on increasing for that node only, decreasing the probability for other nodes in the network, who might want to transmit packets in an empty time slot. I propose an external device which allocates specific time slots for the nodes who might want to transmit packets after a collision has occurred. This method also utilizes a clock on each node and the channel must be divided into multiple bandwidth gaps.

Index Terms- CSMA/CD, time slot allocation, subdivision of time slots, dynamic time slots

I. Introduction

The Carrier Sense Multiple Access with Collision Detection (CSMA/CD) is a multiple access protocol in which each node senses the media channel before transmitting. If the channel is idle, it transmits the packet with a probability of 1. However, if more than one channel sends their packets at the same time, collision occurs in the channel. A jamming signal is now send by the node across the link to notify every other node to stop their transmissions immediately. The collision counters of the nodes involved in collision now increment by 1 according to the binary exponential back-off algorithm (BEB). The BEB algorithm also calculates a range of time slots ranging from 0 to 2^n-1 where n is the number of collisions experienced by a single node for a single packet transmission. The node then waits a random amount of time before trying to transmit again, assuming that no other station has started transmitting in the meantime. There are two problems associated with this method. First, the nodes must wait a particular amount of time before transmitting again. In the meantime, the channel remains empty and other nodes cannot utilize the resources for transmitting. This is the packet starvation effect and significantly reduces the efficiency of CSMA/CD. Second, the time slots selected by the nodes which underwent collision is random. Consider two nodes trying to retransmit after an initial first collision. In this situation, according to BEB algorithm the time slots can either be 0 or 1. If both the nodes select 0 or 1, the probability of success is 50% only. Also, as the number of collisions increases for both the nodes, one node always transmits in greater priority compared to the other. The probability of success decreases further if more than 2 nodes suffer collision in the first occurrence itself.

II. Research Idea

In my variant of CSMA/CD, the channel is divided into multiple bandwidth gaps allocated for each of the nodes. The node which wants to transmit senses if the channel is idle. Then it sends the packet with 100% probability using the full capacity of the channel. If a collision occurs, a device attached to the channel then sends a jamming signal across the link to notify all the nodes to immediately stop all transmission as the channel may be busy. Now, after the signal has been sent, each of the nodes which want to transmit, send a signal in their respective bandwidth to the external device. The nodes which experienced a collision just before, also send their corresponding collision counters, as part of the back-off algorithm. The device marks all the bandwidths that want to transmit next and gets the maximum of all collision counters. Say that the maximum collision counter for a packet is n, therefore we have a total of 0 to 2^n-1 time slots. My idea aims at reducing the collision occurrence probability to minimum after an initial collision has occurred. Say a collision occurs between two nodes A and B, the counter for each increases to 1. The device collects this data and calculates the two time slots 0 and 1. Now, in normal CSMA/CD, both the nodes can randomly select any time slot. However, in this alternative, say nodes A and B want to transmit again. Then the device let say, notifies node A to use time slot 0 and node B to use time slot 1 through their respective bandwidths. A clock attached to both the nodes tells the nodes when their allocated slot comes up and the nodes then transmit packets using the full capacity of the channel. Since the time slots are different, the chances of collision are reduced to almost 0%. Here, we can see that the external device 'allocates' time slots to the transmitting nodes. Now, let us say if a third node also wants to transmit along with A and B, but we only have two time slots 0 and 1. In this case, one of the time slots is subdivided into equal time slots for any of the two nodes and transmission occurs accordingly. I also propose a timer attached to each node to estimate the time required to send a single packet and this data must be sent to the device. In a situation such as if the subdivided time slots are not big enough to send a complete packet, the device may extend the duration of the time slots. This strategy is required in the earlier stages of a packet transmission, when the collision counters are less than 1 or 2 and many nodes want to transmit next after the initial collision has occurred. Also some collisions may occur due to propagation delay. Once the total number of time

slots following a particular collision becomes greater than or equal to the number of nodes in the network, each node transmits with almost 0% probability thereafter. Until then, the available time slots are divided according to the number of nodes. My idea implements the concept of pipelining to the transmission of packets. In the event of a collision between node A and B, where A sends out its first packet, the unoccupied time slots can be used by say node C to send its second packet and so on. Hence, the channel is occupied most of the times by some node or the other trying to transmit. This significantly reduces the packet starvation effect.

III. RELATED RESEARCH

While coming up with a variant for CSMA/CD, I studied about some other protocol(s) which helped me frame my idea and apply it to existing CSMA/CD. These protocols are briefly discussed below:

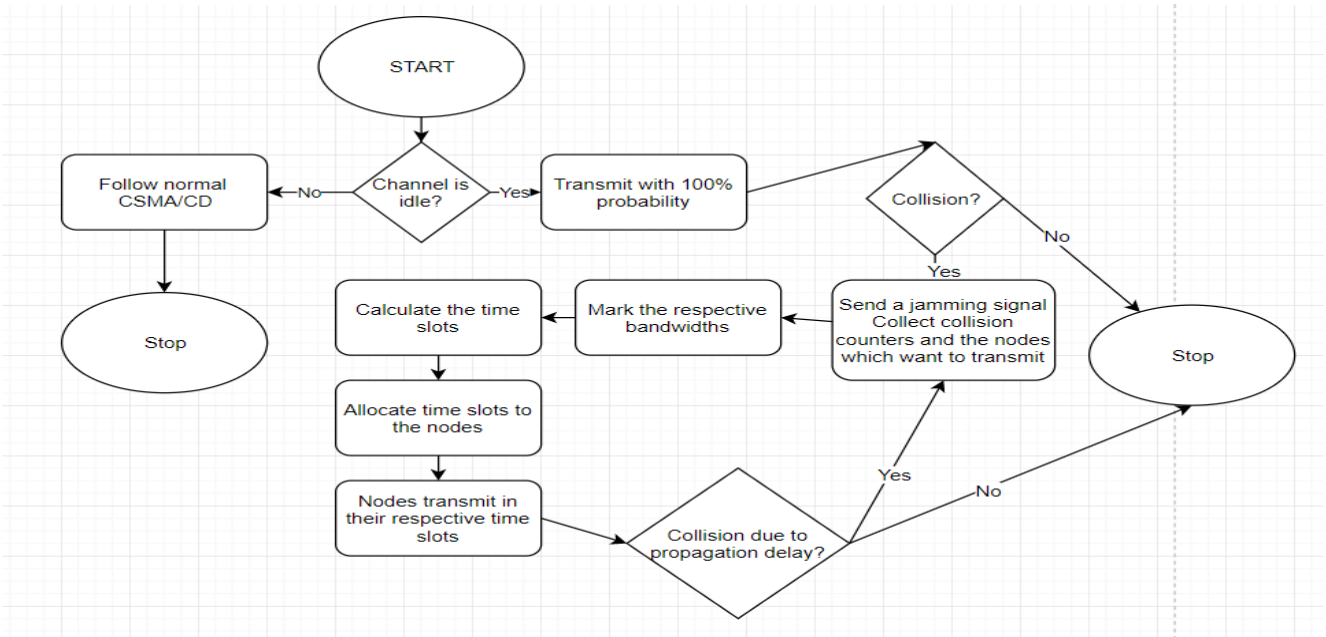
Time Division Multiple Access (TDMA)

TDMA is a multiple access protocol in which the same frequency channel is divided into different time slots for each of the nodes in the network. Nodes can transmit in the allocated time slot in a sequential manner. This slot allocation remains fixed during the entire communication process. In my idea, however, there are different time slots for different nodes but these time slot allocations are dynamic in nature as they can change depending upon the nodes that want to transmit just after a collision and the selection of time slots by the external device which may not be the same for every collision. The period of time assigned to a time slot for a station is determined by the number of TDMA channels on a carrier frequency. In TDMA, for most of the cases the entire system bandwidth for an interval of time is not assigned to a station. In reality, the frequency of the system is divided into sub-bands called carrier frequencies. In my alternative, however, the time period of the time slots for a single collision may change depending upon the total transmission time required for one packet. TDMA also requires accurate synchronization between the transmitter and the receiver and the inability to maintain this can cause interference with other devices.

IV. PROBLEMS WITH THE IDEA

In normal CSMA/CD, the nodes after a collision wait a random period of time which is the duration of the time slot. In this alternative, however, since the duration of a time slot can be extended in case of an overflow of frames, nodes may need to wait a significant amount of time before the previous node have finished transmitting. This occurs during the beginning stages of a packet transmission. As one might notice, the allocation of time slots is properly distributed if there are more number of time slots. Hence, this variant requires some initial collisions to occur to get some collision counters which are not zero in order to give the time slots for the next nodes waiting to transmit. Moreover, a particular network may have an upper limit of time duration i.e. the maximum amount of time that can be permitted for a time slot. If say in a situation where the time slot has reached its limit but the subdivided slots are not able to accommodate a packet, it causes error in the network. Hence, it is preferable that this method be used for smaller networks where the number of nodes are limited in order to keep the required number of collisions as less as possible.

V. ILLUSTRATION



VI. CONCLUSION

My idea simply takes an aspect of Time Division Multiple Access (TDMA) and combines it with the existing CSMA/CD in order to bring down the probability of collision to as low as possible. The only difference is that in TDMA, the time slots are fixed for the nodes and are dynamic while here it is variable for all the nodes for a particular packet transmission. It outperforms the original CSMA/CD in terms of collision probability as long as the number of nodes in the network is limited otherwise in a worst case scenario, in order to allocate the time slots evenly, the number of collisions may increase to an extent that reduces the efficiency of the system.

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Policy Provisions and Grass Root Realities-A Macro Perspective

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Abstract- This article explores government's educational policies focusing on quality improvement of children studying in school. Number of commissions has been undertaken by the government to look in to the structural problem of education in the country. Some of the crucial ones are education commission- 1964 which is also commonly called as Kothari commission, the National education policy 1968 and 1986 will be discussed in details in the below chapter.

The article will focus of the commissions and committees set-up in independent India and critically analysis the recommendations and its impact at grassroots.

Index Terms- National policy on Education, National framework for education, Sarva Shiksha Abhiyan, Right of children to free and compulsory education act 2009.

I. Introduction

Education as a tool for socio-economic development has been emphasized by various scholars and one of the earliest thinkers is Condorcet[1]- he argued that education is an implied right in the constitution. He further stated, there was a need to make it as a right as it would increase the competence of the participant in the society, leading to better and more reasonable outcomes. He further believed that quality of inputs to the legislative process would improve if the quality of education is improved.

II. II. Education Commissions of Independent India

In India since independence, there has been serious effort put in by government to improve the educational status of the country. The drawback of educational structure were reviewed by number of commissions and committees, particularly by the ***University Education commission(1948-49)also known as Radha Krishna commission*** the first education commission of independent India. The aim of the commission was to study the university education in India and suggest improvement for the development of university education in line with the socio-economic development during post independent India. The commission recommended revision of pay scale of teachers so that it attracts talent to improve the educational status at university level and also raise the standard of education as per international standard.

Some of the limitation of the commission was it could able to identify the gap in the university education system but did not suggest any concrete action to improve the situation. And another limitation was it has not gone deep into study the medium of instruction as it is a crucial factor of quality education even today.

The university education commission also identified that the country's secondary education remained the weakest link in the education system and needed urgent attention. Hence ***secondary education commission was set up -1952-53 also known as Mudaliar commission***, to improve the existing secondary education for nation building. Some of the findings of the commission was it was bookish and examination orientation education very limited scope for extra-curricular activities and also there is gap in teacher-student communication. Another very crucial finding was the quality of teachers available in school. The major suggestion of the secondary education commission was reorganizing the secondary education and recommended for duration of seven years between the age group of 11-17 years. The curriculum should be adaptable to meet the need of different category of student. The curriculum should bridge the gap between school and the communities. The commission recommended on mother tongue based education through-out the secondary school but it did mentioned- "subject to that for linguistic minorities special facilities should be made available on the line suggested by central advisory board of education"

Few of the critic of the commission were the recommendation was the recommendation were given hastily which is a time taking task and even today it has not been able to implement these recommendation. This commission is very broad and no specific provisions made for marginalized communities including tribal and girls children.

National committee on women's education (1958-1959) headed by Durgabai Deshmukh was set-up to review the gap in girl's education and recommend ways to bridge the gap and explore possibilities for vocational education for women. As per the recommendation government of India set up national council for women's education in 1959 and created a special unit in the ministry of education to deal with the problem of girl's education and sponsored several schemes and provided large amount of fund for the expansion of girl's education. It was a right move in the policy direction but even today the women literacy rate is only 65.46 percent compared to men 82.14 percent.[2]

The ***education commission (1964-1966***) also popularly known as Kothari commission, was set up to advice government

[1] Nicolas de Condorcet, French philosopher(1743-1794)

[2] Census report 2011

on "the national pattern of education and on the general principles and policies for the development of the education at all stages and in all aspects of education". The major recommendation of the commission was the standardization of educational system on 10+2+3 pattern uniform to the country. It recommended a common public education system to be introduced and it should be vocationalized by introducing work experience as part of the education.

The commission also advised on days of instruction to be followed at all stages of education and reducing number of national holidays at educational institutions. Further linking of college to neighborhood schools were recommended and utilization of school space and facilities 8 hours a day throughout the year, establishment of book banks, identification of talents and provision of scholarships, setting up of day study and residential facilities and opportunities for students to earn while studying. The commission strongly recommended for free education up to secondary level. It also emphasized on promoting women education and government should set up state and central level institutions to administer it.

The commission recommended for a three language formula to be administered while designing the curriculum for lower primary to secondary school. At lower primary level the curriculum should have mother tongue or the regional language as one of the subject and in high school two language subject should be there apart of other subject on science and social sciences.

Another important aspect of Kothari commission was taking a strong note of the Dhebar commission[3] recommendations to strengthening of primary education of tribal children across the country. As part of the Dhebar commission's recommendation- "An intensive efforts have to be made among tribal to provide five years of effective education to all children in tribal areas. Initiate targeted intervention for tribal girl children to encourage them towards formal education. The teacher servicing in tribal areas should be conversant with the tribal language. The medium of education in the first two years of the schooling should be specially prepared in mother tongue. During this first two years the children should be taught by oral instruction in the regional language and their familiarity and command over it to improve. By the third year, the regional language shall be the medium of education. To attract children to school and retain them the school curriculum should be harmonized with the environment. Vacations and holidays should coincide with agricultural season and forest operations and socio- cultural festivities. The school hours should be fixed to suit the work schedule of a tribal household where children are required to support their parents. The introduction of work-experience and emphasis on art education would attract the tribal children as would the teaching of folk songs, stories and riddles which are very popular with the tribal. Tribal games and archery as well as tribal music and dances should be introduced as an extracurricular activity. In several tribal areas, the commission observed that there is a lack of rapport between the teachers and local population i.e. tribal community." Hence the Kothari commission recommended there should be separate sub-cadres in which persons will be selected on the basis of competency and aptitude for work with the tribal children with special incentives for their commitment.

This process of language transition from mother tongue to regional language was crucial and Kothari commission did took strong note of it but while recommending it only talked about three languages subject to be available for children to study as language subject and did not specifically mentioned on mother tongue based teaching learning in schools.

Based on the report and recommendations of Kothari commission, formulation of the first ***National policy on Education (NPE) 1968***, was done by government of India. The NPE aimed in a radical restructuring and equalize educational opportunities in order to achieve national integration and greater cultural and economic development of the country. The NPE called for fulfilling compulsory education for all children up to the age of 14, as stipulated by the Constitution of India. Better training for teacher and selection of well equipped and qualified teachers was one of the major features. The NPE, 1968 stressed on increase of spending in education to six percent of the national income (GDP) from two percent.

In accordance with the NPE 1968, the government of India has formulated certain principles to promote the development of education in the country. These principles are:

Free and Compulsory Education: According to the Indian Constitution, education should be free and compulsory up to the age of 14. Steps should be taken to ensure that the child, enrolled in the school, should successfully complete the course.

Education of Teachers: The teacher is the most important person to determine the quality of education in the country. She should be honored in society. Her emoluments and service standard should be increased, with due regard to her responsibilities and qualifications. Proper attention should be given to quality teacher education. They should, also, get academic freedom to write, to study and to speak on national and international issues.

Language Development: The policy had, also, emphasized on the development of Indian, as well as foreign languages, in the country. The three language formula should be introduced, in which a student at the secondary level, should know Hindi, English and the regional language of his state. The language, Sanskrit, has been included as an optional subject, at the secondary level. Language education was seen as essential to reduce the gap between the Policy maker and general population.

Education Opportunity for all: Under this policy, every child of the country should get education, irrespective of caste, religion, region or whatever the case may be. Special emphasis should be given to backward classes, minority children, girls and physically challenged children to avail the education facilities.

Uniform Education Structure: The structure of education should be uniform throughout the country. It should be a 10+2+3 pattern from higher secondary to college level. During the course of study, each student should get to play sports and games. They should also develop the quality of work experience and should participate in programmes related to National construction and Community services.

[3] Dhebar commission (1960-61) The scheduled areas and scheduled tribe commission

As per the principles outlined under NEP 1968, it also advised government to review the progress of education in the country in a regular interval and suggest remedial mechanism for future development of education.

Subsequently a ***new policy on Education*** was formulated in 1086, which incorporated the principle stated by the education policy 1968. Apart from the principles of education policy 1968, the new policy on Education emphasized on removal of disparities and to equalize educational opportunity, especially for women, Scheduled Tribes (ST) and the Scheduled Caste (SC) communities. To achieve such a social integration, the new policy on Education called for expanding scholarships, adult education, recruiting more teachers from the tribal areas, incentives for poor families to send their children to school regularly, development of new institutions and providing housing and services. The new policy on education stressed on child-centered approach in primary education, and initiated Operation Blackboard to improve quality education at all primary schools nationwide. The policy added to the Open University system with the Indira Gandhi National Open University, which was established in 1985. The policy also advised to establish rural university model, based on the philosophy of Mahatma Gandhi, to promote economic and social development at the grassroots level in rural India. Like the education policy 1968, the new policy on education also advised government of India to increase the spending on education from 2 percent to 6 percent GDP.

Hence to operationalize National policy on education 1986, Acharya Ramamurti committee- 1992 was constituted and formulated plan of Action for the policy. The National Programme of Action- (POA-1992) aimed to achieve the universal enrollment and retention of children and successful completion of education upto 14 years. The POA, outline for substantial improvement in quality of education to enable all children to essential level of learning outcome. It also suggested a decentralized planning and participatory governance in school, stressing on reaching out to marginalized communities, women and ensuring equal educational opportunities for all.

Taking it from the POA 1992 provisions, District Primary Education Programme (1994-2009) emerged as a response to various challenges faced by primary education sector in the country. DPEP adopts a holistic approach and has the essential ingredients required to universalize access to retention and improve learning achievement and reduces disparities among social groups. Adopting an area specific approach with district as the unit of planning, the key strategies of the programme was to retain the conceptuality and sensitivity to local conditions and ensuring full participation of the community.

The DPEP initiative has brought changes to enrollment, retention and learning outcome of children in government school but the decentralized management of school and community participation in school management was not actually materialized at ground level.

III. Sarva Shikha Abhiyan

Sarva Shikha Abhiyan (Education for all movement) 2000-2001, aimed at the universalization of elementary education "in a time bound manner", the 86th amendment of the constitution of the India making free and compulsory education to children between the age of 6-14 years, a fundamental rights. The roots of SSA go back to 1994 DPEP which was also aiming for universalization of primary education. SSA provides the umbrella under which all the programmes of universalization of elementary education have been merged to provide access to all children in the age group of 6-14 years through formal primary education or alternative equivalent educational provisions. Completion of five years of primary education and eight years of elementary education and ensuring quality education has been one of the important aspects of SSA. To achieve the overall goal of SSA number of scheme were introduced nationwide. Some of the major schemes were:

1. Education Guarantee scheme and Alternative and Innovative Education.
2. National programme of Nutritional support to primary education(Midday Meal)
3. National programme for education of girls at elementary level.
4. Kasturba Gandhi Balika Vidyalaya
5. Prathmik Shikha Kosh

SSA has been successful in enrollment of children, as per 2011census 98.85 percent enrollment rate for boys and 101.43 percent enrolment for girls. It could able comply mostly with infrastructural standard. But it struggle with retention of children, nationally 29 percent of children dropout before completing five years of primary education and 43 percent dropout before finishing upper primary school. Below is the table highlighting the dropout rate in India:

Table: 4.1 Drop-out rate in percent:

Class	Tribal Boys	All Boys	Tribal Girls	All Girls	Tribal Total	All Total	Gap
I-V	37.2	28.7	33.9	25.1	35.6	27	8.6
VI-VIII	54.7	40.3	55.4	41	55	40.6	14.4
I-X	70.6	50.4	71.3	47.9	70.9	49.3	21.6

Source: statistic of School Education 2010-2011

Even though there is a hundred percent enrollment of children at entry level in School but gradually the children dropout rate increases specially tribal girls dropout rate of the school. The common perceptions towards reason for dropout of children from school remain as economic condition and social background of the family. And some research studies also indicate poverty as a major reason of drop-out, other reasons are inadequate facilities, problem of medium of instruction, inadequate training to teachers and their indifferent attitude, lack of teaching and learning materials, absence of proper inspection and supervision of schools as the reasons of drop-out. J.Sarma (1998) conducted a study on 'Problems and prospects of Disadvantaged groups of Assam with special reference to gender issues among scheduled castes and Scheduled Tribe children at primary level. The findings reveals that in spite of several efforts made by the government through SSA, a large number of SC and ST children of school going age group are still remained out of school in Assam. Dropout rates

were also higher in case of girls 54.05 percent of ST (hills rural) children never enrolled in any educational institution.

Curriculum and medium of Instruction plays a crucial role in quality education and one of the major reasons for dropout of children in school. The national council for educational research and training was established in 1961by government of India to advise and assist government on policies and programmes for qualitative improvement in school education. NCERT is also a nodal agency for achieving the goal of universalization of elementary education. Hence the national curriculum framework is one of the four National curriculum frameworks published in 1975, 1988, 2000 and finally in 2005 by NCERT to contribute to achieve universalization of elementary education.

IV. National Curriculum Framework

I will be discussing only the National Curriculum Framework 2005, As per this policy document- provides the framework for making school syllabus, developing textbooks and teaching practices within the school education system in India. The NCF 2005 draw its framework from the document "Education as Learning without Burden" and national policy on education 1986. NCF stressed on learning through enjoyable and in a participatory way. The school curriculum should focus on holistic development to enhance physical and mental development in individual as well as with peer interaction. Learning should be enjoyable and should relate to real life experiences involving concepts and deeper understanding of the theme. Constructive learning should be part of the curriculum and student should be encouraged to interact with peers, teachers and communities which would open up rich learning opportunities for the children. To make the learning foundation strong and firm, School should provide sufficient space to explore and develop rational thinking and have knowledge of concepts, language etc.

The NCF recommended three language formula systems to be followed; medium of instruction should be home language. The first language to be studied must be the mother tongue or the regional language. The second language should be Hindi in Hindi speaking states and for non Hindi speaking some other modern Indian language or English. And the third language, in Hindi speaking state will be English or a modern Indian language not studied as second language and for non Hindi speaking state it will be English or a modern Indian language not studied as second language.

Some of the limitation of the National curriculum framework 2005 has been ignoring multi-grade teaching especially for primary schools. In India due to uneven distribution of teacher deployment and teacher unwillingness to relocate to rural and tribal areas there are single teachers school in these areas. Even through Government claimed to have 24:1 ratio at primary level[4] but in reality there are 92, 275 single teacher school in India.[5] There is a urgent need to come up with a clear framework on multi-grade teaching learning to ensure quality education taking place in school.

The three language formula stated by the NCF, has not been implemented effectively all over the country. Different states interpreted this formula in different ways and as a result its implementation has been uneven. In many cases, the formula has become 3+/-1 formula. For the speaker of linguistic minority the three language formula become four language formula as they had to learn their mother tongue, the dominant regional language, English and Hindi. In many of the Hindi speaking states Sanskrit become the third language instead of any modern Indian language. Whereas the non Hindi speaking states it operate like two language formula, In North Eastern states either English/Hindi. Even European languages were considered as third language. NCF should have recommended ways to implement three languages especially for linguistic minorities including tribal children. Below is one of the examples of experimenting with three language formula with tribal children.

In 2003, Government of India, under SSA approached states with substantial tribal population to introduce mother tongue based Multi-Lingual Education (MLE) for tribal children, the same year, Andhra Pradesh government decided to start an experimental pilot project to provide MLE in eight tribal languages in 1000 schools. To impart the MLE framework new curriculum, text books, teaching learning material and teacher training programme were also prepared. Under the programme teachers were trained extensively to deal with the issues of multilingual education. The tribal language was written in the script of the state or the regional language with some modifications to accommodate the linguistic features that were not common among the two languages. Then, special efforts were made to incorporate the cultural and daily life experiences of the children and indigenous knowledge system s, games, songs and stories from the tribal communities into the curriculum, textbooks, pictures and illustrations, teaching learning materials and children's learning activities.

The NCF 2005 has also not clearly spelt out on teacher training to implement three language formula. Unless teacher's pedagogies include the language practices of the learner, and unless all the learners are taught in a manner that is in consonance with their cultural and language practices, the education system cannot expect the involvement of the children in the learning process in the classroom and the objective of an active and aware learning process cannot happen.

V. The Right to Free and Compulsory Education Act 2009

Another Crucial step taken by government of India was The Right to Free and Compulsory Education Act 2009(RTE), which describes the modalities of the importance of free and compulsory education for children between the age of 6-14 years in India under Article 21A of constitution of India. The RTE act provides for the rights of children to free and compulsory education till completion of elementary education in a neighbourhood school. It clarifies that compulsory education means obligation of the appropriate government authority to provide free elementary education and

[4] Press release issued by Ministry of Human resource development –February 2017

[5] Right to Education Act compliance report 2019

ensure compulsory admission, attendance and completion of elementary education to every child in 6-14 years age group. "Free" means that no child shall be liable to pay any kind of fee or charges or expenses which may prevent any child from pursuing and completing elementary education. It also makes provision for a out of school child to be admitted to an age appropriate class.

It specifies the duties and responsibilities of appropriate governments, local authorities and parents in providing free and compulsory education, and sharing of financial and other responsibilities between the central and state governments. The RTE act lays down the norms and standards relating to pupil teacher ratio (PTR) school buildings and infrastructure, School working days, teachers working hours and rational deployment of teacher and prohibits on deployment of teacher for non-educational work. The Act prescribes norms for appointment of professionally trained teacher with the requisite entry and academic qualifications.

It prohibits physical punishment and mental harassment of children, screening procedures for admission of children, collection of fee and private tuition by government school teacher. And also no detention of any child till they complete elementary school.

The act provides for development of curriculum in consonance with the values enshrined in the constitution and which would ensure the overall development of the child, building on child knowledge, potentiality and talent through a system of child friendly and child centered learning.

Section 29(2)(f) of the RTE act 2009 states that" Medium of instructions shall, as far as practicable, be in child's mother tongue". However the curriculum and evaluation framework are to be decided by the state governments and it is up to them to decide the medium of instruction in the school. Several states have taken appropriate steps to impart education to the child in their mother tongue. In Assam Bodo children have the privilege to learn in their own mother tongue.

However the RTE act 2009 has been criticized for being hastily drafted and not consulting groups actively working in the field of education, not considering on the quality aspect of the educational improvement and excluding children from 0-6 and 14-18 years of children. Many of the provisions were seen as continuation from Sarva Shiksha Abhiyan and District Primary Education programme.

As it has been widely discussed about the quality of education provided by government schools and its effectiveness, it suffers from shortage of well qualified teachers and infrastructural gaps. Several areas, specially tribal areas do not even have schools, to address this quality aspect RTE provisioned for 25 percent quota in privately run school but faced criticism of partly transferring its constitutional obligation of providing free and compulsory elementary education of children to non state actors, while continue to collect 2 percent cess on the total tax payable for primary education.

Another criticism of complying with mother tongue based medium of instruction as the authorities lack competency in designing effective teaching learning and assessments tool for local languages which in turn hampers measuring of learning outcomes. If children are learning in multiple languages the assessment needs to take cognizance of the different pace of the kids in core skills such as numeracy, literacy and problem solving.

VI. Conclusion

While efforts put in by government of India over the past couple of decades has resulted in substantially increased in enrollment of children across the country through DPEP and SSA. But quality of education has not improved significantly, particularly in the early years of schooling. Children who do not learn to read in the first few years of schooling are more likely to repeat their classes and eventually drop out of school. This trend of children leaving school at early years leads to educational attainment gap between readers and non readers increases overtime.

It is equally important to note that a large proportion of children in our country in secondary schools do not acquire even the most basic competencies in Language. Because of lack of age appropriate learning at primary school, children at secondary schools lack critical abilities in language that not only hinder their ability to transact curricula but also over burden secondary schools to deal with the learning deficits.

To overcome this learning deficit, one of the recommendations will be to strengthen the school governance system through promoting active parent teachers interaction and Community's involvement in preparation of curriculum, textbooks and teaching learning material. The teaching learning materials should depict the local culture and daily live experience of children.

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A Basic Approach for Designing Pitch, Yaw and Supervisory Control System of Wind Turbines

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Abstract— This paper proposes a strategy for designing pitch, yaw and supervisory control of wind turbine including a 3D modeling of the whole system. The system is considered here to avoid mechanical losses as well as maintain a constant rotor speed in wind turbine. The wind speed will be varying from time to time, so to protect the turbine from any kind of damage due to wind speed variation, the pitch control system is designed. The direction of nacelle is also varying with time to capture the maximum energy from the air, a yaw control system is premeditated. To analyze operating conditions for determining the state of turbine to enable or disable operation such as bringing the turbine to stop by applying parking brake or releasing the brake enabling the turbine to spin, supervisory control system is introduced as an intermediary link in between pitch and yaw control system to avoid undesirable events. The 3D model, pitch, yaw and supervisory control system of wind turbine has been simulated in MATLAB Simulink™ and simulation results also show the coherence with the proposed analogy.

Index Terms— *Blade forces; Pitch, Yaw and Supervisory Control; 3D Modeling of Wind Turbine; Renewable Energy.*

INTRODUCTION

Since 1979, the Chinese economy has increased at an average annual rate of 10%, doubling every 7 years. To maintain this high rate of economic growth, China needs to continue expanding its electricity supply. China is rich in coal reserves, but limited in gas and oil supply. Electricity generation based on coal is highly polluting and carbon-intensive, thus creating significant political and international pressure [1]. As an alternative, China has so far achieved remarkable progress in wind energy development. Wind power now represents 4% of the overall power generation [2] which is largely due to the country's vast wind resource, relative technical maturity and relatively low cost compared to other renewable resources. In 2018, China has produced 366,000 GWh [3] electricity from wind energy having the capacity of 184,260 MW [4]. To capture the maximum power from wind, after the capital costs of commissioning wind turbine generators, the biggest costs are operations, maintenance and insurance. Reducing maintenance and operating costs can considerably reduce the payback period and provide the impetus for investment and extensive acceptance of this clean energy source.

A wind turbine has a tower, in top of the tower there sits the nacelle. Inside the nacelle, we will find the generator which is connected to the electrical grid. The wind turbine attempts to spin the generator at a constant speed or at its rated speed. For the generator to spin, we have a hub which can rotate and blades are connected to the hub. The wind strikes the blades which enables the hub to rotate and the hub is connected to the generator with a gear train. In order to control the lift and drag which the blades generate, a yaw control system that points the wind turbine into the incoming wind and there is a pitch control system that controls the angle of the blades in order to control how much lift and drag the blades produce. The gearbox interconnects the rotor shaft and generator shaft. The power generated from the generator is sent to the grid by a transformer. A basic structure of wind turbine is given below in Fig. 1.

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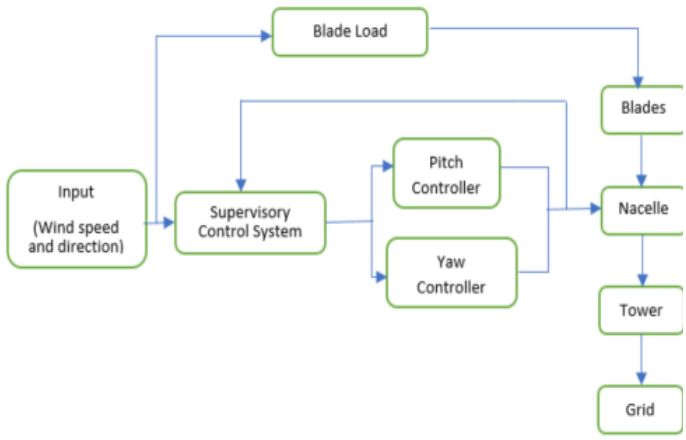
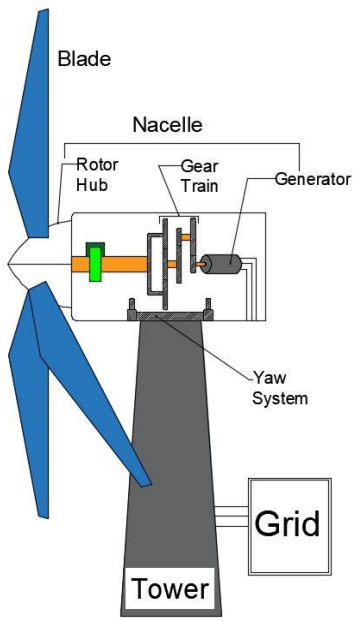


(a) Block diagram of a wind turbine



b) Main components of wind turbine

Figure 1: Basic structure of Wind Turbine

The fundamental equation of wind power answers the most basic quantitative question-how much energy can be generated by a wind turbine per unit time. The power of the wind is the rate of wind energy flow through an open window. Wind energy depends on three factors- a) amount of air (the volume of air in consideration), b) speed of air (the magnitude of its velocity), c) mass of air (related to its volume via density). In other words, wind power is the rate of kinetic energy flow. Using the fluid mechanics concept, the fundamental equation in power analysis can be derived [5].

$$P = \frac{1}{2} \cdot \rho \cdot A \cdot v^3 \quad (1)$$

Where P = available power of wind; ρ = density of air; A = swept area by the wind; v = velocity of the wind. It exhibits a highly nonlinear cubic dependency on wind speed. Wind turbines reach the highest efficiency at a wind speed between 10 and 15 ms^{-1}. Above this wind speed, the power output of the rotor must be controlled to reduce driving forces on the rotor blades as well as the load on the whole wind turbine structure [6]. High winds occur only for short periods and hence have little influence in terms of energy production. All wind turbines are designed with a type of power control. There are different ways to control aerodynamic forces on the turbine rotor and therefore limit the power in high winds in order to avoid damage to the wind turbine [7].

Advanced control strategies for wind turbines have been investigated over a few decades which are broadly classified into the classic control, modern control and intelligent control [8] as shown in Table I.

Table I Classification of Wind Turbine Control Strategy

Control theory	Classical control	Modern control	Intelligent control
Control objective	SISO, LTI system	SISO/SIMO/MISO/MIMO, Linear/nonlinear time variant/invariant/ univariate/multivariate, Discrete/continuous system	Large scale, Complex structure, Incomplete information, Multivariate system
Analysis method	Frequency domain approach	Time-domain approach	Time-domain approach
Mathematical model	Transfer function	State-Space equation	Subsystem
Mathematical tool	Laplace transform	Matrix Algebra, Vector-space theory	Cybernetics, Operation research, Artificial intelligence
Control method	PID Control	Optimal Control, Robust Control, Adaptive Control, Sliding Model Control, Predictive Model Control	Bayesian Control, Fuzzy Control, Neural network Control, Genetic Algorithm, Intelligent agents

In the partial load regime, the main control objective is to capture the maximum power available from the wind. The rotor speed and pitch angle should be controlled in a way such that

the maximum power point tracking (MPPT) is obtained. To achieve the MPPT, the classical PI controller is used which is simple and practical, but needs to tune the PI parameters repeatedly. In the full load regime, the main control objectives are to regulate both the generator power and speed at their rated values, respectively. These objectives can be achieved by manipulating the desired pitch angle and/or generator torque set-point.

Sometimes unwanted loads are caused by the wind at the blades such as sudden changes in wind direction, uneven loading of blades, wind turbulence and accumulation of dust on the blades. All these factors influence the generation rate of electric power. The basic formulation and governing equations regarding wind turbine modelling has been discussed in section 2 and 3D modeling of the whole project has been developed using various contents like *Simscape multibody, Simmechanics, Simhydraulics* in MATLAB. In section 3, the control schemes required for capturing maximum power from wind have been discussed named as pitch, yaw and supervisory control systems. The mechanical power of the wind turbine is controlled by the pitch angle adjustment of the blades. If the wind speed is greater than the rated wind speed, the pitching angle should be increased and if it's lesser than rated speed, the pitching angle should be reduced. For the sudden change in wind direction, the yaw action should occur i.e. move the whole nacelle in the direction to the upcoming wind. So, a single control system with four servo motors at 90^0 apart from each other has been considered which should operate simultaneously. After that, an overall supervisory control system is required to monitor the state of the turbine in case of emergency or during the time of maintenance and to identify statutory constraints of the turbine like whether its running on rated speed or not, generator becomes saturated or not etc. Different types of simulations using MATLAB are performed and results have been discussed in section 4 and 5. Simulation parameters have been given in the *Appendix (Part B)*. Finally, the paper concludes with a generic discussion and suggestion about future scopes of work.

WIND TURBINE MODELING

Modeling is a basic tool for analysis such as optimization, design and control. Wind energy conversion systems are very different in nature from conventional generators and therefore dynamic studies must be addressed in order to integrate wind power into the power system. Models used for steady-state analysis are extremely simple while the dynamic models for various types of analysis related to system dynamics: stability, control system and optimization. Modern wind turbine generator systems are constructed mainly as systems with a horizontal axis of rotation, a wind wheel consisting of three blades, a high speed asynchronous generator (also known as induction generator) and a gear box. Asynchronous generators are used because of their advantages, such as simplicity of construction, possibilities of operating at various operational conditions and low investment and operating costs. A typical wind energy conversion system is displayed in Fig. 2.

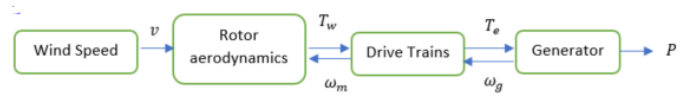


Figure 2: Wind turbine energy conversion scheme

B. *Modeling of Blades*

The forces that are acting on rotor blades which are generated from the wind speed during the conversion of the kinetic energy of the wind into mechanical power then converted into electrical power is described by the aerodynamic system [9]. There are mainly two forces on the blade which cause the moment in the blades, the forces are lift and drag force. The torque and thrust force are resolved from the tangential component and an axial component respectively. The forces acting on the blades are shown in Fig. 3.

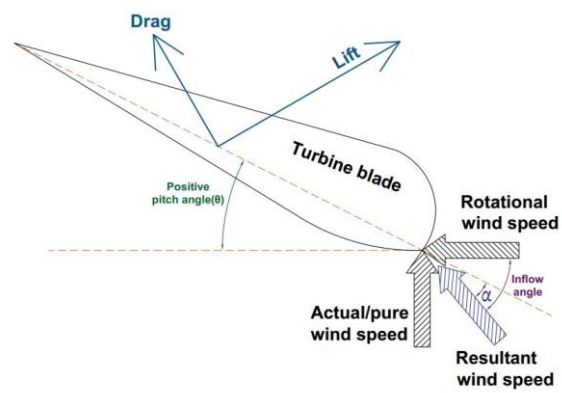


Figure 3: Forces acting on the blade

$$\text{Lift force} = \frac{1}{2} \cdot C_L \cdot \rho \cdot A \cdot v^2$$

$$\text{Drag force} = \frac{1}{2} \cdot C_D \cdot \rho \cdot A \cdot v^2$$

$$\text{Rotational wind speed}(v_r) = Rotor\ speed(\omega) \times Radius$$

$$\text{Inflow angle} = \tan^{-1}\left[\frac{Initial\ wind\ speed(v_{int})}{Rotational\ wind\ speed(v_r)}\right]$$

$$\text{Angle of attack}(\alpha) = Inflow\ angle - Pitch\ angle$$

Where,

C_L = coefficient of lift; C_D
= coefficient of drag and they depend on angle of attack(α)

As mentioned earlier in (1), the turbine blades extract kinetic energy in the wind and transform it into mechanical energy. The kinetic energy in air of an object of mass m moving with speed v is equal to,

$$E = \frac{1}{2} \cdot m \cdot v^2 \qquad \text{(II.A.1)}$$

The power in the moving air (assuming constant speed velocity) is equal to,

$$P_w = \frac{dE}{dt} = \frac{1}{2} \cdot m \cdot v^2 \qquad \text{(II.A.2)}$$

Where m is the mass flow rate per second. When the air passes across an area A (e.g. the area swept by the rotor blades), the power in the air can be computed by using (1). The air density ρ can be expressed as a function of the turbine elevation above sea level H,

$$\rho = \rho_0 - 1.194 \times 10^{-4} \cdot H \qquad \text{(II.A.3)}$$

Where $\rho_0 = 1.225\ \text{kgm}^{-3}$ is the air density at sea level at temperature, $T = 298K$.

The power extracted from the wind is given by

$$P_{Blade} = C_p(\lambda, \beta) \cdot P_w = C_p(\lambda, \beta) \cdot \frac{1}{2} \cdot \rho \cdot A \cdot v^3 \qquad \text{(II.A.4)}$$

The power factor, C_p has a maximum theoretical value equal to 0.593 and a function of the tip-speed ratio (λ) and the blade pitch angle (β) in degrees. The blade pitch angle is defined as the angle between the plane of rotation and the blade cross-section chord. The tip-speed ration is defined as,

$$\lambda = \frac{\omega_m \cdot R}{v} \qquad \text{(II.A.5)}$$

Where ω_m is the angular velocity of the rotor and R is the rotor radius (blade length).

The rotor torque T_w can be computed as

$$T_w = \frac{P_{Blade}}{\omega_m} = \frac{C_p(\lambda,\beta) \cdot \frac{1}{2} \rho \cdot A \cdot v^3}{\omega_m} \qquad \text{(II.A.6)}$$

The power coefficient C_p can be defined as a function of the tip-speed ratio and the blade pitch angle as follows:

$$C_p(\lambda, \beta) = c_1 \left(c_2 \cdot \frac{1}{\gamma} - c_3 \cdot \beta - c_4 \cdot \beta^x - c_5 \right) e^{-c_6 \cdot \frac{1}{\gamma}} \qquad \text{(II.A.7)}$$

With γ defined as

$$\frac{1}{\gamma} = \frac{1}{\lambda + 0.08\beta} - \frac{0.035}{1 + \beta^3} \qquad \text{(II.A.8)}$$

While the coefficients $c_1 \sim c_6$ are proposed as equal to: $c_1 = 0.5, c_2 = 116, c_3 = 0.4, c_4 = 0, c_5 = 5, c_6 = 21$ ('x' is not used here as $c_4 = 0$)

An example of the power coefficient $[C_p(\lambda, \beta)]$ characteristics computed taking into account (II.A.7, II.A.8) and the parameters $c_1 \sim c_6$ for a given rotor diameter, rotor speed and for various blade pitch angles (β) is presented in Fig. 4 [10]. The 3D modeling of the blades has been given in the *Appendix (Part C).*

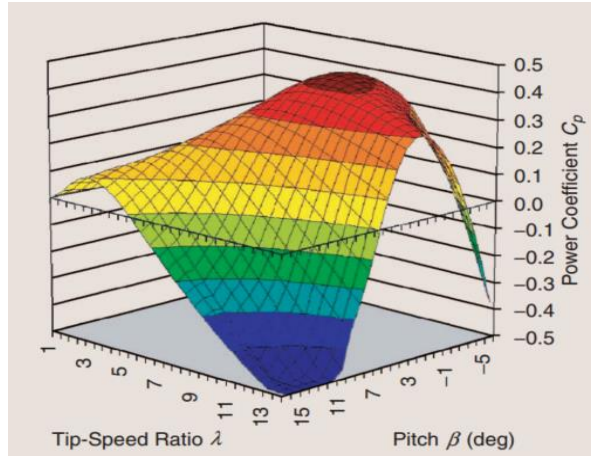


Figure 4: Analytical approximation of $C_p(\lambda, \beta)$ characteristics

C. *Modeling of Drive-train*

The drive train of a wind turbine system generally consists of a blade pitching mechanism, a hub with blades, a rotor shaft and a gearbox with generator. The drive train model presented in this paper includes the inertia of both the turbine and generator. The moment of inertia (MOI) of the wind wheel (hub with blades) is about 90% of the drive train total moment, while the generator rotor MOI is equal to about 10%, the generator represents the biggest torsional stiffness. The structure of the model is presented in Fig. 5 [11].

The equations of motion of the induction generator is given by

$$H_g \cdot \frac{d\omega_g}{dt} = T_e + \frac{T_m}{n} \qquad \text{(II.B.1)}$$

Since the wind turbine shaft and generator are coupled together through a gearbox, the turbine shaft system should not be considered stiff. To account for the interaction between the wind turbine and rotor, an additional equation describing the motion of the wind turbine shaft is adopted.

$$H_m \cdot \frac{d\omega_m}{dt} = T_w - T_m \qquad \text{(II.B.2)}$$

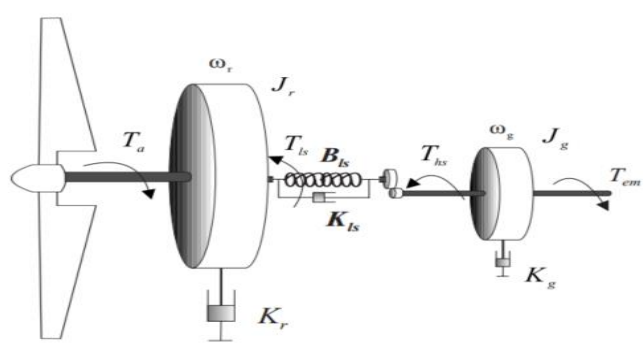


Figure 5: Drive train dynamics

The mechanical torque T_m can be modelled with the following equation,

$$T_m = K \cdot \frac{\theta}{n} + D \cdot \left(\frac{\omega_g - \omega_m}{n}\right) \quad \text{(II.B.3)}$$

$$\frac{d\theta}{dt} = \omega_g - \omega_m \quad \text{(II.B.4)}$$

Where n is the gear ratio, θ is the angle between the turbine rotor and the generator rotor; ω_m, ω_g, H_m and H_g are the turbine and generator rotor speed and inertia constant, respectively. K and D are the drive train stiffness and damping constants; T_w is the torque provided by the wind (from section A) and T_e is the electromagnetic torque. The 3D modeling of the gear train system has been given in the *Appendix (Part C).*

D. Yaw System Modeling

Yaw system plays an important role in wind turbine generator because of the direction and intensity of wind is time-varying. Yaw system consists of yaw control system and yaw drive system which mainly make the wind wheel track the wind direction and unwind the cables automatically when it is winded in a certain amount of rings [12]. The yaw movement differential equation is given below:

$$J\frac{d^2\alpha}{dt^2} + k_a \cdot \frac{d\alpha}{dt} = F_v \quad \text{(II.C.1)}$$

Where α is the yaw rotational angle; J is the nacelle inertia; k_a is the air friction constant and F_v is the wind force, as follows:

$$F_v = F_0 \cos\alpha;\ F_0 = k_v \cdot v^2 \quad \text{(II.C.2)}$$

Where k_v is a constant and v is the wind velocity.

The yaw angle is the angle between the direction of the oncoming wind speed and the rotor axis and the turbine power is multiplied by the cosine of the yaw angle. When there is a non-zero yaw angle, the wind does not strike the leading edge of the blade orthogonally. Hence, the blade does not generate the same lift forces as it would generate with orthogonal inflow. Therefore, for the calculation of turbine power, only the orthogonal component of wind should be used. So, (II.A.4) can be written as [13],

$$P_{Blade} = C_p(\lambda, \beta) \cdot \frac{1}{2} \cdot \rho \cdot A \cdot v^3 \cdot (\cos\alpha)^3 \quad \text{(II.C.3)}$$

In reality, the simulation is complex. To obtain the real power that is produced by the rotor accurately, a detailed study using computational fluid dynamics (CFD) should be performed. It is beyond the scope of this work to perform such calculations.

E. Modeling of the Asynchronous Generator

The mechanical power of the wind turbine is converted into electrical power by an AC or DC generator. The AC generator can be either a synchronous or an induction (asynchronous) machine. The latter is the most widely used in wind power industry and was selected for this project. The electrical machine works on the principle of action and reaction of electromagnetic induction. The resulting electromechanical energy conversion is reversible. As we have focused on control systems of the turbine and dynamic modeling is beyond the scope of this paper, the fixed speed induction generator has been considered which is discussed in [14], [15].

Control Systems

For the proper operation of wind turbine, we have considered three control systems namely pitch, yaw and supervisory. Pitch control will help to monitor the blade position by adjusting angle of attack. Yaw control will assist to determine nacelle movement as per requirement and finally supervisory control system will govern the overall state of the turbine.

F. Blade Pitch Control System

Let us consider, the wind turbine has three blades. To control the pitch angle of the blade, hydraulic actuator is used for each blade and all the three hydraulic actuators should act simultaneously. The blade of wind turbine can rotate around one axis. To rotate the blade, we have a mechanical linkage which is attached to a blade and a hydraulic cylinder. The hydraulic cylinder can extend or contract in order to rotate the blade. To control the piston position i.e. flow of the hydraulic fluid inside the cylinder, hydraulic valves are used. The actuator controller will control the position of the spool of the valve. For this actuator controller to work, it has to know measured pitch angle and actual pitch angle command. Actuation is based on deviation from a commanded value. The mechanical power which has to be delivered to the generator must be limited when the turbine reaches the rated power. In our design, the cut-out speed of wind turbine is $25ms^{-1}$, the rated wind speed is $12.5ms^{-1}$ and the cut-in wind speed is $3ms^{-1}$. Rated power of the generator will be attained at $12.5ms^{-1}$. Hence, after this rated speed, the generator will be saturated i.e. it will rotate with an over speed, so it has to be controlled. The controlling of the over speed of generator is done by adjusting the pitch angle through the control system loop [16]. We have a desired rotor speed and from that we have to determine the pitch angle command. The control system will compare the actual rotor speed to the desired rotor speed to determine the desired angle of attack. Then we compare the desired angle of attack with the inflow angle, the angle at which the wind strikes the blades, finally to determine pitch angle command. The other control system is involved to determine the state of the turbine. This is called event-based control where system changes mode based on event or in other words named as supervisory control. Fig. 6 shows the control structure of pitch controller.

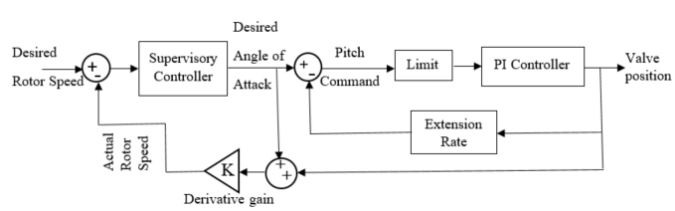


Figure 6: Control structure for pitch control system

A traditional approach to design commonly used linear controllers such as PI controller requires that the non-linear turbine dynamics be linearized about a specified operating point by using root-locus and Bode Plot methods as well as control system tool box in MATLAB. Linearization of the turbine equation would yield:

$$J_t \Delta\omega_t = A\Delta\omega_t + B\Delta v + C\Delta\beta \quad \text{(III.A.1)}$$

Where J_t is the MOI of the turbine rotor, ω_t is the rotor speed and linearization coefficients A, B and C are given by,

$$A = \left(\frac{\partial T_m}{\partial \omega_t}\right)_{op} = \frac{1}{2}\rho A {v_{op}}^3 \cdot \frac{\partial}{\partial \omega_t}\left[\frac{C_p(\lambda,\beta)}{\omega_t}\right]_{op} = K_{11} + K_{12} + K_{13}$$
(III.A.2)

$$B = \left(\frac{\partial T_m}{\partial v}\right)_{op} = \frac{1}{2}\rho A \frac{1}{\omega_{top}} \cdot \frac{\partial}{\partial v}\left[C_p(\lambda,\beta)\cdot v^3\right]_{op} = K_{21} + K_{22} + K_{23} \quad \text{(III.A.3)}$$

$$C = \left(\frac{\partial T_m}{\partial \beta}\right)_{op} = \frac{1}{2}\rho A \frac{{v_{op}}^3}{\omega_{top}} \cdot \frac{\partial}{\partial \beta}\left[C_p(\lambda,\beta)\right]_{op} = K_{31} + K_{32} + K_{33}$$
(III.A.4)

Where $\lambda_{op} = \frac{\omega_{top} R}{v_{op}}$

$K_{11}, K_{12}, K_{13}, K_{21}, K_{22}, K_{23}, K_{31}, K_{32}$ and K_{33} are written in the appendix (Part A). $\Delta\omega_t, \Delta v$ and $\Delta\beta$ represent deviation from the chosen operating point ω_{top}, v_{op} and β_{op} respectively.

Selection of the operating point is critical to preserving aerodynamic stability in this system. For theoretical analysis, the desired operating point of rotational speed, wind speed and blade-pitch angle is selected as 1200 rpm, 12.5 ms^{-1} and 9^0 respectively.

After Laplace Transformation (III.A.1) becomes:

$$J_t s\Delta\omega_t = A\Delta\omega_t + B\Delta v(s) + C\Delta U(s) \quad \text{(III.A.5)}$$

The turbine rotor shaft speed can be represented as

$$\Delta\omega_t = \left[\frac{B}{J_t}\Delta v(s) + \frac{C}{J_t}\Delta U(s)\right] \cdot \frac{1}{\left(s - \frac{A}{J_t}\right)} \quad \text{(III.A.6)}$$

Equation (III.A.6) describes the linearize model of the wind turbine.

As mentioned above the movements of the blades are achieved by using double-acting hydraulic actuators and the mathematical modelling of the actuation system can be found in [17].

The PI controller is used for controlling the rotor speed. The transfer function between the input rotor speed ($\Delta\omega_t(s)$) and the output pitch angle command ($\Delta U(s)$) can be described as follows:

$$T(s) = \frac{\Delta U(s)}{\Delta\omega_t(s)} = \frac{K_p s + K_I}{s} \quad \text{(III.A.7)}$$

By using Simulink Control System Toolbox, we have tuned the PI controller by observing step responses adjusting Root Locus and Bode Plots at a particular operating point and found the proportional (K_p) and integral (K_I) gain values which are given in the appendix (Part B).

G. *Nacelle Yaw Control System*

The angle of attack will be affected by changing the yaw angle of a wind turbine. Thus, the different aerodynamic behavior of the blade can be resulted, so the performance characteristics of the wind turbine can be varied with respect to the yaw angle [18].

The nacelle sits on a tower. Inside the nacelle, there is a gear called ring gear, attached to the tower and it does not rotate. On the side of the ring gear, there are yaw gears, these gears can rotate. When they rotate, pushing against the fixed ring gear allowing the nacelle to rotate about its axis. We have to design a control system which will determine the torque requirements for the yaw actuator (servo motors) to rotate the yaw gears and adjust the nacelle position facing to the incoming wind direction. The yaw controller will determine a yaw command and with that it will determine how much torque the yaw actuator will need to provide to turn the gears in order to rotate the nacelle. The controller will compare the yaw command with nacelle yaw angle and then the controller will determine a yaw rate command [19]. Part of our requirement is the nacelle is allowed to rotate faster than 0.5 degrees per second. So, in our control logic we will put a limit on that yaw rate command and again will compare with the actual yaw rate and that control loop will determine what will the torque should be. Fig. 7 shows the control structure of yaw control system.

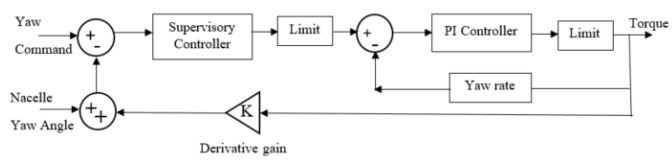


Figure 7: Control structure for yaw control system

Like the pitch controller, the yaw control system also includes a PI controller to control the preferred torque required for the nacelle movement. The non-linear wind turbine model described above has been used and extensive trial and error iteration based on guess and check are carried out [20]. Using Integral of Time-weighted Absolute Error (ITAE) criterion [21] as a performance index measure. The proportional action acts as the main controller where integral action refines it. The controller gain, K_p, is adjusted with the integral gain, K_I held at minimum, until a desired output (rise time) is obtained. The tuning K_I for best transient response while maintaining Kp at its pre-selected value. The proportional (K_p) and integral (K_I) gain values are given in the appendix (Part B).

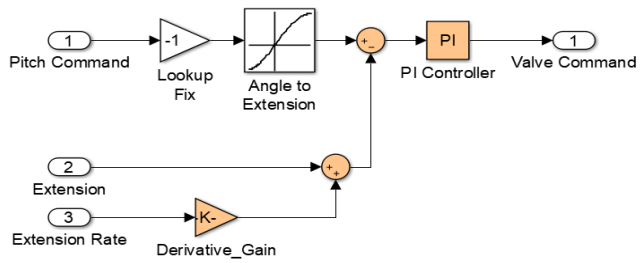
The yaw moment of the wind turbine should be zero for a zero-degree yaw angle. The yaw momentum about the tower for yaw angle 0^0, 10^0, 20^0 and 30^0 when it is located in upstream. The turbine which is operating with the positive yaw angle which will be in order of 2^0 to 4^0. The yaw momentum about the tower for yaw angle 0^0 as for yaw angle 10^0, 20^0 and 30^0 when it is located in downstream, the turbine which is operating with the negative yaw angle will be in order of -2^0 to -4^0.

H. Supervisory Control Using State Machine

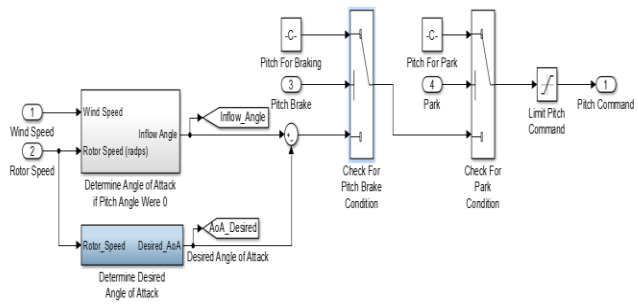
We will define several states like the first one is 'Park' state where the parking brake is turned on, pitch brake is turned off and the generator is not connected to the grid. When the wind velocity gets above the certain speed i.e. the cut-in speed, we will move to the 'Startup' state releasing the parking brake and leave the other two systems at their previous states. When the turbine reaches the minimum operating speed, we will then connect the grid with the generator and the turbine will be in 'Generating' state. Under number of different operating conditions, we may have to stop the turbine, so we need a 'Brake' mode to slow down the turbine to stop by activating pitch brake and when it reached slow enough speed, it will put the turbine in Park mode. By using *Stateflow* in MATLAB, we have created the event-based supervisory controller that sets the state of the brake, generator, pitch and yaw angle based on turbine's different operating conditions. The coding of state machine is done by using C language.

SIMULATION DIAGRAMS OF THE CONTROL SYSTEMS

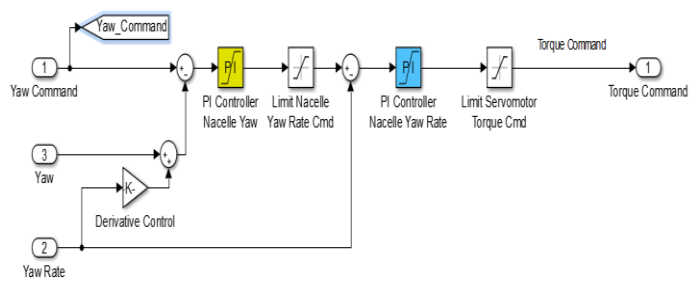
The above mentioned three control systems named as pitch, yaw and supervisory control system are simulated by using MATLAB. Fig. 8 represents the control structure of each individual system. In Fig. 8a, pitch command is the input defining how pitch should vary, angle of extension is used to determine how much pitch angle has to be changed for the next instant. Extension rate is the rate at which the angle has to be extended and required actuation force is the output from this control loop which is the inner loop of the pitch control system. The outer loop which incorporates the wind and preferred rotor speed as input and with the help of inner loop, the rotor speed is calibrated as per the desired angle of attack, as shown in Fig. 8b. Fig. 8c represents the yaw control system where yaw command is the input and the required torque at which the nacelle rotates is the output. In both the control loops, we have used PI controller for less overshoot and to avoid sudden change in actual pitch or yaw angle. We have used *Simulink design optimization* toolbox to tune the controller parameters automatically until it meets system requirements. Fig. 8d introduces the event-based supervisory control system to maintain proper balance with each and every component and turn on/off the primary or auxiliary parts of the turbine.



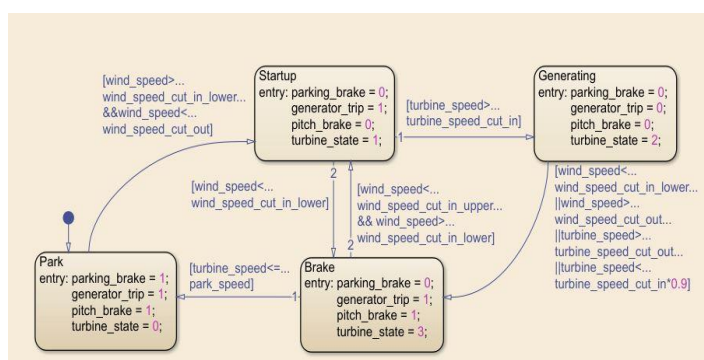
(a) Pitch controller- Inner loop



(b) Pitch controller- Outer loop



(c) Yaw control system



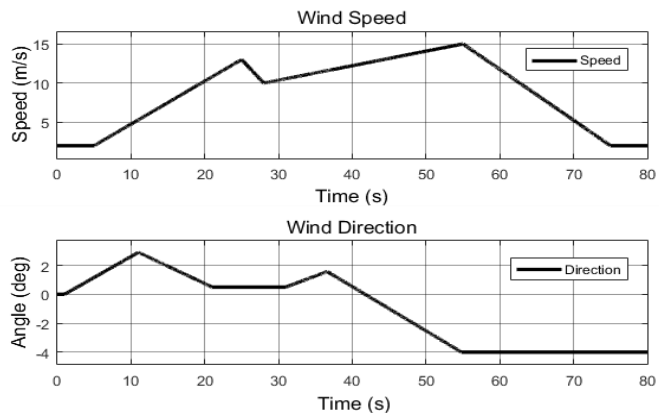
(d) Supervisory control algorithm in state machine

Figure 8: Simulation diagrams in MATLAB Simulink™

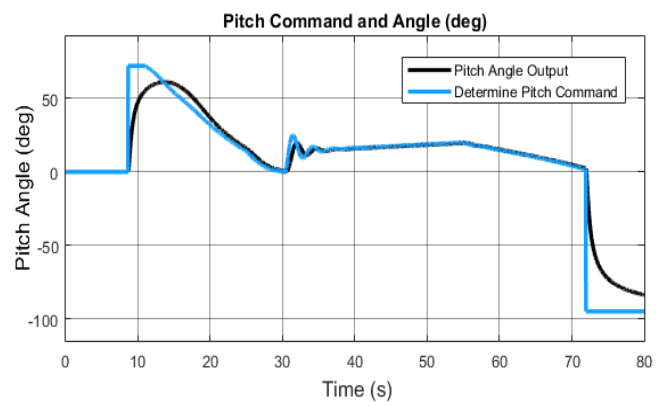
SIMULATION RESULTS

The simulation results of these three control systems are shown in Fig. 9a to 9l. Fig. 9a shows turbine input which is the wind in terms of speed and direction (inflow angle) by using signal generator. There are four types of inputs generated in the input block- normal wind, cut out wind, high speed wind and varying

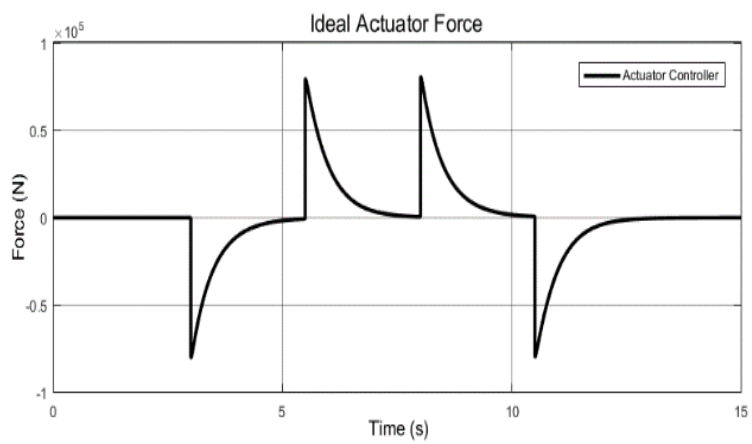
wind. To make the simulation more practical, we made variation in both wind speed and direction with time and chose the 'varying wind' block as input. Fig. 9b shows pitch control waveforms where the blue color indicates the input command and black color indicates the output which is following the pitch command. To find out the hydraulic actuator requirements, at first we have used ideal actuator in the pitch system. Fig. 9c shows the behavior of ideal actuator i.e. pitch angle variation with the input command and actuation force. The hydraulic actuator should be designed as per these results. Fig. 9d depicts the cylinder piston velocity for both ideal (black) and hydraulic (blue) actuators where the piston is linked with the blades. The performance is nonlinear in nature. A comparison between the performance of ideal and hydraulic actuator is shown in Fig. 9e. The hydraulic actuator force is quite acceptable as it remains almost similar with the ideal actuation force curve and finally we can keep the pitch control system with that performance in hand. Now we will focus on yaw control system and likewise pitch control we will use an ideal actuator to determine yaw torque requirement for our system. The torque curve for ideal actuator is shown in Fig. 9f. Fig. 9g indicates the nacelle's yaw movement as per given yaw command and nacelle yaw rate (degree per sec) which is below 0.5 degrees complies with design requirements. Now with these two data sets, we can find out the required torque for servomotor actuation. Fig. 9h shows a comparison between two yaw actuators- ideal (red) and servomotor (black) actuator. The generated torque by using servomotor actuators are pretty good as following the nature of ideal actuator. Fig. 9l interprets the supervisory control system namely the states of the turbine- turbine startup, generator trip, parking and pitch brake which are pretty much convenient as per event-based control algorithm. Lastly, Fig. 9i shows our main control objective which is controlling the rotor speed with various operating conditions. It is evident from the curve that when time is zero, the rotor is at parking position. After sometime when wind strikes the blades it starts to turn slowly. When the wind speed exceeds the cut in speed after 30 seconds, the rotor has reached its maximum rotational speed which is approximately 15 rpm and remained steady up to next 30 seconds and goes to generating mode. After 70 seconds, the wind reached the cut-off speed, so the rotor needs to be stopped to avoid unnecessary damage and from the response curve, we can see, the rotor speed is gradually decreasing and finally reaches to zero i.e. in parking mode. From this region, maximum safe electrical power is given up to the cut-off speed, which is the speed of wind that is no longer safe to run the turbine [22]. Therefore, we can conclude that the supervisory control system is maintaining the desired linkage between pitch and yaw controllers, respectively. Fig. 9k shows the estimation of generated output power. As we can see, the rotor speed gets the steady value after 30 seconds and so as the power reaches its maximum value which is more than 2MW and keeps a steady state till 55 seconds, then decreases as the rotor speed slows down. Fig. 9j indicates the step response of two different iterative methods named as Lumped Parameter Model and matrix based Finite Element Analysis (FEA) calculating the rotor speed and torque at the blade base and both results are identical. The rotor speed is showing steady with no overshoot, on the other hand torque curve is oscillatory in nature but bounded by the limiting values. Selecting an efficient control system requires doing tradeoff studies in early stages to determine which will provide enough force or torque while drawing the least power. The actuator must be developed together with the control systems and there may be multiple control loops that must interact with the actuation system.



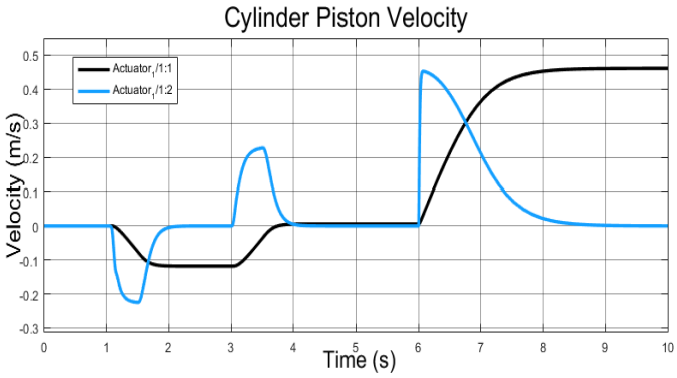
a) Input wind speed and direction



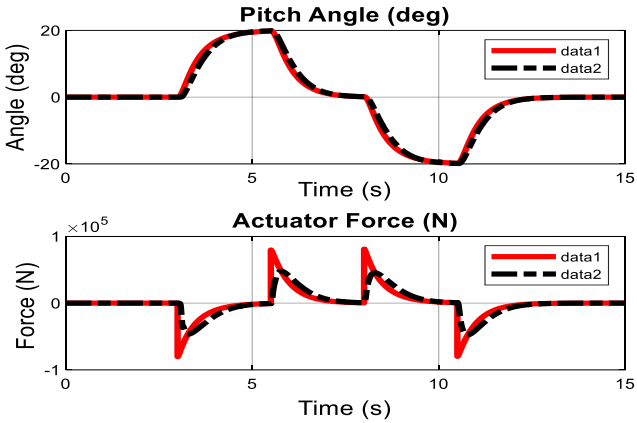
b) Pitch controller waveforms



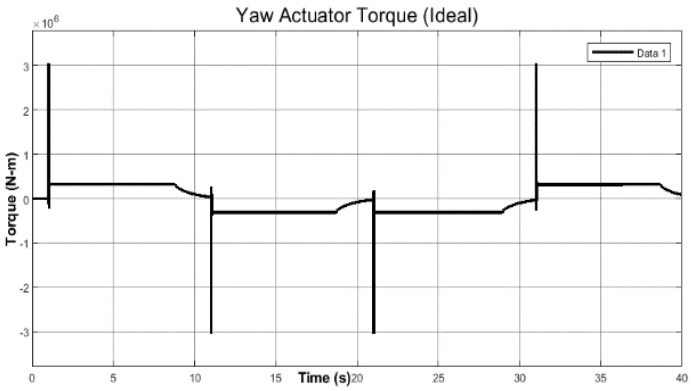
c) Behavior of Ideal Actuator (Pitch system)



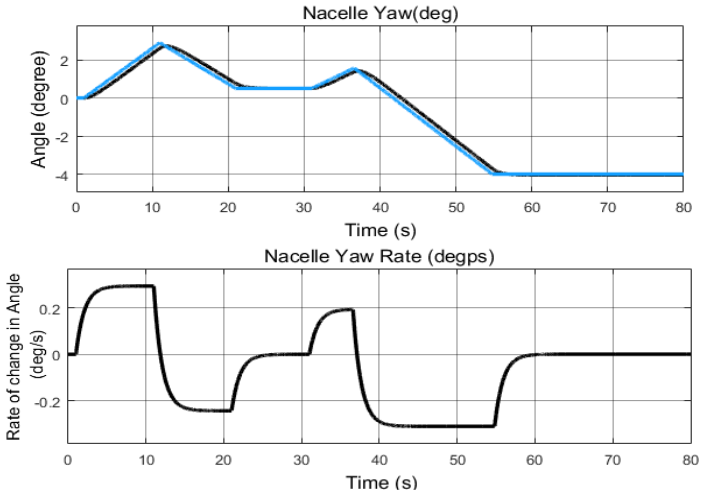
d) Cylinder piston velocity requirements for hydraulic actuator



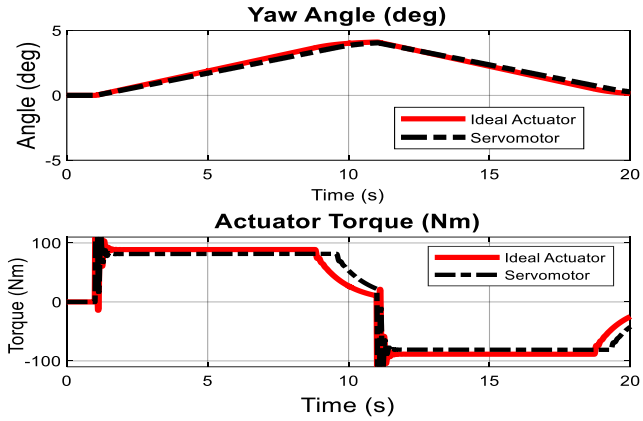
e) Comparison between ideal and hydraulic actuator performance (pitch control)



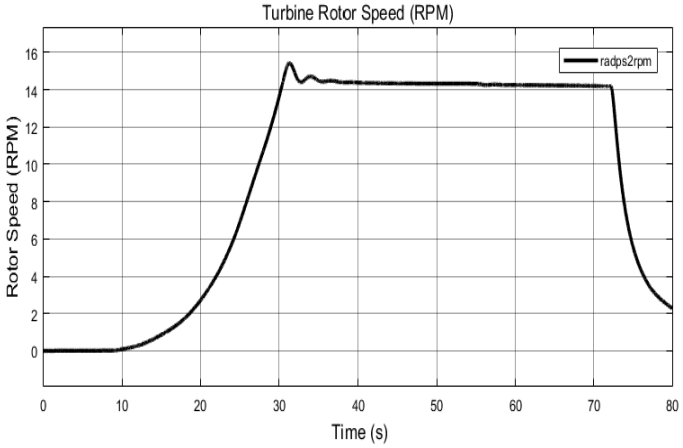
f) Torque requirement for Ideal Actuator



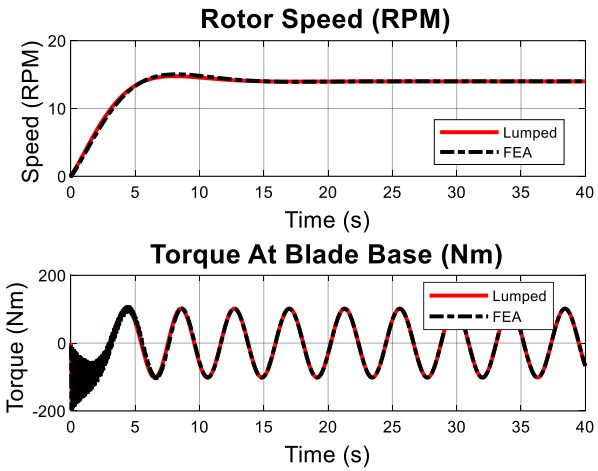
g) Yaw angle and rate of change of Nacelle



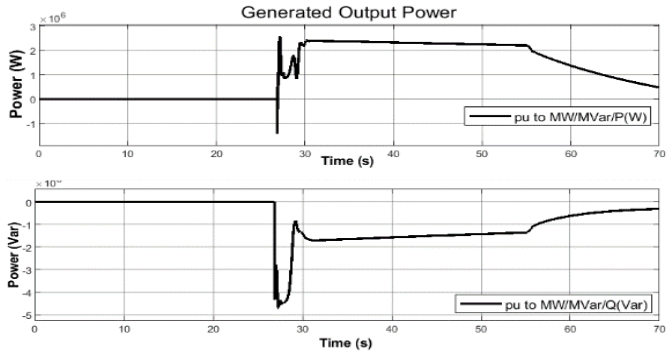
h) Comparison between ideal and servomotor actuation performance (yaw system)



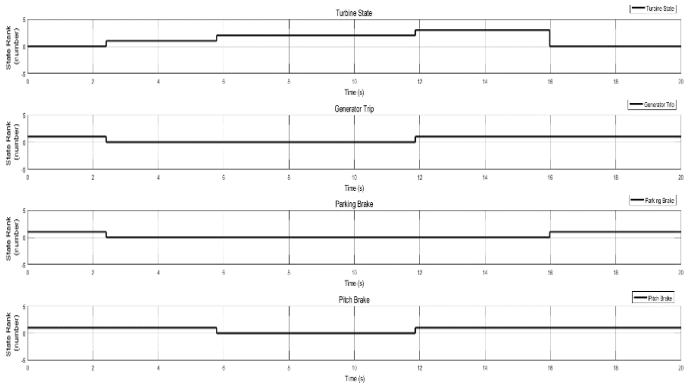
i) Turbine rotor speed



j) Step response computation of rotor speed and blade torque using lumped data and FEA



k) Generator output-electric power



l) Graphical presentation of supervisory control response

Figure 9: Simulation results for pitch, yaw and supervisory control systems

CONCLUSION

As the world is currently facing an energy and climate crisis, the development and utilization of alternative sources of energy has become an important challenge. Among the available renewable energy sources, wind energy proved to be one of the cleanest and most reliable solutions for electrical energy production. The complexity of control systems in wind turbines is expanding rapidly and their design can be the difference between an immensely profitable system and a dormant or damaged system. Designing a robust control system requires an accurate model of the plant and tools that enable rapid iteration to find the best design. The control system must be optimized as possible while meeting multiple and sometimes conflicting system requirements. Pitch and yaw controllers must interact with supervisory logic controller in order to operate and protect the turbine under a wide range of environmental and statutory conditions. We have used linear control theory (Root locus, Bode plot, ITAE) to tune the controller parameters. After getting linearized model, we applied it to test the overall nonlinear model using Simulink design optimization. The simulation results show that the classical PI controller performs well, adjusts accurately the blade pitch angle so that the rotor turns at a sequential speed with the generator shaft and required yaw movement to change the nacelle position. To build this model in MATLAB, we have used *Simscape multibody, Simmechanics, Simhydraulics, Control system toolbox and State machine* [23]. It allows us the ability to simulate the physical systems such as mechanical, electrical, hydraulic and various control systems in a single environment. It enables engineers to incorporate requirements into the development process, design at the system level and to predict and optimize overall system performance without relying on only hardware prototypes as well as minimizing the cost.

FUTURE WORK RECOMMENDATIONS

The results obtained during this investigation are encouraging. It appears that the control methods allow the wind turbine to operate smoothly. A comparison of Fuzzy PI controllers with the classical PI controllers would be desirable to demonstrate if significant performance improvement of the classical PI controller approach over Fuzzy controlled PI controllers or using deep neural networks or PSO based algorithm is possible. Furthermore, validating the developed wind turbine model with real-time implementation on an actual turbine would be appreciated. This study is limited to the available data and further validation of the model with other wind turbines, other operating points and different disturbances would be advisable, For instance, this study can be improved by taking into account wind gusts and other practical problems. The insertion of the power electronics, converter, inverter, rectifier, capacitor and transformer would make the model more complete. Further research includes modeling and control of a group of interconnected wind turbines or wind farm as well as maintaining robustness requirements for controllers.

APPENDIX

Part A

Results of Linearization of the Wind Turbine Equation

$$K_{11} = \left[\frac{K{v_{op}}^3}{R\omega_{top}}(0.44 - 0.0167\beta_{op}) \cdot \frac{\pi R}{v_{op}(15 - 0.3\beta_{op})} \cdot \cos\left\{\pi\left(\frac{\lambda_{op} - 3}{15 - 0.3\beta_{op}}\right)\right\}\right]$$

$$K_{12} = -\frac{K{v_{op}}^3}{R{\omega_{top}}^2}(0.44 - 0.0167\beta_{op}) \sin\left[\pi\left(\frac{\lambda_{op} - 3}{15 - 0.3\beta_{op}}\right)\right]$$

$$K_{13} = -0.00184\left(\beta_{op}{v_{op}}^2 + \frac{3\beta{v_{op}}^3}{R{\omega_{top}}^2}\right)K$$

$$K_{21} = \frac{3K{v_{op}}^2}{R\omega_{top}}(0.44 - 0.0167\beta_{op}) \sin\left[\pi\left(\frac{\lambda_{op} - 3}{15 - 0.3\beta_{op}}\right)\right]$$

$$K_{22} = -\frac{K{v_{op}}^3}{R\omega_{top}}(0.44 - 0.0167\beta_{op}) \cdot \frac{\pi\lambda_{op}}{{v_{op}}^2(15 - 0.3\beta_{op})} \cdot \cos\left\{\pi\left(\frac{\lambda_{op} - 3}{15 - 0.3\beta_{op}}\right)\right\}$$

$$K_{23} = -0.00184K\left(2v_{op}\beta_{op} - \frac{9\beta_{op}v_{op}}{\lambda_{op}}\right)$$

$$K_{31} = -\frac{0.0167K{v_{op}}^2}{\lambda_{op}} \sin\left[\pi\left(\frac{\lambda_{op} - 3}{15 - 0.3\beta_{op}}\right)\right]$$

$$K_{32} = \frac{0.0167K{v_{op}}^2}{\lambda_{op}}(0.44 - 0.0167\beta_{op})\left[0.3\pi\left(\frac{\lambda_{op} - 3}{15 - 0.3\beta_{op}}\right)\right]\cos\left\{\pi\left(\frac{\lambda_{op} - 3}{15 - 0.3\beta_{op}}\right)\right\}$$

$$K_{33} = \frac{0.00184K(\lambda_{op} - 3){v_{op}}^2}{\lambda_{op}}$$

Part B

Wind Turbine Model and Simulation Parameters

1. Blade Requirements

Type description	AL 40
Blade length	40 m
Material	Carbon/wood/glass/epoxy
Standard color	RAL 7035
Gloss	Class 2: (30-70%) to be measured acc. to DS/ISO2813
Type of rotor air brake	Full blade
Blade profiles	FFA - W3, NACA 63.4
Twist	20°
Largest chord	3.08

2. Brakes Requirements

Mechanical	
Type description	Active Brake
Brake disc	Steel, mounted on high speed shaft
Number of calipers	2 piece
Brake Hydraulics	
Voltage	3 x 480 V
Working pressure range	140-150 bar
Oil capacity	11

3. Environment Requirements

Temperature interval for operation	-30 to +30°C
Temperature interval for structure	-40 to +50°C

4. Gear Train Requirements

Type description	1. step planet, 2. step helical
Gear house material	Cast
Ratio	1:84.3
Mechanical power	1800 kW
Bending strength acc. to ISO 6336	SF > 1.6
Surface durability acc. to ISO 6336	SH > 1.25
Scuffing safety acc. to DNV 41.	SS > 1.3

Shaft seals	Labyrinth
Oil sump	App. 250 l

5. Generator Requirements

Type description	1 speed generator, water cooled
Rated power	1650 kW
Apparent power	1808 kVA
Rated current IN	1740 A
Max power at Class F PFma	1815 kW
Max current at Class F IFmax	1914 A
No load current I0	430 A
Reactive power consumption at rated power (tolerance. acc to IEC 60034-1)	740 kvar
Reactive power consumption at no load (tolerance. acc to IEC 60034-1)	447 kvar
Number of poles P	6
Synchronous rotation speed n0	1200 rpm
Rotation speed at rated power nN	1214 rpm
Slip at rated power sN	0.0117
Voltage UN	3 x 600 V
Frequency F	60 Hz
Coupling	Δ
Enclosure	IP54
Insulation class/ Temperature increase	F/B

6. Main Controller Requirements

Annual average wind speed 8.5 m/s	8.5 m/s
Wind shear 0.20	0.2
Extreme wind speed	42.5 m/s (10 min. average)
Survival wind speed 59.5 m/s (3 sec. average)	59.5 m/s (3 sec. average)
Automatic stop limit 20 m/s (10 min. average)	20 m/s (10 min. average)
Re-cut in 18 m/s (10 min. average)	18 m/s (10 min. average)
Characteristic turbulence intensity	16% (including wind farm turbulence)
Maximum in-flow angle	8°

7. Nacelle Requirements

Material EN-GJS-400-18U-LT	EN-GJS-400-18U-LT
Standard colour RAL 7035	RAL 7035
Corrosion class, outside Acc. to DS EN ISO 12944:C5 I	Acc. to DS EN ISO 12944:C5 I
Rotor	
Number of blades 3 pieces	3 pieces
Tip speed (synchronous) 61.8 m/s	61.8 m/s
Rotor shaft tilt 5°	5°
Eccentricity (tower center to hub center)	3447 mm
Solidity (Total blade area/rotor area)	0.05
Rotor orientation	Upwind

8. Pitch Actuation Requirements

Hydraulic pressure	2e7 Pa

Accumulator Capacity	0.1 L
Accumulator Preload Pressure	1.5e7 Pa
Accumulator Maximum Pressure	2.5e7 Pa

9. Pitch Controller Requirements

Track angle within	1 degree
Rise Time	3 seconds
Settling Time	5 seconds
Proportional Gain, Kp	92845
Integral Gain, K_I	307

10. Yaw Actuation Requirements

Type description	Planetary gear motor
Gear ratio of yaw gear unit	app. 1:1687
Voltage	3 x 480 V
Rotational speed at full load	1140 rpm
Number of yaw gears	4 pieces
Yaw Brake	Hydraulic disc brake
Number of Yaw Friction Units	6 pieces
Voltage	3 x 480 V
Working pressure range	140-150 bar
Oil capacity	App. 10 l.

11. Yaw Controller Requirements

Max Yaw Rate	0.5 deg/sec
Rise time	3 seconds
Settling time	5 seconds
Proportional Gain, Kp	300
Integral Gain, K_I	0.1

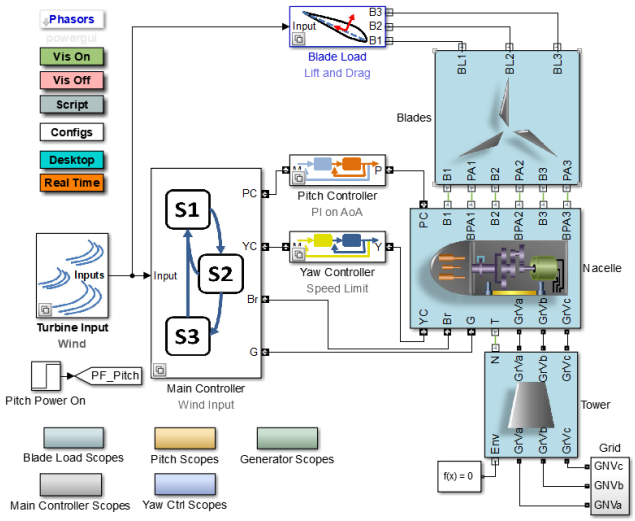
12. Tower Requirements

Type Description Conical, tubular	Conical, tubular
Material Welded steel plate	Welded steel plate
Corrosion class, outside Acc. to DS EN ISO 12944: C5 I	Acc. to DS EN ISO 12944: C5 I
Colour RAL 7035	RAL 7035
Access conditions	Internal, safety harness, ladder cage

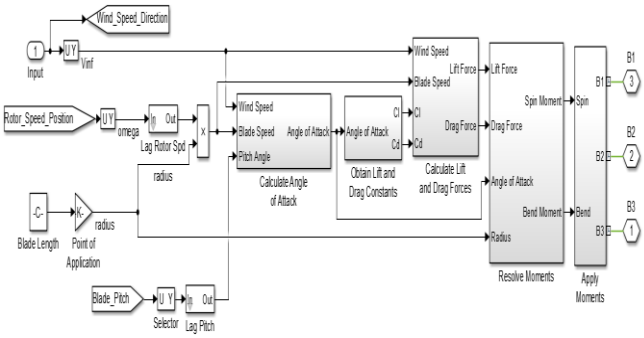
Part C

3D Modeling Structures built in Simulink™

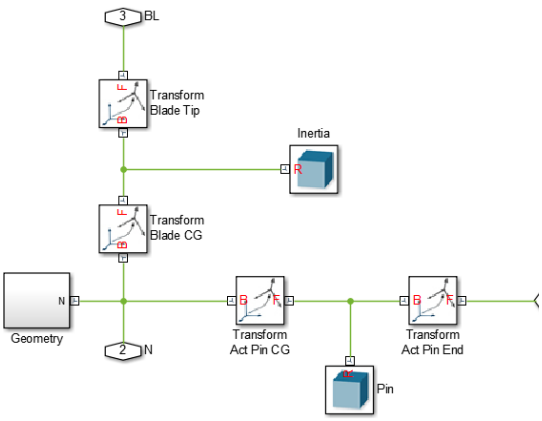
1. Overall Wind Turbine Model



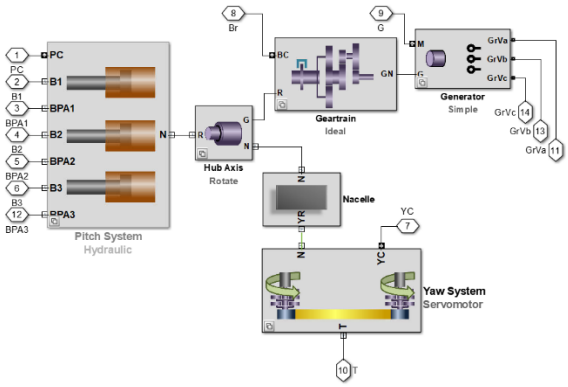
2. Blade Load Model



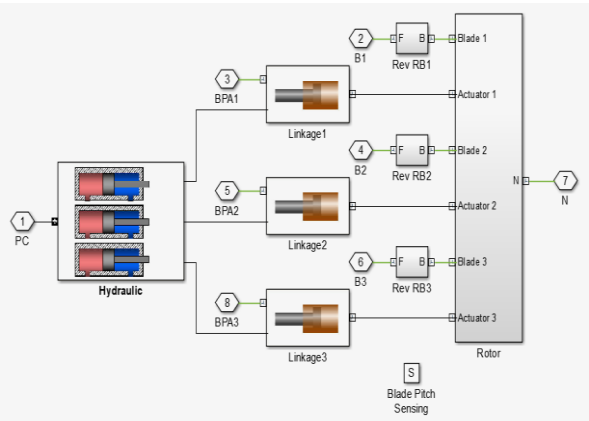
3. Blade Mechanics Model



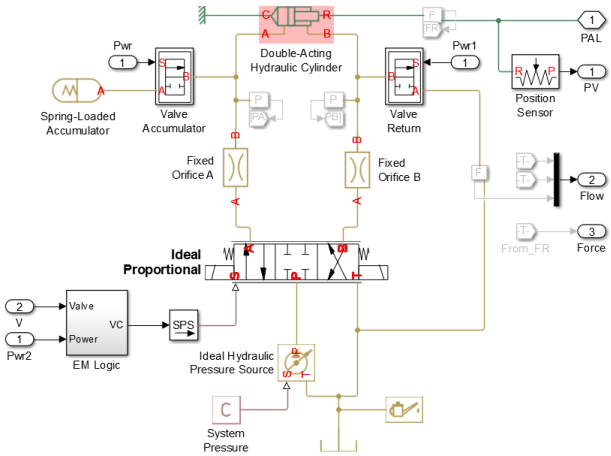
4. Nacelle Model



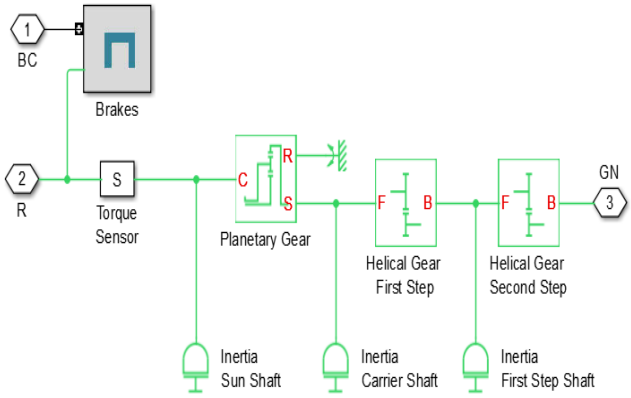
5. Pitch Mechanism Model



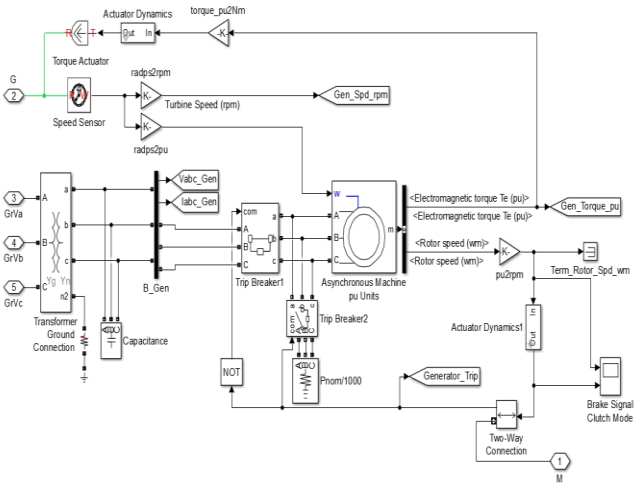
6. Hydraulic Actuator Model



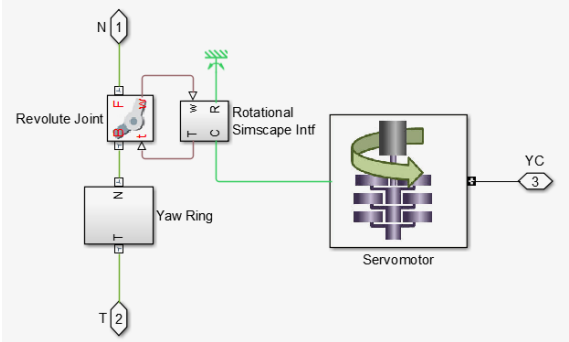
7. Gear train Model



8. Generator Model



9. Yaw system Model



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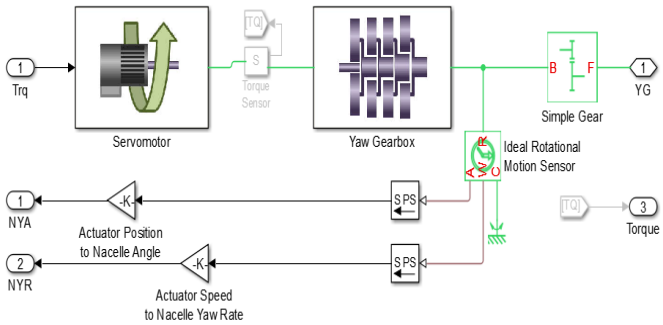

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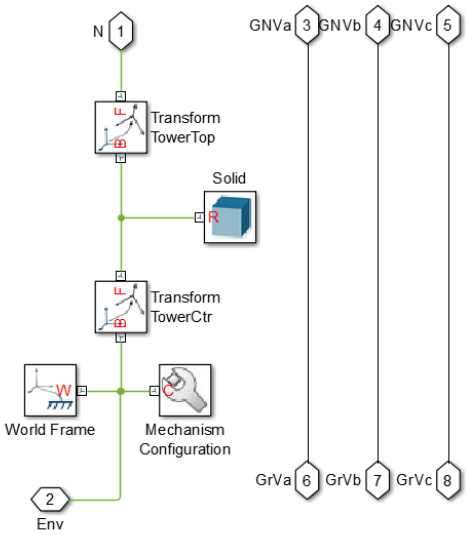
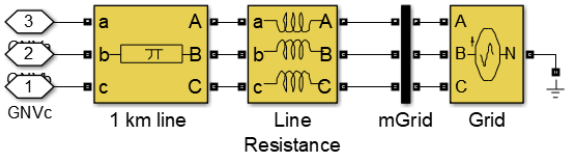


12. Grid Model



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The Relationship Between Prostate Volume and Prostate Specific Antigen in Benign and Malignant Prostatic Lesions

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***Abstract*- BACKGROUND**: Men often have prostatic lesions especially with advancement in age above 50 years. Lesions of the prostate are common health problems globally with prostate cancer said to be the second commonest malignancy in men. Prostate Specific Antigen (PSA) is a nonspecific marker but very sensitive for prostatic lesions. Benign and malignant prostatic lesions cause appreciable enlargement of the gland and significant rise in PSA. Transrectal ultrasonography is a readily available and affordable imaging modality for evaluating the prostate.

AIMS AND OBJECTIVES: This study aimed at evaluating the relationship between prostate volume and PSA in patients who had prostatic lesions in Abakaliki.

MATERIALS AND METHODS: It was a cross sectional study done within eight months in which seventy-four males within the age range of 45 to 89years who were suspected to have prostatic lesions either on digital rectal examination (DRE) or increased PSA were evaluated using transrectal ultrasound. The ultrasound machine used for the study was Medison Accuvix A30 and all the patients later had 12 core biopsy.

Data analysis was done using Statistical Package for Social Sciences (SPSS) version 20. Results were presented in charts, tables and scatter diagrams. T-test was used to compare the means of continuous variables. To test for relationships, Pearson's correlation analysis was used and p-values ≤ 0.05 were considered significant. Linear regression was also used to show the relationship between dependent and independent variables.

RESULTS: The histology results revealed that forty-nine patients had benign prostatic hyperplasia while twenty-five patients had adenocarcinoma of the prostate.

The mean (±SD) prostatic volume was significantly lower in benign prostatic lesions when compared with malignant lesions (79.70±62.10ml verses114.40±69.50 ml, p=0.032).

The mean (±SD) PSA was significantly higher in patients with malignant lesions compared to those with benign lesions (84.90±135.80ng/ml verses 17.90±32.00ng/ml, p=0.002). Similarly, a significant difference was noted in the mean (±SD) PSA density of these two groups (0.82±1.17ng/ml^2 versus 0.27± 0.51ng/ml^2, p=0.006).

There was significant positive correlation between PSA and Prostate volume in benign lesions (r=0.356; p=0.012) but there was no significant correlation in malignant lesions (r=0.136; p=0.516).

CONCLUSION: In benign lesions, prostate volume correlates well with PSA in a positive trend. Therefore, PSA may be used as a close alternative to prostatic volume when selecting patients for 5α reductase inhibitor therapy where there is no facility to assess the prostatic volume.

***Index Terms*-** Transrectal ultrasound, Prostate volume, Prostate specific antigen, prostate specific antigen density, prostatic lesions.

I. Introduction

Lesions of the prostate often occur in men as they get older usually fifty years and above.[i]The lesions could be benign or malignant. The benign ones include benign prostatic hyperplasia (BPH) and prostatitis while the malignant ones comprise mainly the prostate cancer and very rarely metastasis to the prostate. Prostate cancer is the second commonest malignant tumour and the sixth commonest cause of cancer-associated deaths in adult male worldwide.[i]

Since 1980, the measurement of the PSA level is the most useful screening tool for prostatic lesions. Prostate Specific Antigen (PSA) is a serine protease with molecular weight of 34000 which is produced by ductal and acinal epithelial cells of normal, hyperplastic, and malignant tissues of the prostate.[ii] It is a marker which is organ specific that is often raised in prostatic lesions, PSA value more than 4ng/ml gives a high index of suspicion for prostatic lesion.[iii,iv] Because the serum level of PSA is raised in both benign and malignant diseases of the prostate, it is therefore nonspecific for screening prostate cancer. Lesions with PSA values of 0-4ng/ml are more likely to be benign while those with values >10ng/ml are more likely malignant.[2,v]Prostate specific antigen (PSA) when considered alone has 4.6% cancer detecting rate, 32% positive predictive value and low specificity for prostate cancer (CaP).[vi]

Transrectal ultrasound (TRUS) is a relatively affordable, well tolerated and widely used imaging tool for the prostate. Transrectal ultrasound could be considered an extension of the urologist's finger for early detection of prostate cancer.[vii] TRUS has been used in morphological analysis such as measurement of prostate volume, study of echotexture, illustration of tissue

elasticity, administration of treatments like brachytherapy and monitoring of cryotherapy in prostate cancer management.[4]

It is a common knowledge that both benign and malignant prostatic lesions can present with high PSA level. Stamey et al[3] noted that the serum PSA of cancerous tissue appears to be thirty times more than the normal prostatic epithelial tissue and ten times that of BPH. From the result of simple prostatectomy series, the authors calculated that each gram of BPH and CaP elevated the serum PSA by 0.3ng/ml and 3.5ng/ml respectively.[3]Most patients with prostate cancer have PSA values more than 20ng/ml while those with benign lesions have lesser PSA values.[viii] However, the sensitivity and specificity of PSA alone in differentiating malignant from benign lesion is poor especially in patients with PSA <20ng/ml.[ix]Another study done by Ekeke et al[x] noted that most patient with PSA >10ng/ml have advanced cancer. Prostate cancer has also been found in individuals with normal PSA levels meaning that normal PSA does not translate to absence of cancer and there is no absolute level of PSA that signifies prostate cancer.[xi]

Udeh et al[xii] did a study in Nigerian men from 45 to 99 years of age and noted a statistical difference in PSA between BPH and CaP with mean PSA of 13.71 ± 17.46 and 49.86 ± 41.49 ng/ml for BPH and CaP patients respectively. Although there was statistical difference in mean PSA between CaP and BPH, the mean prostate volume was not significantly different in the two groups. This implied that the difference in PSA could not be explained by the volume of the prostate; rather, the distortion in the basement membrane could be the likely explanation. Their challenge was that in our environment, most patients present to the clinicians only when they are symptomatic.

In 1992, the concept of PSA density (PSAD) was introduced to correlate PSA and prostate volume. This was based on the knowledge that most PSA is produced by prostate epithelial cells and cancer cells produce more PSA per unit volume than benign cells. Prostate specific antigen density (PSAD) was obtained by dividing the total serum PSA with prostate volume, as determined by transrectal ultrasound measurement using the formula; volume = length x width x depth x 0.52.[xiii] Benson et al[xiv] noted that the mean PSAD for prostate cancer (CaP) was 0.581ng/ml^2 while that for BPH was 0.044ng/ml^2 ($p < 0.002$) and no patient with BPH had a PSAD of more than 0.117ng/ml^2 suggesting that PSAD could help to distinguish between CaP and BPH in men whose PSA levels are between 4 and 10 ng/ml. However 6 out of 61patients used in the study with PSAD less than 0.1 had cancer. Other studies have been done to ascertain the relationship between prostate volume and PSA. The correlation was so significant that PSA level could represent an acceptable proxy for prostate volume measurement when selecting candidates for 5-α-reductase inhibitor therapy. Jozo et al[xv] observed that increased prostate volume correlated with increased level of total and free PSA in serum ($p < 0.001$). A similar result was obtained by Putra et al[xvi] in Indonesian men with BPH, they noted that PSA was significantly correlated with prostate volume ($r = 0.26$, $P < 0.0001$) and both increased with age. Similar study done in Nigeria by Udeh et al[xvii] showed that in Nigerian men with biopsy proven BPH, the volume of the prostate was significantly correlated with serum PSA. The maximum PSA value recorded in their study was 35ng/ml with a mean PSA of 12.44±15.49 ng/ml while the maximum prostate volume recorded was 223.82ml with mean prostate volume of 72.79± 44.38ml. The correlation between prostate volume and PSA was 0.3365 based on the Pearson's correlation coefficient with $p<0.05$.[xvii]

The aim of this study was to evaluate the relationship between prostate volume and PSA in various prostatic lesions which will help in monitoring and follow-up of patients with prostate disease.

II. METHODOLOGY

STUDY DESIGN

This was a cross–sectional study to evaluate the relationship between the prostate volume and PSA of benign and malignant lesions of the prostate in patients who were suspected to have prostatic lesions that presented in surgical outpatient and Radiology department of Alex Ekwueme Federal University Teaching Hospital Abakaliki (AEFETHA).

III. STUDY AREA

The study was conducted at AEFUTHA, a tertiary institution in Ebonyi State. The surgical outpatient department serves a large number of patients coming from Abakaliki, Afikpo and suburban areas. The population of Ebonyi state is about 2.39million and men account for about 1.16million.[xviii]

STUDY POPULATION

The participants for the study were men with abnormal digital rectal examination findings or raised PSA who presented in surgical outpatient and Radiology of AEFETHA. Participation was voluntary.

IV. STUDY DURATION

The study period was 8months.

INCLUSION CRITERIA

1. Men who had abnormal prostate findings on DRE.
2. Men who had increased serum PSA level > 4.0ng/ml.
3. Patients that had prostate biopsy with available result.

EXCLUSION CRITERIA

1. Patients who declined consent.
2. Participants with anal fissure or stenosis and uncooperative patients.
3. Normal individual with no suspected prostatic lesions.
4. Patients whose prostate biopsy result were not available.
5. Patient on 5-α-reductase inhibitor treatment.
6. Patient who are on urinary catheter.

EQUIPMENT

The machine used for the prostate scan was Accuvix A30 (MEDISON LV Korea 2013) with transrectal probe of 5 - 9 MHz.

TECHNIQUE

All transrectal ultrasonography in this study were done only by a Radiologist to eliminate inter observer variability. To avoid bias, the Radiologist was not aware of the patient's histology report before the scan.

Positioning: Having explained the procedure and obtained consent, the patient was positioned in a left lateral position with both knees flexed. The patient's privacy was maintained during the procedure.

Preparation of the probe and insertion: Before the insertion of the transducer, digital rectal examination (DRE) was done to ensure there was no contraindication to the procedure such as anal stenosis and fissure. Double condom sheaths were used to cover the probe for protection. Contact jelly was poured into the sheath to establish good contact with the probe and remove air interface for better transmission of sound waves. K-Y jelly was used to lubricate the sheathed probe which was then introduced into the anus and gently angled posteriorly with respect to the curve of the rectum.

Scanning: The prostate was evaluated in both longitudinal and transverse planes for morphology. Transverse scan was done beginning from the bladder base at the level of seminal vesicles to the apex of the prostate while the longitudinal scan was done by moving the probe from right to left lateral parts of the gland. Before the transrectal scan, the patient was asked to empty his bladder. The sonographic measurement of the prostatic volume is shown in figures 1below.

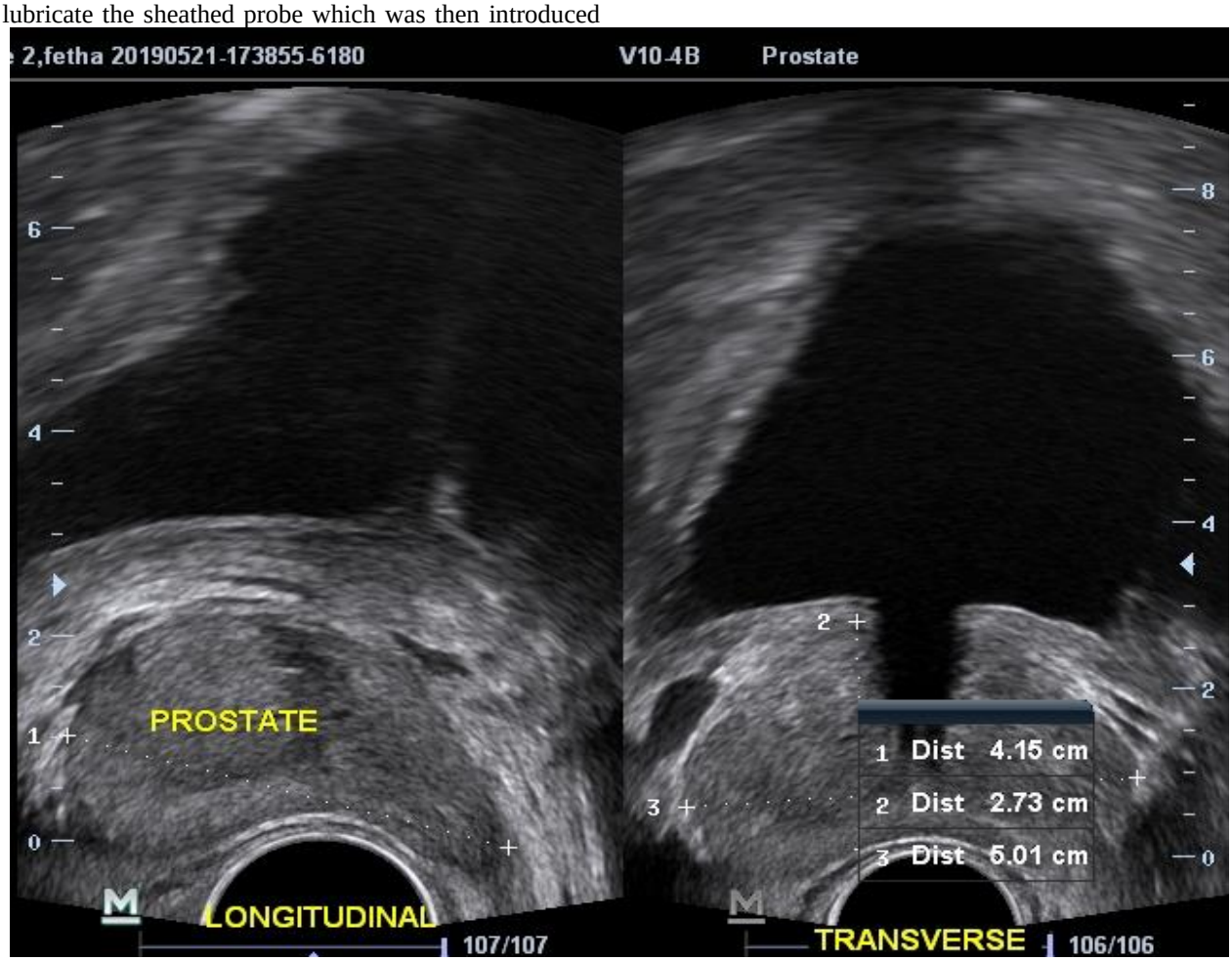


Figure 1: Longitudinal and transverse views of Transrectal ultrasound showing the measurement of the prostate volume.
D1= Superio-inferior diameter.
D2 = Anterio-posterior diameter.
D3 = Transverse diameter.

V. PSA ASSAY

Blood samples of patients were collected and analyzed in the hospital laboratory by the Lab. Scientist. To assay for PSA, TECO (ELISA) kit was used.

VI. PROSTATE BIOPSY

Each participant underwent digitally directed 12-core prostate biopsies which was done by Urologist in the theatre. The Samples collected were sent to the Pathologist for histology reports. The biopsy results were collected later and recorded in the data sheet.

VII. DATA ANALYSIS

The data analysis was done with Statistical Package for Social Sciences (SPSS) for windows version 20 package. The reults were presented using tables and charts. Statistical tests were considered significant at p-value ≤ 0.05.

The data was summarized using descriptive statistics like percentage, frequency, mean and standard deviation. Student t-test and Chi-squared test were used to compare continuous and categorical variables. The test for relationship between variables was done using Pearson's correlation analysis.

VIII. RESULTS

The study was conducted on 74 adult male patients within the age range 45 – 89years with average age of 68.1± 8.5 years who had prostatic lesions. The modal age group was 61– 75years which accounted for 45(60.8%) of the participants. The age group 76-89years recorded the least number 14 (18.9%) of the participants.

Majority 70(94.6%) of the participants were Igbo while just a few of them 4(5.4%) were from other tribes of Nigeria. Seventy two (97.3%) of them were Christians.

Twenty seven (36.5%) participants were farmers, 23(31.1%) were retirees, 10(13.5%) were civil servants, 8(10.8%) were traders while 6(8.1%) were artisans.

Fifty seven (77.0%) of the studied population had formal education while 17(23%) did not receive any formal education.

These demographic variables (age, ethnicity, religion, occupation, marital status and highest level of education) are shown in table 1 below.

Table 1: The demographic variables of the study population

Demographic	Frequency	Percentage (%)	Cumulative percentage (%)
Age Group			
45 – 60years	15	20.3	20.3
61 – 75years	45	60.8	81.1
76 – 89years	14	18.9	100.0
Ethnicity			
Igbo	70	94.6	94.6
Others (Efik, Yoruba)	4	5.4	100.0
Religion			
Christianity	72	97.3	97.3
Traditionalist	2	2.7	100.0
Occupation			
Farmer	27	36.5	36.5
Retiree	23	31.1	67.6
Civil Servant	10	13.5	81.1
Trader	8	10.8	91.9
Artisan	6	8.1	100.0
Marital Status			
Single	3	4.0	4.0
Monogamous	44	59.5	63.5
Polygamous	26	35.1	98.6
Widower	1	1.4	100.0
Highest Level Of Education			
Informal education	17	23.0	23.0
Primary education	25	33.8	56.8
Secondary education	7	9.4	66.2
Tertiary education	25	33.8	100.0

From the study, 49(66.2%) participants had benign lesions while 25(33.8%) participants had malignant lesions. No patient had prostatitis or metastasis to the prostate as shown in table 2 below.

Table 2: The histology reports of the participants

Prostatic lesions	Frequency	Percentage (%)	Cumulative percentage (%)
Prostatitis	0	0.0	0.0
Benign prostatic hyperplasia (BPH)	49	66.2	66.2
Metastasis	0	0.0	66.2
Adenocarcinoma	25	33.8	100.0

There was significant difference in the mean (±SD) prostate volume of benign (79.70±62.10ml) and malignant (114.40±69.50 ml) lesions (p=0.032). The mean prostate volume was 34.70ml larger in malignant than benign lesions.

The mean (±SD) PSA for malignant lesions was 84.90±135.80ng/ml while that of benign lesions was 17.90±32.00ng/ml which was significant (p=0.002). The mean PSA was 67.00ng/ml lower in benign than malignant lesions.

The mean (±SD) PSA density was significantly higher in malignant lesions (0.82±1.17ng/ml^2) compared to the benign lesions (0.27± 0.51ng/ml^2) with p=0.006.

The details of the prostate volume, PSA and PSA density values are shown in table 3.

Table 3: Measurements of PSA, prostate volume and PSA density in benign and malignant lesions

Parameters	Benign (n=49)		Malignant (n=25)		Mean Diff	t-test	df	P-value
	Range	Mean ±SD	Range	Mean ±SD				
PSA (ng/ml)	0.20-134.00	17.90±32.00	0.50-613.40	84.90±135.80	67.00	3.30	72	0.002
Prostate volume (ml)	15.60-292.60	79.70±62.10	36.10-298.20	114.40±69.50	34.70	2.18	72	0.032
PSA density(ng/ml^2)	0.00-3.36	0.27± 0.51	0.01-4.82	0.82±1.17	0.55	2.83	72	0.006

There was significant positive correlation between PSA and Prostate volume in benign lesions (r=0.356; p=0.012) but there was no significant correlation in malignant lesions (r=0.136; p=0.516). This is shown in table 4 below.

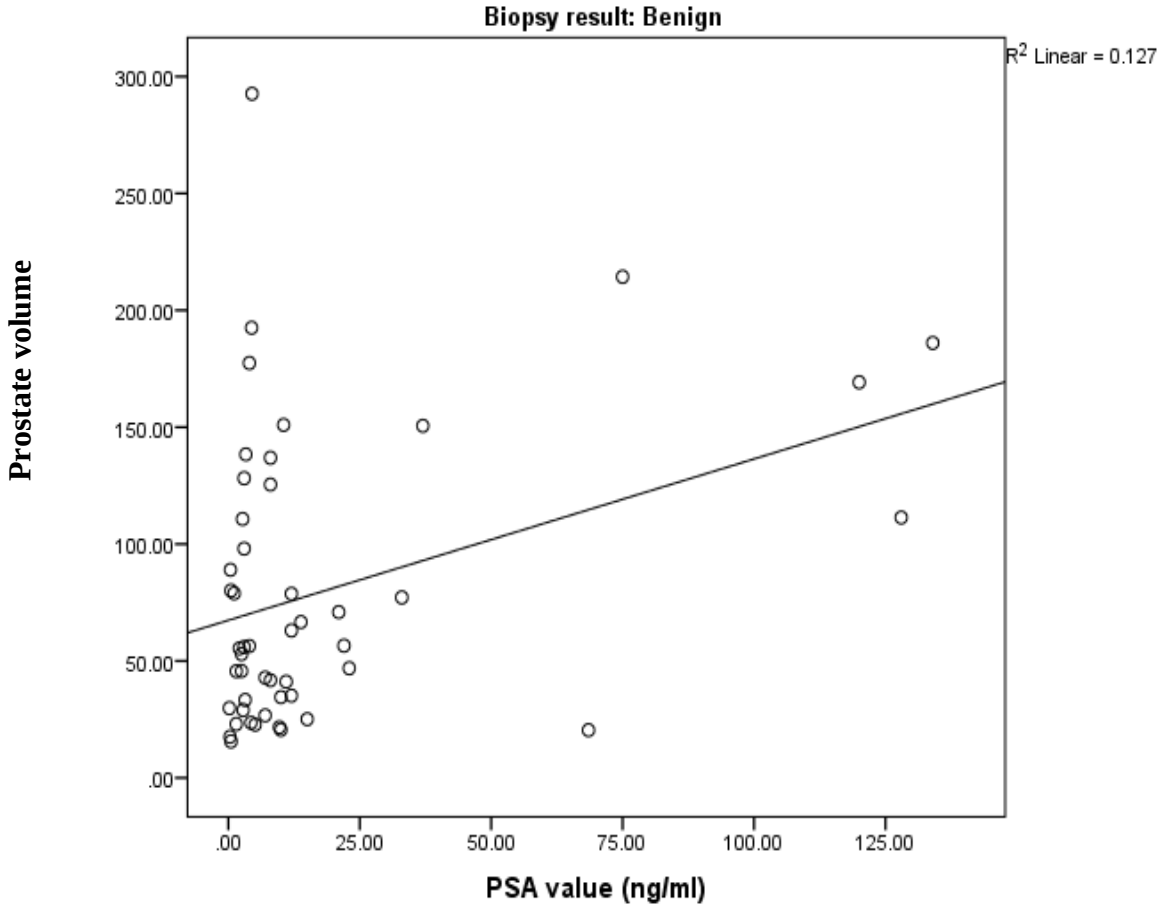
Table 4: The correlation between PSA and prostate volume in benign and malignant lesions

		Prostrate Volume	
		Benign	Malignant
PSA value (ng/ml)	Pearson Correlation	0.356	0.136
	P-value	0.012	0.516
	N	49	25

There was a direct relationship between PSA and prostate volume (r=0.356) in benign lesions. As the prostate volume increases, the PSA also increases.

Majority of PSA in benign lesion clustered below 25.00ng/ml while prostate volume clustered below 100.00ml. This is illustrated in figure 2 below.

Figure 2: A scatter plot with trend line of relationship between PSA and prostate volume in benign lesions.



IX. DISCUSSION

Seventy-four adult male aged 45 to 89years with prostatic lesions were recruited for the study.

The modal age group was 61-75years which represented 60.8% of the studied population.

In 2011, Anunobi et al[xix] noted a modal age group of 60-69years with a mean age of 67years for prostatic lesions which agreed with the present study. Other studies carried out in Pakistan and Nigeria observed similar mean age and modal age group with none contradicting this current study. This might imply that prostatic lesions could be part of aging processes.[xx,xxi] Out of the total number of people recruited for the study, benign prostatic hyperplasia (BPH) accounted for 49(66.2%) while prostate cancer (CaP) accounted for 25(33.8%) which agreed with the common knowledge that BPH is the commonest prostatic lesion in adult males. Nwafor et al[20] noted that in Nigeria men, BPH accounted for 62.8% and was distantly followed by CaP that accounted for 29.3% of histology results which was similar to findings in this study. However, Aslams et al[21] quoted a much higher proportion for BPH 42(87.5%) as against CaP 6(12.5%). This difference might be due to geographical variation because their study was done in Pakistan.

A significant statistical difference was noted in the mean prostate volume in benign (79.7±62.1ml) and malignant (114.40±69.50ml) lesions (p=0.032). The larger volume seen in malignant lesions might be because most patients presented late with advanced cancer which had invaded the surrounding structures. It might also be due to the difference in the number of participants with benign and malignant lesions (49 versus 25) used for this study. Udeh et al[17] showed no statistical difference in the mean prostate volume of these two groups. Conversely, Al-Khalil et al[xxii] noted an inverse relationship between prostate volume and the incidence of CaP.

There was significant difference between the mean PSA of patients with benign (17.90±32.00ng/ml) and malignant (84.90±135.80ng/ml) prostatic lesions with p-value=0.002. Although the PSA values in these two conditions were elevated compared to the normal value of ≤4.0ng/ml, it was markedly higher in malignant lesions.[11]The study done by Stamey et al[iii] noted a similar exceedingly higher PSA value in CaP than in BPH. Another study done in Nigeria by Udeh et al[12] noted a statistical significant difference in PSA value between BPH and CaP in favour of CaP which also agreed with the findings of this index study. The difference in PSA level between these two prostatic lesions could be attributed to distortion of the basement membrane

of prostatic epithelium by prostate cancer resulting in higher production of PSA.[12] Though Ekeke et al[7] observed that most patient with PSA >10ng/ml had advanced prostate cancer, this might not be generally true since BPH could also give such high PSA values.

A statistical significant difference was noted in the mean PSA density (PSAD) in benign (0.27± 0.51ng/ml^2) and malignant lesion (0.82±1.17ng/ml^2) with p-value = 0.006. This agreed with the common knowledge that cancer cells produce more PSA per unit volume than benign cells. A study done in New York by Benson et al[xiv] observed that the mean PSAD for prostate cancer (CaP) was significantly higher in malignant prostatic lesions than in BPH (0.581ng/ml^2 versus 0.044ng/ml^2, $p < 0.002$) and no patient with BPH had a PSAD of more than 0.117ng/ml^2 suggesting that PSAD could help to distinguish between CaP and BPH in men whose PSA levels are between 4 and 10 ng/ml. Although their result agreed with that of present study, the values were much lower. This might be due to racial differences. Bastola et al[xxiii] stated that PSA density was a better predictor of prostate cancer in Chinese men with PSA levels of 4-10 ng/ml. They noted that 88.9% of patients with malignant prostatic lesions had PSA density > 0.15 ng/ml/cm^3 which was significantly higher compared to those with benign lesions (p=0.02). They also observed that at a cutoff of 0.134 ng/ml/cm^3, the sensitivity and specificity of PSA density in detecting prostate cancer were 90 %and 33.7%, respectively.

There was significant correlation between PSA and Prostate volume in benign lesions(r=0.356, p=0.012) while malignant lesions did not show any significant correlation (r=0.136, p=0.516). This might be because most PSA was produced by prostate epithelial cells and cancer cells cause distortion in the basement membrane and produce more PSA out of proportion compared to the prostate size.[7]It might also be due to variation in the number of participants with benign and malignant lesions in this index study. A Study done in Bosnian and Herzegovina men by Jozo et al[15] observed that increased prostatic volume correlated with increased level of total and free serum PSA ($p < 0.001$) but their work did not specify whether in benign or malignant prostatic lesions. Putra et al[16] did a study in Indonesian men with BPH, they noted that PSA was significantly correlated with prostate volume ($r = 0.26$, $p< 0.0001$) which was similar to the findings in this study. Another study done in Nigeria by Udeh et al[xvii] in men with biopsy proven BPH, gave a similar result of significant positive correlation between prostate volume and serum PSA. Similarly, Benson et al[14] noted that the relationship between PSA and prostate volume in BPH was so significant that PSA level could represent an acceptable proxy for prostate volume measurement when selecting candidates for 5-α-reductase inhibitor therapy. Stamey et al[iii] observed that PSA was strongly correlated with volume of prostate cancer (r= 0.70) and bivariate and multivariate analyses of their study indicated that cancer volume was the primary determinant of serum PSA levels. Their observation was not in agreement with the finding of this present study. This variation might be due to larger number of patients with CaP in their study when compared with the present study (102patients verses 25patients).

X. CONCLUSION

There is a positive relationship between prostate volume and PSA in benign prostatic hyperplasia. Therefore, both parameters can be used interchangeably in assessment and monitoring patients with BPH especially in selecting patient for 5 α- reductase inhibitor treatment. PSA density is a useful tool in differentiating benign from malignant prostatic lesions.

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Social Media As An Driver Of Business Performance Through The Company Reputation

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Abstract
This study aims to: a) measure and analyze how much influence social media has on business performance both directly and indirectly through the company's reputation, b) measure and analyze how much influence the reputation of the company on business performance. Research use survey method with data collection using questionnaires and interviews. The population of this research is all hotels in Makassar, which are 157 hotels. Samples used in the study were taken as many as 70 based on the number of questionnaires returned. A total of 70 samples have met the criteria for testing using the Partial Least Square (PL S) analysis tool . The main analysis in this study is the organization or the hotel manager. Respondents representing the unit of analysis at the manager level . The analytical method used is Structural equation modeling (SEM) with short or Partial least square path modeling (PLS-PM) using the Smart PLS 3 application program. The results of this study indicate thata) social media has a significant positive effect on business performance, b) social media has a significant positive effect on company reputation, c) social media has a significant positive effect on business performance indirectly through company reputation, d) company reputation has a significant positive effect on business performance.

***Index Terms*:** Social media, performance, company reputation

I. INTRODUCTION

Tourism is one sector that plays a major role in the economy of a country. This is evident from the domestic income provided by the tourism sector, such as contributors to the country's foreign exchange and job creation. Tourism can be a security for the economy in a country if the tourism sector in a country is managed properly. The tourism business in Indonesia is quite potential considering that Indonesia naturally has a lot of potential natural beauty, diversity and cultural uniqueness and so on. All of these potentials become capital in the tourism industry and their sustainability is still maintained. Tourism activities create demand, both consumption and investment, which in turn will lead to activities in the production of goods and services so that investment in various fields is needed, such as hospitality. It is widely known that the relationship between the hotel industry and tourism is closely interrelated, this is inseparable from the fact that the hotel industry is one of the backbones supporting the development of the tourism sector. The contribution of the hotel industry will have implications for the development of tourism and become one of the benchmarks of a region's success in promoting or inviting tourists to come to the area.

Hospitality accommodation can not be separated by tourism. Without tourism activities, it can be said that hotel accommodations will be paralyzed, otherwise tourism without hotels is impossible. The hotel includes the principal means of tourism (*around tourism superstructures*), this means that life and living tar hanging on a lot or at least the tourists who come. Especially now developing a type of tourism that the market potential is people who travel for the purpose of conferences, seminars, symposia, workshops, discusion national and other such activities which would require facilities or infrastructure. However, in the tourism industry, hotels are not the only form of accommodation for tourists and other travelers, but there are still many accommodations known as *supplementary accommodations*, including: 1) jasmine hotels, 2) lodging, 3) pondok wisata, 4) Villa, and other accommodation services *(Kabarindonesia.com).*

Several benchmarks to determine success in bringing tourists to tourist destinations such as the number of tourists, the length of stay of tourists and hotel occupancy rates. The number of tourists staying at the hotel can indicate the number of tourists visiting the area, the length of stay of the tourists also plays an important role in knowing how interested tourists are in the area they visit. The longer tourists stay in an area, this indicates that the area is indeed in demand by tourists. In addition, the percentage or level of hotel

occupancy also plays a role to see the success of a hotel, the higher the occupancy rate means the more number of rooms that can be sold.

Since the year 2012 to the year 2016, the development of the number of foreign guests in hotels is constantly increasing, as is the case with foreign guests in non-star hotels continue to show improvement, only in 2015 has decreased the number of guests. As for the development of the number of Indonesian guests at starred hotels from 2012 to 2016 also continues to experience an increase, while the number of Indonesian guests at non-starred hotels from 2012 to 2016, the trend also increased only in 2015 experienced a drastic decrease of 50% more if compared to 2014. Despite a decline in 2015, in 2016 the number of Indonesian guests at non-star hotels increased by more than 50%.

For the average length of stay of foreign guests in starred hotels, there was an increase from 2012 to 2014, but after that in 2015 and 2016 continued to decline, as was the case with non-star hotels, the average length of stay of foreign guests in non-hotels stars increased from 2012 to 2014, but after that, in 2015 and 2016, they continued to decline. As for the development of the average length of stay of Indonesian guests at starred hotels in 2012 and 2014 there was an increase, after that, in 2015 and 2016 continued to decline. Likewise, the development of the average length of stay of Indonesian guests in starred hotels, namely in 2012 to 2014, has increased, then afterwards it has decreased in 2015 and 2016. For the average length of stay of Indonesian guests in non-star hotels only happened from 2012 to 2013, after that, it continued to decline until 2016.

The growth of hospitality is not only general in Indonesia, but in the province of South Sulawesi there is also growth in this sector. However, the growth of hospitality in South Sulawesi was not followed by an increase in room occupancy , which indicates that there are still obstacles in managing the hospitality. The development of telecommunications in South Sulawesi shows that there was no increase in the number of star-rated hotels in 2012 to 2013, namely only 57 star-rated hotels. Later in 2013 will continue to grow until 2016. For the number of non-star hotels, an increase in the number of hotels also occurred in 2012 to 2015, but in 2016 there was a decrease in the number of non-star hotels. As for the room occupancy rate, the increase in occupancy rates of starred hotel rooms from 2012 to 2013 increased from 49.60 to 53.93. However, in the following years until 2016, the occupancy rate of star-rated hotels in South Sulawesi continued to decline. Meanwhile, for non-star hotel room occupancy rates, the decline will continue until 2015, then in 2016 there will be an increase.

The phenomenon of hospitality in South Sulawesi can be seen that the number of star and non-star hotels continues to grow from year to year, but this development is not always followed by an increase in room occupancy rates. Seen in star and non-star hotels, it appears that the increase in the number is not followed by an increase in the occupancy rate of the rooms, a significant increase is not followed by a balanced demand.

Studies conducted by (WG Kim, Lim, & Brymer, 2015) contribute to hotel marketing and social media literature by managing online reviews as an important determinant of hotel performance. Hospitality needs to allocate resources to regularly respond to negative online comments from customers on social media networks and other travel websites to meet customer needs and increase customer satisfaction. Businesses today must explore how to make full use of traditional media and new social media for marketing. not only relying on traditional marketing or completely changing their channel to online marketing but looking for ways to maximize their communication through interactive media to reach their customers. Whether positive or negative reviews, exposure on social media can help hotels create strong brand awareness and increase booking opportunities by increasing eWOM advertising. Hotel marketers must collect and monitor overall ratings as key internal metrics such as traditional customer satisfaction ratings. In addition, hotel managers must make their best efforts to improve online reviews, thereby improving hotel performance. Negative comments can be significantly linked, for example, room cleanliness, facilities, and location as well as intangibles such as service and staff member elements, so that managers can show how the hotel faces some deficiencies by responding to customers, and they can increase budget allocations in the right areas for improvement hotel. By increasing areas that are relatively less efficient in hotel products and services, hotels can expect far better online reviews from customers. The results of the study (WG Kim et al., 2015) show that managing online reviews leads to improved hotel performance.

Studies to understand the use of social networking sites are hospitality in a resource-based and capability-based perspective conducted (WH Kim & Chae, 2018) that explores the relationship between company access to resources and the use of Social Networking Sites and the relationship between social networking Site usage and performance in industry hotel. Hotels must see Twitter as a potential strategic tool for business operations and seek to improve their ability to utilize Twitter and other social networks for organizational purposes such as sales, promotions, customer service. The use of social media is an innovative business practice that requires the incorporation of company resources, hotel resources are expected to influence the adoption and use of social media. A positive relationship is found between the level of use of social media and hotel performance. The use of social media is seen as an organizational capability and considers the involvement of eWOM and customers.

(Schaarschmidt & Walsh, 2018) explained that when employees use social media, their behavior can be attributed to their superiors, thus forming the company's reputation in the view of various stakeholders. As such, employees are advised to use social media in a manner consistent with social norms on social media to avoid damaging the reputation of their company. Research conducted (Schaarschmidt & Walsh, 2018) about work related to employees and social media to connect the appearance of corporate social media with the appropriate employee social media behavior. The point is employee awareness can shape the reputation of the company. Everywhere social media outside and inside the workplace requires companies to consider employee communication

activities to ensure that their company's reputation does not compromise unwise use of social media. The results found that the use of social media has an impact on awareness of the company's reputation.

The study (Carmeli & Tishler, 2005) highlights the strategic role perceived organizational reputation in creating superior performance among industrial companies. It was explained that only high quality products / services that meet customer expectations and ensure customer satisfaction creates sufficient conditions for a favorable organizational reputation. The findings of his research indicate that the perception of an organization's reputation influences company performance. Building a favorable organizational reputation is a long and expensive process and returns on the organization's reputation must be expected in the long run, so that the reputation of the organization has a direct effect on the company's growth and the accumulation of customer orders.

The study (Karjaluoto, Hanna, & Joel, 2016) developed a proposition to examine the relationship between company activity on social media and company reputation and company performance. This is based on the idea that customers want to participate, interact, and create value, and social media gives companies the possibility to participate and interact with customers, which leads to greater involvement and commitment and greater customer satisfaction, which leads to reputation better company. His research contributions show that companies that are more active have a better reputation than those who are not active on social media.

Previous studies based on the description above only connect social media with company reputation, as well as social media with performance and reputation and performance, therefore, the authors are motivated to examine the effect of social media on business performance through corporate reputation. Based on the above background, the following research problems are formulated: 1) Does social media have a significant effect on business performance both directly and indirectly through the company's reputation. 2) Does the company's reputation have a significant effect on business performance?

II. LITERATURE REVIEW

Resource-based theory

Barney in his article in his 1991 resource-based view argued that sustainable competitive advantage comes from the company's valuable and scarce resources and control capabilities, which cannot be replicated, and cannot be substituted. These resources and capabilities can be seen as a collection of tangible and intangible assets, including company management skills, organizational processes and routines, as well as information and knowledge that they control. (Barney, Wright, & Ketchen, 2001) . The history of the company's resource-based view cited by (Debadutta Panda Sriharsha Reddy, 2016) can be traced from Robinson's theoretical work in 1933 from his book on economics of imperfect competition and Chamberlin's 1933 from his book on monopolistic competition theory and 1959 Penrose from his company growth theory. Clulow et al., (2007) cited by (Debadutta Panda Sriharsha Reddy, 2016) explained that resource-based views are also discussed in relation to customers where customer value greatly contributes to real and unreal company resources and competencies.

The resource-based view (RBV) has evolved into a resource-based theory (RBT), and vice versa that the use of the term resource-based view has diminished, reflecting the view of the research community. The use of the term resource-based theory shows a picture of a contemporary theoretical framework. Resources and capabilities are the main constructs in resource-based theory. Resources refer to tangible and intangible assets that companies use to understand and implement their strategies (Barney and Arikan, 2001) in (Kozlenkova, Samaha, & Palmatier, 2013) . The word resource refers to something that an organization can pull to achieve its goals. Barney and Hesterly (2012) cited by (Kozlenkova et al., 2013) suggest four main resource categories: physical, financial, human, and organizational. Capability is a part of a company's resources, representing the company's specific resources that are not transferable in an organization whose purpose is to increase the productivity of other resources owned by the company that are generally based on information, tangible or intangible processes that enable the company to deploy resources others more efficiently thereby increasing the productivity of these resources. Thus, capability is a special type of resource whose purpose is to increase the productivity of other resources owned by the company (Makadok 2001) in (Kozlenkova et al., 2013) .

Dynamic capability

(David Teece and Gary Pisano, 1994) defines dynamic capabilities as a company's ability to integrate, build and reconfigure internal and external competencies to cope with a rapidly changing environment. Dynamic capabilities reflect the ability of organizations to achieve new and innovative forms of competitive advantage given the dependencies of market paths and positions. (Eisenhardt & Martin, 2000) said that dynamic capability is considered as a routine in the company that guides and facilitates the development of the capabilities of the company (organization) by changing the underlying resource base within the company.

Dynamic capabilities are similar to capabilities, where dynamic capabilities are resources that can be used to modify other resources and create value, for example including product development routines, transfer processes, resource allocation routines, alliance and acquisition capabilities, and knowledge-making processes. Some researchers argue that dynamic ability is a stand-alone theory, but other researchers see it as a means to expand resource-based theory into a dynamic environment. The view that sees dynamic capabilities as a stand-alone theory stems from the idea that sustainable competitive advantage (SCA) obtained from unique resources is rarely achieved in dynamic markets, because rapid change makes many resources obsolete because companies quickly and constantly configure re, obtain, dispose of its resources to meet changing market demands. But in practice, resource-based theory

can handle resources with short-term benefits and capabilities that are more valuable in certain environments (for example, high-speed markets) to explain their effects on sustainable competitive advantage (Kozlenkova et al., 2013)

(Pim den Hertog Wietze van der Aa Mark W. de Jong, 2012) in its conceptual framework explains the capabilities to manage service innovation. The article identifies and reflects a set of dynamic capabilities to manage service innovation and applies the dynamic capability view (DCV) of the company to managing service innovation. It was hypothesized that successful service innovators, which might include manufacturing companies developing into service solution providers, outperformed their competitors at least in some abilities. Those involved in managing service innovation are offered a framework for systematically assessing the capability of dynamic service innovation. His main contribution is that he links the service perspective (innovation) to the company's DCV by proposing a set of dynamic service innovation capabilities. This begins with a basic understanding that successful service innovators are service companies and organizations that have introduced innovative service experiences and service solutions repeatedly.

(Eisenhardt & Martin, 2000) explore dynamic capabilities and more generally RBV. His research suggests rearranging the concept of dynamic capabilities. Dynamic abilities are not tautological, vague, and relentless as recursive as suggested by some people (for example, Priem and Butler, 2000; Williamson, 1999). But on the contrary, dynamic capabilities consist of many well-known processes such as alliancing, product development, and strategic decision making which have been widely studied apart from the RBV. Its value for competitive advantage lies in its ability to change its resource base: creating, integrating, combining, and releasing resources. Dynamic capability also shows similarity across companies related to superior effectiveness or it can be said that dynamic capability also refers to the company's ability to integrate, assign, and move internal and external resources into the best configuration to be able to create and develop new capabilities and create opportunities new market.

(Conceição et al., 2018) explained from previous study studies that ability refers to the knowledge and skills accumulated by a company which in turn allows it to increase the value of using its resources and also that marketing capabilities are responsible for changing the company's marketing resources be a valuable result. It was further explained that when a company can manage the process and development of new products, it means that the organization is focusing its efforts to achieve sustainable competitive advantage. In turn, when a company has a well developed innovation capability and can provide value to its customers better than competitors, it provides recognized value to its customers. Therefore, studying the operation of these capabilities within the company is fundamental to understanding the mechanisms that help the search for organizational differentiation. In a contemporary business environment, companies rely on external sources of information to promote innovation, stimulate new products, and improve performance.

(Pavlou & Sawy, 2011) say that dynamic capabilities are usually embedded in organizational processes and routines that allow a company to adapt to changing market conditions to reconfigure its source base, enable change and adaptation, and ultimately achieve an edge over competitors. Furthermore, four dynamic capabilities, namely, sensing, learning, integration, and coordination, are proposed as sequential logic to reconfigure existing operational capabilities. The company must depend on its ability to create, maintain, and renew its base of competitive advantage in inturbulent environmental conditions. If companies with highly dynamic capabilities are able to quickly cope with dramatic changes in the external environment, it can build competitive advantage and increase their market value.

(Tseng & Lee, 2014) said that companies must strive to integrate capabilities, and improve organizational performance, for example, companies must frequently observe market trends and new technologies to seize new opportunities and dedicate resources to the functions of new and existing products / services to ensure that their products / services can meet customer requirements. To integrate capabilities, companies must clearly understand who has the techniques and knowledge relevant to their work and incorporate individual knowledge into the capabilities of the new operational units, as well as organize and disseminate tasks, resources, and activities.

Social media

Social Media defined by (Kaplan & Haenlein, 2010) is a group of internet-based applications that are built on the foundation of ideology and Web 2.0 technology and that allow users to create and exchange content. Likewise social media is a term that covers various types of applications. (Roberta Bocconcelli, Marco Cioppi, 2017) conducted a study on the adoption of social media in sales activities, the process of adopting social media in terms of a combination of resources where social media was considered as one of the main resources and explained that social media can represent valuable resources that are allows small companies to increase their visibility and enter new markets, which would otherwise be very difficult to reach. Social media provides various tools that can support a company in various stages of the sales process. Social media makes it easy to access foreign customers with limited costs and to gain a valuable reputation in the market. The effectiveness of social media as a new resource for SME sales activities. These resources are internal knowledge held by internal organizational units, product features - and external, specifically social media knowledge and are used by existing and potential customers. Social media can provide a very effective communication vehicle when the company has limited marketing resources, as in the case of SMEs, and aims to reach out and establish contact with new customers, both distributors and end customers. The extensive use of social media in the customer relationship management process can increase opportunities for new market contacts and increase the efficiency of the sales process. Reaching new customer segments and markets may pave the way for new product development utilizing available technology bases.

Marketing directed to social media continues to grow which shows that interest in building a brand's presence on social media, interacting with fans, helping shape its experience, and even utilizing its voice for greater marketing impact. Gillin (2007) cited by (Tsimonis & Dimitriadis, 2014) explains some of the factors shifting towards social media are: 1) Declining response rates, consumers increasingly ignore conventional marketing such as banner advertisements and e-mail because they are not interested. 2) Technological developments, developing information technology infrastructure, new equipment, and an increasing online population contribute to the attractiveness of social media. 3) The demographic shift, people especially young individuals, have moved online and the use of traditional media channels has declined. 4) Customer preferences, trust is important on the internet and people trust their friends and other internet users more than the company. 5) Low cost, flight campaigns can generate more customers involved than television campaigns at much lower costs.

(Tsimonis & Dimitriadis, 2014) also explains the expected benefits, and objectives related to using social media as follows: 1) Brands can effectively develop and enhance relationships with customers. Social media not only intensifies existing company-to-customer and customer-to-company relationships, but also creates new variations on conventional options, increasing the company's ability to interact in customer-company dialogue, strengthening their communication. There are fundamental changes in the ease of contact, the volume, the speed, and the nature of this interaction. 2) The company can reach people who cannot be contacted. Content transfer social media to a variety of people who are more diverse than the mass media. They create a "small world" network where content is easily distributed to large numbers of people, because networks are formed through voluntary connections and require fewer steps to share information. 3) Social media can build and increase brand awareness. Social media tools allow companies to access millions of people, because a large number of people have visited social media, the presence of brand names throughout the network can help inform people about it and become familiar with the company, creating brand awareness. 4) Social media relationships can increase sales. By having people who visit the brand page on social media, it might create traffic for the website and make more sales online. The company expects a number of specific benefits from their presence on social media. Customer involvement is referred to as the most important and is recognized as an opportunity offered by interactive aspects of web technology and tools for changing the relationship between customers and sellers. Its interests are primarily wanting to exploit social media to build lasting relational exchanges with strong emotional ties and improve business performance.

Studies conducted by (Dlamini, Johnston, Dlamini, & Johnston, 2018) revealed that social media is important in organizations to build relationships, maintain advertising contacts, marketing, attracting customers, brand management and information gathering. The majority of organizations use social media for free advertising, customer relationship management, and marketing. Social media is an easy customer relationship management tool and offers effective and efficient capabilities. Integrating the use of social media with organizational processes to market and advertise new products is an easy and cost-effective way of communicating with customers, and helps in reaching out and attracting new customers. Organizations that use social media because it is very popular among individuals and easy to use.

Company reputation

(Shamma, 2009) assesses a company's reputation as an attitude that represents stakeholder evaluations of a company. It was explained that different stakeholders have different sources of knowledge which drive their perceptions about the company's reputation which in turn affect their perceptions about the company's reputation. The customer forms a perception as a result of his personal experience with the company, the knowledge obtained from the media and also the knowledge obtained from each other individuals. The importance of customer experience and personal interaction with the company as a key driver in forming perceptions about the company's reputation. Media is also an important source where customers form perceptions about the company. While customer experience can advance perceptions about a company's product or service and the level of trust and credibility of the company, the knowledge gained from the media gives an indication of other aspects of the company's reputation that are important for building reputation. This sees the importance of the media in helping customers form perceptions about non-relational factors that are important to a company's reputation (eg financial performance). Sources of information from other individuals also influence perceptions about the company's reputation, at least having an impetus in shaping perceptions about the company's reputation compared to other sources. This can be explained by the idea that customers do not get enough information about various aspects of the company from other individuals compared to other sources such as the media. On the other hand, the general public encourages perceptions about companies, especially from media sources. The mass media is the main source through which the general public forms perceptions about the company's reputation. The relatively strong relationship between knowledge from the media and company reputation further supports the importance of the media as an important source for building a company's reputation.

The study (Lee & Roh, 2012) confirms resource-based theory that assets are valuable, cannot be imitated, and cannot be substituted as corporate reputation directs companies to improve financial and market performance. However, the effect depends on company characteristics such as company size, R&D intensity, debt leverage ratio, and capital intensity. The company's reputation seems to emerge as a critical dimension of comparing company performance. The findings of his research show that the company's overall reputation, product / service quality, company size, and R&D intensity appear to be significantly and positively related to company performance in various indexes of the company's economic performance measures. However, corporate social care, innovation, capital intensity, and debt leverage do not seem to affect performance uniformly. This finding shows that the strategic relationship between company reputation and company performance plays an important role in the high and low tech industry groups.

The study (Soleimani, Schneper, Newburry, & Newburry, 2014) builds a stakeholder strength approach to company management. Reputation is defined as a collective representation of a company's past actions and results in relation to many stakeholders. The conceptualization takes a broad perspective that focuses on the general price, admiration, and trust held by the public in a company. The company's reputation is rooted in beliefs about the role of business in society; This belief is built according to strong stakeholder preferences.

(Ghosh, 2016) A company's reputation is the overall estimation of a company by its stakeholders expressed by demonstrative behavior to customers, employees, investors, business partners, and the general public. The goodwill and reputation created by the efforts to develop a company's strategic planning in the market can gain the trust of consumers and other stakeholders which will in turn produce sustainable competitive advantages for the company.

(Chen-Chu Matilda Chen Bang Nguyen TC Melewar, 2016) considers that the use of a company's reputation is categorized into three groups namely value creation, influence on competitors' actions and development of relationships with stakeholders. About Value creation, that the company's reputation is used and presented to stakeholders as a valuable company or as an intangible asset that creates value in the future. Likewise, the company's reputation is used as an asset, which cannot be bought, so it is not easy to be copied or replaced. Regarding strategic resources, it is explained that the company's reputation is generally used as a defense strategy to ward off competitors. In addition, the company's reputation is generally used as a means to highlight and signify the company's beliefs, attitudes and intentions towards market participants, therefore, it is interpreted by stakeholders. As a result, companies aspire to achieve competitive advantage by implementing strategies that will effectively differentiate them from competitors. While the reputation category is corporate communication that the company's reputation is used to communicate corporate social responsibility activities to stakeholders in the business environment. In addition, the company's reputation is used as a way to shape the perceptions of shareholders and stakeholders. A company's reputation usually forms the opinions and perceptions of shareholders and stakeholders alike

(Samuel Famiyeh Amoako Kwarteng Samuel Ato Dadzie, 2016) put forward the idea that reputation issues can be characterized by stakeholders inside and outside the organization. The company's reputation is measured using three constructs namely product and service quality, management performance and organizational attractiveness. His research aims to assess the relationship between corporate social responsibility and its impact on the company's reputation and overall company performance. The results of his study show a positive relationship between the company's reputation (ie product and service quality, management performance, company attractiveness) and overall company performance in terms of return on investment, sales growth, market share and overall profitability. This shows that a good reputation can have a significant positive impact on overall company performance.

(Gianluca Ginesti, Adele Caldarelli, 2018) views the company's reputation as a company value driven by strategic assets. Companies that have a higher reputation are able to translate the knowledge, skills, and cultural principles of their employees into dynamic value activities for stakeholders that inspire trust and generate a strong reputation over time.

(Wilson, 2018) empirically investigated the impact of perceived customer relationship investment on the company's reputation. It is said that having a strong reputation is the desired resource for companies in dealing with today's competitive business environment. Investing in relationships with customers has a significant contribution to building sympathy for the company. Investment perceptions in customer relationships and company reputation are important for developing long-term relationships. The company's reputation is a strategic asset that the company can use to influence stakeholder behavior, thereby facilitating its long-term success. A strong reputation is very important for companies that operate in a business context characterized by managing long-term relationships.

Business performance

Sloma 1980 cited by (Tseng & Lee, 2014) said that performance is the level of targets achieved by organizations or as an evaluation of the effectiveness of individuals, groups, or organizations. At the individual level, this refers to job satisfaction, goal achievement, and personal adjustment; at the group level, this refers to passion, cohesion, efficiency, and productivity; and at the organizational level, it is about profit, efficiency, productivity, absenteeism, turnover , and adaptability. Venkatraman and Ramanujam (1986) cited by (Tseng & Lee, 2014) also assume that performance can not only be measured based on financial measurement indices, but also by organizational performance, which can be measured based on financial performance, business performance, and organizational effectiveness. Financial performance is measured by standards: return on investment, growth in sales, and income; while business performance includes not only financial measurement indices, but also includes operational performance that includes market share, product quality, new product introductions, marketing effectiveness, value added production, and other non-financial matters.

(N. Gladson Nwokah, 2009) quoting from several authors that the goal of measuring final performance is an increase in financial results in a commercial organization. However, this type of measurement of financial results alone does not provide enough information to help direct decision making that will achieve improved performance. Explained further that financial metrics are usually the first type used to evaluate marketing performance. Financial measurements include turnover, contribution margins, and profits. Market share is also used as an indicator of business performance in assessing the extent of customer focus on business

performance. They argue that market share is often used to describe the position of an organization in its industrial sector. The implication is usually that the greater the market share, the more successful the organization.

(Conceição et al., 2018) which cites the opinion of Slater et al., (2006) explains that performance is defined as the achievement of set goals, which implies that if someone achieves or exceeds the set goals, a person has achieved positive performance. There are two broad groups of indicators that are most commonly used as evidence of performance in organizations, namely financial or non-financial.

(Anil Menon, Sundar G. Bharadwaj, 1999) uses perceptual measures of marketing performance that are estimated or valued through market share, and sales growth rate to measure marketing performance. (Anil Menon, Sundar G. Bharadwaj, 1999) explains that marketing performance or market performance is a common construct (factor) to measure the impact of a company's strategy. The company's strategy is always directed to produce company performance, both in marketing and in finance. The study conducted by (Anil Menon, Sundar G. Bharadwaj, 1999) as a measurement of its output uses marketing performance as measured by three scale items, where the level of achievement or strategy performance is met with expectations for overall sales performance or profit, and profit.

Based on the conceptual framework that has been proposed, the conceptual framework can be described as follows:

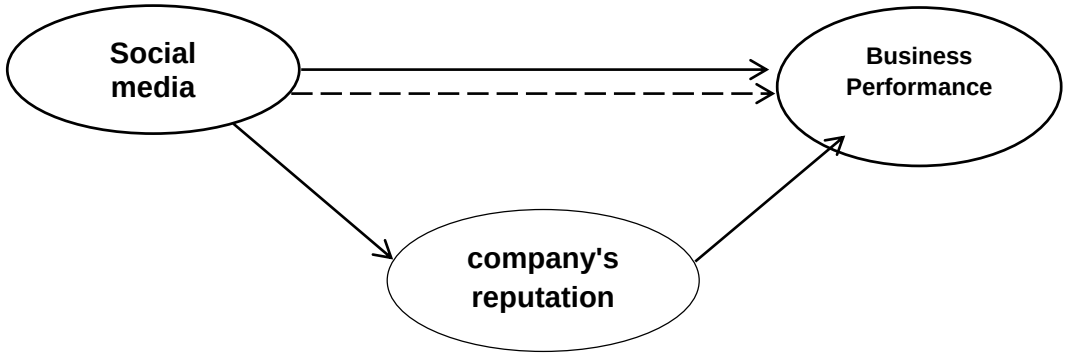

Figure 3.1: Conceptual framework

Based on the conceptual framework of this study, the following hypotheses are proposed:

Hypothesis 1 : Social media has a significant positive effect on business performance directly and indirectly through the company's reputation

Hypothesis 1 a. : Social media has a significant positive effect directly on business performance.

Hypothesis 1b : Social media has a significant positive effect on company reputation

Hypothesis 1c . : Social media has a significant positive effect indirectly on business performance through the company's reputation.

Hypothesis 2 : Company reputation has a significant positive effect on business performance

III. METHODOLOGY

This research was designed using the Hypothetical-descriptive approach, which is a research process approach that allows the development and testing of the null hypothesis with a complete description and empirical facts to illustrate the accompanying theoretical conceptions (Ferdinand, 2014). To test the hypothesis in this study, the data collection instruments in this study starts from the determination of the variable-miscellany bell for examination and further defined the indicators of her, and then created a list of questions in tabular form for submission to the respondent . The population of this study is all hotels in the city, namely as many as 157 hotels. Samples used in the study were taken as many as 70 based on the number of questionnaires returned . A total of 70 samples have met the criteria for testing using the Partial Least Square (PLS) analysis tool. Based on the purpose of this study, the analysis unit in this study is the organization or the hotel manager. Respondents representing the unit of analysis were taken as sources of information on the level of hospitality managers. The analytical method used in this research is Structural Equation Modeling (SEM) with the variance approach or commonly called Partial least square path modeling (PLS-PM) using the Smart PLS 3 application program . SEM is a statistical technique that has the ability to analyze patterns of relationships between latent constructs with each other, as well as direct measurement errors. The reason for using SEM is because of SEM's ability to estimate relationships between variables that are *multiple relationships* . This relationship is formed by the structural model, in addition, SEM also has the ability to describe the pattern of relationships between latent (*unobserved)* and manifest variables (manifest variables).

IV. RESULTS AND DISCUSSION

The first step is to evaluate the measurement model, namely the evaluation of the relationship between constructs and indicators through two stages of evaluation, namely convergent validity and discriminant validity. The results of the evaluation of the convergent validity look like in table 1 below:

Table 1: Convergent validity

Contruct reliability and validity

	Crombach's Alpha	rho_A	Composite Reliability	Average Variant Extracted (AVE)
BUSINESS PERFORMANCE	.851	.856	.889	0.527
COMPANY REPUTATION	0.799	0.829	0.867	0.620
SOSMED	.855	.858	.893	0.582

From table 1 it can be seen that the Crombach's alpha value is above 0.7 . Likewise, the rho_A value is above 0.7 and the composition value of reliability is above 0.7 while the AVE value for all constructs is above 0.5 so that it can be said that the social media construct, company reputation and business performance are reliable. For the evaluation of discriminant validity as shown in table 2 below:

Table 2: Discriminant validity

Discriminant validity

	Businesss Performance	Company reputation	Social Media
BP1	**0.745**	0.330	0.370
BP2	**0.750**	0.416	.379
BP3	**.778**	0.311	.381
BP4	**0.756**	0.507	0.460
BP5	**0.805**	0.484	0.475
BP6	**0,700**	.451	.387
CR1	.347	**.704**	.291
CR2	.392	**0.782**	.388
CR3	0.433	**0.814**	0.427
CR4	0.558	**0.844**	0.540
SOCMED1	.444	0.475	**0.789**
SOCMED2	0.389	.451	**0.796**
SOCMED3	.441	0.345	**.801**
SOCMED4	.443	.404	**0.775**
SOCMED5	.391	0.423	**.757**
SOCMED6	.391	.357	**.647**

From table 2, it can be seen that each indicator correlates higher with each construct compared to other constructs, so it is said to have good discriminant validity. For the value of R square seen in table 3 below:

Table 3: R Square

R Square

	R Square	R Square Adjusted
Business performance	.401	.383
Company reputation	.291	.281

Based on table 3 above, the R square value of the business performance contract is 0.401, which means that the social media construct and company reputation are simultaneously able to explain the variability of business performance constants of 40.1%, the rest is determined by other factors outside this research model. Furthermore, the R square value for the construct of the company's reputation of 0.291 means that the social media construct is able to explain the company's reputation construct of 29.1%, the rest is determined by other factors outside this research model. The structural model, as shown in Figure 2 below:

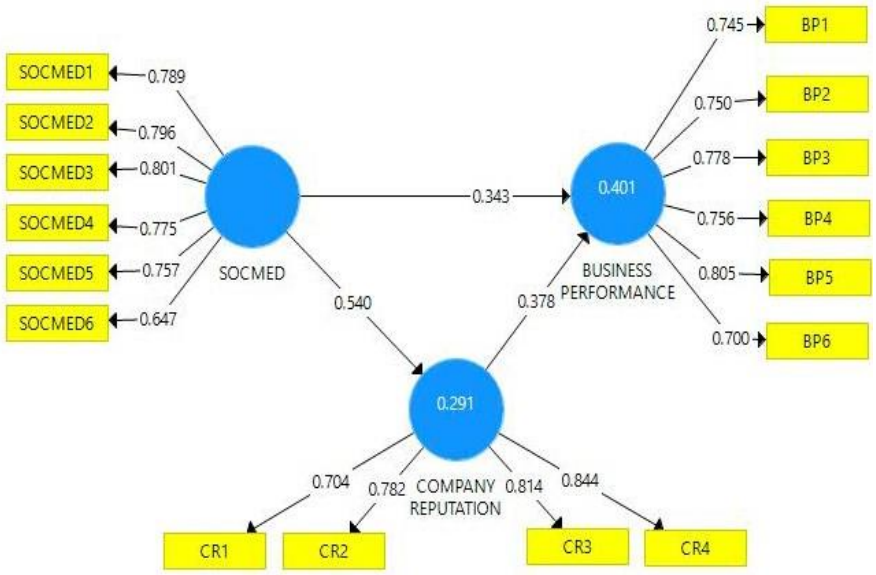

Figure 2: Structural model

The next evaluation is testing the research hypothesis as shown in the table below:

Table 4: Path coefficients

Coefficient path

			Original sample (O)	Sample Mean	Standard Deviation	T statistics (| O / STDEV |)	P value
Company reputation		Business performance	.378	0.370	.107	3,550	0,000
SOCMED		Business performance	.343	.363	.105	3,253	.001
SOCMED		Company reputation	0.540	0.561	0.073	7,362	0,000
SOCMED	Company reputation	Business performance	.204	.206	0.062	3,265	.001

From table 4 shows the results of testing the direct and indirect effects. For testing the direct effect consists of three hypotheses, namely hypothesis 1 a about the direct effect of social media on business performance, shows a path coefficient of 0.378 and a statistical T value of 3.253 which is above 2.0 and P value <0.05. This result means that social media has a significant positive effect on business performance. Thus hypothesis 1a is accepted. For the direct influence of social media on company reputation shows a path coefficient of 0.540 and a statistical T value of 7.362 which is above 2.0 and P value <0.05. This result means that social media has a significant positive effect on the company's reputation. Thus hypothesis 1b is accepted. For the direct influence of the company's reputation on business performance shows a path coefficient of 0.378 and a statistical T value of 3.550 which is above 2.0 and a P value <0.05. This result means that the company's reputation has a significant positive effect on business performance . Thus hypothesis 2 is accepted. As for the indirect effect, namely hypothesis 1c about the effect of social media on business performance through the company's reputation, it shows a path coefficient of 0.204 and a statistical T value of 3.265 which is above 2.0 and a P value <0.05. This result means that Socila Media has a significant positive effect on business performance through the company's reputation. Thus hypothesis 1c is accepted.

Discussion and conclusion

This study supports the results of research conducted by (Roberta J. Schultz, Charles H. Schwepker, Jr., 2015) which shows that the use of social media positively influences sales performance. This shows the importance of social media in marketing, social media is a strategic force. The results of this study also support the results of the study (WH Kim & Chae, 2018) which found a positive relationship between the level of social media usage and hotel performance. The adoption and use of organizational technology that varies among companies is very dependent on company resources. Hotel resources are an important consideration in the use of social media, because the adoption and use of social media platforms is considered an innovative business practice, which involves costs and requires investment in technology, people, organizational policies and other infrastructure. The continued use of social media requires company resources (eg technology, people and capital) and coordination among the actors of the organization. The ability of a hotel to utilize social media is very dependent on its resources, and the use of social media in a company for communication and involvement is considered as one of its capabilities or competencies.

The results of this study are in line with research conducted by (Schaarschmidt & Walsh, 2018) who found that the use of social media has an impact on awareness of the company's reputation. Likewise, research (Hyunmin Lee & Hyojung Park, 2013) shows empirically that actively responding to public comments posted on organizational websites and blog sites positively influences the perception of a company's reputation. This shows the importance of open two-way communication to produce and maintain a long-term positive relationship between the public and the organization. The results of this study are also in line with research (Muhammad Mohtsham Saeed, 2012) that perceived organizational reputation is related to organizational performance and functions as an immune system to the organization, which leads to better organizational performance. This research is also in line with research conducted by (Taghian et al., 2015) who found evidence of a positive relationship between company reputation and business performance in changing market share. Employees are valued as developers of the company's reputation because they are directly involved with organizational processes, and they contribute and benefit from the company's success. The positive attitude of employees can have an impact on their motivation to make changes which in turn can affect the quality of the work they do, resulting in higher company performance. Likewise with research (Deborah Goldring, 2015) which shows that reputation orientation positively influences marketing performance. This research is also in line with research (Parastoo, So, & Saeidi, 2014) which shows that a company's reputation has a positive and significant effect on company performance. A better reputation is a consequence of increasing customer satisfaction after being involved in social care. Because the main goal of business is to achieve a higher level of financial benefits.

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Using Objective Structured Clinical Examination (OSCE) in evaluation of a training program for newly-graduated nurses: A case study of Veteran General Hospital in Taiwan

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Abstract- Background: Adequate preparation for newly graduated nurses is a critical nursing development component for new nurses' success. The two-year training program for postgraduate nurses at Veteran General Hospital in Taichung (VGH- Taichung) was initiated in 2008. The mission of this program was to foster the nurses to become competent clinicians who are able to provide high quality patient-centered care.

Method & Design: The paper describes the process of how VGH-Taichung adopted OSCE for evaluating first year trainee's psychomotor, cognitive and affective skills in a simulated environment to improve their performance scores among newly graduate nurses.

Results: The results from this pilot study provided evidence on the implementation of OSCE-based evaluation and instructions with improved core competencies of postgraduate training programs in VGH-Taichung. The OSCE appears to be a useful and feasible method for trainees' clinical performance.

Discussion: The implementation reported in this study was a positive learning experience for the trainees. The quantitative data and qualitative information from this pilot study provide information for improving the design and implementation of postgraduate nursing education.

Index Terms- respiratory system, physical assessment, objective structured clinical examination (OSCE), Nurse Post Graduate Year

I. Introduction

Adequate preparation for newly graduated nurses is a critical nursing development component for new nurses' success. Previous studies suggest that effective educational strategies, for example, orientation programs and preceptor/mentor models are successful in improving new nurses confidence and competencies (e.g., knowledge and critical-thinking skills), in caring for patients in the clinical environment result in improved patient outcomes with reductions in falls, medication errors, and hospital-acquired pressure ulcer rates.[1,2]

Strategies that have been developed or adapted include: residency programs, simulation exercises, assignment of a preceptor/mentor, and inclusion of socialization activities designed to assimilate the new graduate into the established workforce. [3-6] Health-care administrations recognize the importance of orientation processes that may impact new nurses' satisfaction and increase stability and retention. Providing graduate nurses with support, adequate training, and professional guidance may empower new nurses by increasing their sense of belonging and giving them the confidence to provide quality patient care.

With recognition of the current nursing shortage, heath care executives are forced to assess orientation processes and the option of nurse internship/residency programs that may impact new nurse satisfaction in order to increase job stability, satisfaction, and retention. Although several factors affect new graduate satisfaction, an understanding of what is satisfying to new graduate nurses will allow administrators to develop strategies such as residency or internship programs that may increase new nurse satisfaction, making them more comfortable in their professional nursing role.

In order for the Department of Health in Taiwan to plan and implement improvement for continuing education among healthcare providers, the Taiwan Joint Commission on Hospital Accreditation (TJCHA) was authorized to initiate the Teaching Quality Improvement Program for Teaching Hospitals. The program assists healthcare professionals to establish and implement a postgraduate clinical training system. The two-year training program for postgraduate nurses at Veteran General Hospital in Taichung (VGH- Taichung) was initiated in 2008. The mission of this program was to foster the nurses to become competent clinicians who are able to provide high quality patient-centered care.

During the first year of implementation of this training program in 2008, VGH-Taichung monitored 56 nurses and compared their skills in physical assessment during the baseline and post-test at two years after completion of training. The evaluation showed that there was only 15% improvement on physical assessment scores after the training. At the post-test in 2010, one of the systems in physical assessment that scored lower

than other areas was breast sound auscultation skills. Among the trainees, majority (56.7%) scored in the category of less than good (2 points) in a 5-point system, and 52.9% could not correctly identify abnormal breast sounds during auscultation during simulation. As a result, this is an area identified for further instructional improvement.

The Professional Development Committee for Nursing at VGH-Taichung identified and implemented the objective structured clinical examination (OSCE) as an approach to evaluate trainees' clinical performance. Developed by Harden and his colleague,[7] OSCE provides a comprehensive tool to evaluate students' interpersonal and communication skills, decision-making and problem-solving abilities, and teaching and assessment skills. It offers an innovation learning experience based upon the interaction among trainees/students, standardized patients, and instructions/preceptors.[8] OSCEs have been widely used in the context of undergraduate and postgraduate education because of their advantages in terms of good validity and reliability[9,10] in nursing, medicine, and other medical-related professions.

In 2012, a pilot OSCE was implemented with an objective to assess the clinical competencies of nursing trainees to provide feedback on their performance in the two-year postgraduate training program at VGH-Taichung. However, little is known about the effectiveness of OSCE for nurse trainees after implementing this OSCE curriculum. The mission of this program was to foster the nursing trainees to become competent clinicians who are able to provide high quality patient-centered care. The framework of this VGH-Taichung training program was constructed based on the five core competencies identified in the *Health professions education* document from the Institute of Medicine (IOM) (2003). These competencies are: 1) patient-centered care, 2) teamwork and collaboration, 3) evidence-based practice, 4) quality improvement, and 5) informatics.

II. PURPOSE

Because little is known about the effectiveness of the postgraduate program in Taiwan on trainee learning. Therefore, the purpose of this paper is to describe the process of how VGH-Taichung adopted OSCE for evaluating first year trainee's psychomotor, cognitive and affective skills in a simulated environment to improve their performance scores among newly graduate nurses in postgraduate training program. We hope that the quantitative data can be used to improve program design and accurately evaluate the implementation of postgraduate Nursing training in Taiwan.

III. MATERIALS AND METHODS

Study Overview and Participants

This study has a cross sectional descriptive design and participants were newly-graduated nurse trainees (within 4 years of graduation) working at VGH-Taichung. A convenient sample of 376 trainees who were in the postgraduate straining program between 2012-2014 were included in the current study.

Procedure

An ethical approval was obtained from VGH-Taichung Nursing Department Research Committee. During the 3-month training period for the respiratory system module, nursing trainees learned how to perform clinical physical assessment skills by using simulation-based learning with OSCE procedures. The examination team involved all the staff in each department who received training on OSCE before the actual exam.

The education training included a certified Nursing preceptor instruction. The trainee received an online curriculum that provided cognitive aspects of respiratory system health assessment. Next, the curriculum included video demonstration using the VitalSim high-fidelity simulator for human breath sounds auscultation assess skills. The preceptor discussed the simulated scenarios provided by the online curriculum and provided additional guidance on challenges raised by the students. Next, the preceptor arranged time for the trainees to visit the Clinical Skills Center site, so trainees could use the VitalSim high-end simulator which was designed to simulate various respiratory sounds for trainees to practice auscultation skills. With simulation, trainees improved their health assessment skills by repeated practices identifying abnormal breath sounds. The trainees were required to complete two clinical scenarios with one normal and another one abnormal breast sounds.

After completing the online instructional module and simulation experience, the trainees were required to complete a respiratory system assessment test as part of OSCE procedure where the preceptor evaluated trainees' interpersonal and communication skills, problem-solving abilities, teaching and assessment skills, and ethical and professional decisions. OSCE also provided innovative teaching strategies with situational simulation that was complemented with interactive reflections during debriefing.

During the simulation experience, the preceptor used Direct Observation of Procedural Skills (DOPS), an assessment checklist to evaluate the students' ability in health assessment on the respiratory system. Using the objective DOPS, the preceptor was able to evaluate if trainees possessed the knowledge of specific skills and know how to apply this knowledge into practice.

During the debriefing, the preceptor provided students feedback on their knowledge and skills, pointed out deficiencies in knowledge, and gave suggestions on how to improve the performance of clinical skills. At the debriefing, both trainees and the preceptor completed scenario discussions with interdisciplinary staff, for example, a respiratory therapist. Trainees gained confidence in performing clinical skills in a simulated environment before performing the same skills in actual clinical settings. The process of OSCE evaluation can be shown in Figure 1-4 with briefing/introduction by the preceptor, testing with high-fidelity simulation, evaluation, and debriefing and group discussion. Once trainees passed the respiratory system evaluation with DOPS, the preceptors informed the trainees that they were able to apply their health assessment skills in clinical practice.

Figure 1. Reading

Figure 2. Testing with simulation

Figure 3. Bi-directional feedback between examiners and students

Figure 4. Group discussion and sharing feedback

Figure 1-4: The postgraduate program flow

Tools of Data Collection

The measurement tool was developed and reviewed by five panels of content experts in the field of medical and surgical nursing with needed modifications before the study was carried out. The 12-item Observation of Procedural Skills (DOPS) provides accurate judgment on trainees' adequacy regarding three domains of attributes (i.e., cognitive, attitudes, and technical/skills) in respiratory system health assessment (Table 1).

Before using DOPS, preceptors received training in order to achieve inter-rater reliability of using DOPS. The training included instructional videos, review of the rating procedures using interactive response system (IRS), observing two master trainers on using DOPS with two clinical case scenarios, and questions and answers by master trainers. Consensus of assessment standards were shared during the training. Any discrepancies on DOPS results were expected to be resolved among preceptors in order to achieve the consistency in ratings.

Preceptors were asked to rate on a 5-point scale ranging from 5-excellent, 4-good, 3-acceptable, 2-less than expected, and 1-not passed- 1 point. The trainees were informed that they had to achieve a rating of 3 on each item. The overall performance grading: at the end of the test, overall performance was calculated using a global ratings scale (GRS) with standards divided into A, B, and C levels: A-Excellent, which means fully understanding what they learn: overall points of 95-100, B-Good, with total points of 85-94, which means understanding most of what they learn, and C: Not passed, 84 points or less -5 points, not passed, which means they did not understand most of what they learned. The trainees needed to pass with level B or higher in GRS. Statistical analysis was performed using SPSS version 26.0 (SPSS Inc., Chicago, IL, USA).

IV. RESULTS

Participant Demographics

The participants were new graduate nurses with less than four years of nursing experience working in direct patient care settings. All nurses (n=376) included women (95.2%) and men (4.8%). The mean age was 23.3 years (SD 1.16 years; range 20–26 years). They were all graduated with undergraduate degrees or above.

Table 1 Participant Demographics (N=376)

Variable	Number (%)	Minimum	Maximum	Mean score Mean(SD)
Gender				
woman	358 (95.2)			
man	18 (4.8)			
Age		20	26	23.3(±1.16)
Education				

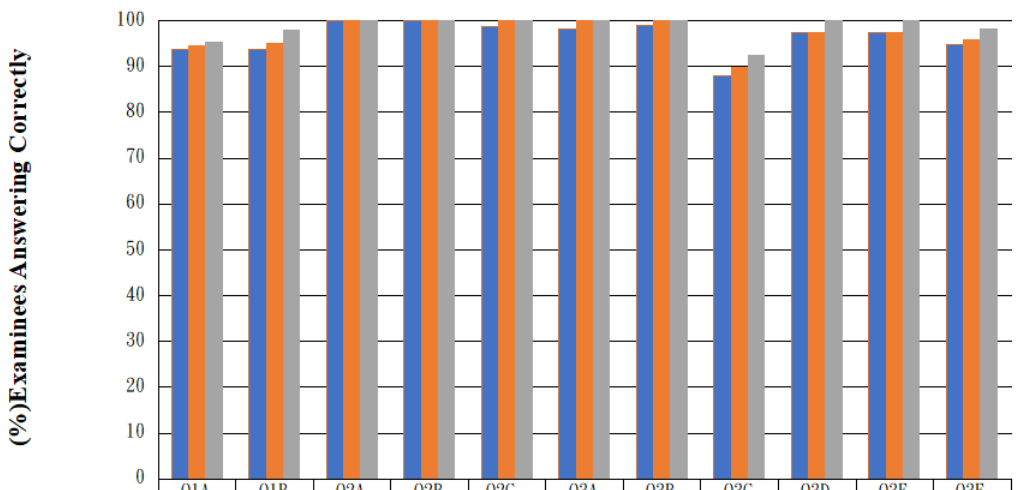
Undergraduate or above	376 (100)			

Assessment of performance by preceptors

Between 2012 -2014, there were 155, 103 and 118 trainees with a total of 376 students. Figure 5 shows that the objective structured clinical evaluation using DOPS by preceptors showed improvement over the 3-year period in all three aspects, i.e., cognition, affection, and skills. For the cognitive aspect, more than 95% of trainees achieved competency on the two items in 2014, “correctly distinguish abnormal breath sounds” and “be able to tell what abnormal breath sounds mean."

For the affective aspect, trainees demonstrated competency in respecting patient privacy and rights, organizing and integrating the assessment process of the respiratory system, and maintaining the comfort of the patients with the percentage of below 95% in 2012 on the items "introduction of self and verifying patient identification" and "describing assessment procedures and potential discomfort for the patients," which increased to 95% and 98% in 2014. With item, "be able to help patients take a comfortable supine position,” the percentages increased to 100% in 2013 and 2014.

For the technical/skills aspect, the deficient areas for the trainees included “able to identify the location of the lower, middle and upper right lobe, and left upper and lower lobe from body surface” whereas the percentages were 88.1%, 89.9% in 2012 and 2013, which increased to 92.5% in 2014. Four items in the skills aspect achieved 100% in 2014 (Figure 1).



	Q1A	Q1B	Q2A	Q2B	Q2C	Q3A	Q3B	Q3C	Q3D	Q3E	Q3F
2012 Year	93.8	93.7	100	100	98.7	98.3	99	88.1	97.5	97.5	94.7
2013 Year	94.4	95.1	100	100	100	100	100	89.9	97.5	97.5	95.8
2014 Year	95.2	98	100	100	100	100	100	92.5	100	100	98.1

Figure 1 Respiratory System Assessment OSCE Test Results Chart.

Overall Performance with Global Rating System

Evaluation of the overall performance: based on integrated global rating system (GRS) assessment, the testing results were divided into A, B, and C levels, with level B as the passing standard. The results of using GRS are shown in Figure 6. Comparison of global ratings of trainees’ performance between 2012 to 2014 showed improved performance from 2012 to 2014.

The percentages of trainees who did not reach level B in three years were 3.9%, 3.4%, and 1.9% (Figure 2). These trainees failed in four items, including "able to identify the location of the lower, middle and upper right lobe, and left upper and lower lobe from body surface," "able to tell abnormal breath sounds", "able to tell what abnormal breath sounds mean", and "able to perform nursing interventions for abnormal breathing sounds." The OSCE evaluation protocol helped to identify the deficiency areas for the trainees. With the guidance from the head nurse of the department and preceptors, these trainees were able to retake the OSCE test and passed with evaluation of level B and above.

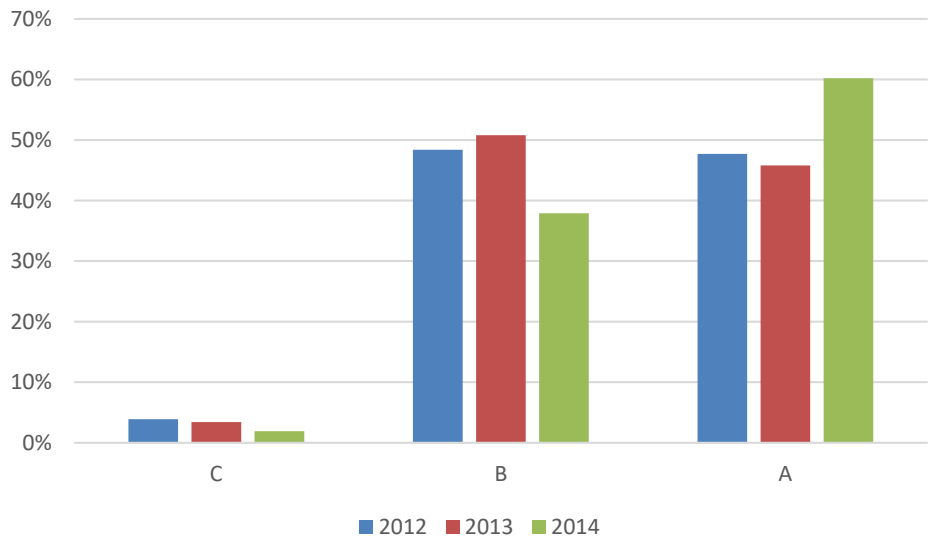


Figure2. Evaluate the overall performance

Trainees' Feedback and Comments

After the OSCE test, students were asked to complete satisfaction surveys which included their self-reflection of overall performance, and also feedback was encouraged during debriefing group discussion. The satisfaction on overall learning effectiveness was greater than 90.75%. In qualitative data, trainees highly acknowledged the bi-directional feedback and group discussion during the debriefing. Through guiding and encouraging the ability of critical thinking, trainees were able to identify areas of weakness. Usually, trainees were too busy to think during normal clinical work period; with simulation experience, they were able to take time to experience nursing processes with a thorough learning experience. Through discussion at the debriefing, trainees reported that they were encouraged to solving a patient's problem and also they are more confident with nursing practice after they received training for interdisciplinary team collaboration and respiratory disease care management with comorbidities.

V. DISCUSSION

The postgraduate training program for the nursing profession was implemented by by the TJCHA with the aim of improving the competency of nursing graduates with respect to patient-centered care as well as developing their the ability to perform competent nursing care. In Taiwan, nursing graduates have been required to complete a general postgraduate training program since August 2008.

The OSCE curriculum reported in the current study for Taiwanese postgraduate nurses was developed in responding to limited improvement and performance on respiratory system health assessment by postgraduate nurse trainees in VGH-Taichung in 2008-2010. The profession of medicine in Taiwan also adopted OSCE for residents to perform holistic medical care and competency in medical knowledge, clinical skills, and professional attitude as postgraduate medicine training program.[11,12]

Based on "learner-centered" pedagogy, VGH-Taichung developed a curriculum for trainees to assess the respiratory system, diagnose patients' problems, and provide quality nursing care. With a simulation-based learning environment, it facilitates experiential learning that trainees obtain content-related knowledge, critical thinking and communication skills, and gain confidence in a non-threatening safe environment without fear of personal failure or patient endangerment. The preceptor in our study provided oral feedback to trainees immediately after the assessment while other studies reported that the feedback in the OSCE was helpful and promoted learning.[13] With debriefing, the trainees were guided to self-reflect on insights that can improve their ability to integrate newly-obtained skills into clinical practice.

Despite the OSCE-based evaluation and teaching having several advantages that strengthen trainees' skills in history taking, health assessment, and communication skills, as well as skills on making nursing diagnosis and appropriate nursing intervention, the issues that hinder the large-scale implementation of the OSCE include its high cost and the complex logistics in its organization. Similar to studies reviewed in Rushforth (2007), OSCE implementation in VGH-Taichung was labor intensive, which cost a lot of resources and funding, particularly in high-fidelity simulation and OSCE-based evaluation.[14] During early phases of implementation in 2010, each unit only could afford to have one staff to be trained as an OSCE preceptor while there were more than 100 trainees each year scheduled to participating in the training. Due to the large number of trainees under examination with limited preceptors, the evaluation was time consuming. In addition, the cost for training at the clinical skills center was high. Starting in 2015, the hospital was able to train additional preceptors and each ward is equipped with at least 2-3 preceptors, which significantly increased the capacity to allow numbers of trainees completed the required curriculum.

This study has limitations. The participants/trainees were from one hospital; therefore, the limitation is the difficulty of extrapolating the results to other populations. The results of this study may be relevant to other hospitals that undergo a similar

situation and attempt to implement the OSCE for their postgraduate training programs. Another limitation is that, in our study, only tasks in respiratory system health were assessed. Future studies are warranted to include a wider perspective of clinical skill tasks that could have increased the generalizability of the study.

VI. CONCLUSION

Overall, the results from this pilot study provided evidence on the implementation of OSCE-based evaluation and instructions with improved core competencies of postgraduate training programs in VGH-Taichung. The OSCE appears to be a useful and feasible method for evaluating and improving trainees' clinical performance. The implementation reported in this study was a positive learning experience for the trainees. The quantitative data and qualitative information from this pilot study provide information for improving the design and implementation of postgraduate nursing education.

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Table 1: Description of DOPS Evaluation Tool

Q1A: Self-introduction and patient identification (Aff.)

Q1B: Explain to the patient examination procedures, possible discomfort, and breathing guide (Aff.)

Q2A: Help the patients take a comfortable recumbent position (Aff.)

Q2B: Observe the patient's breathing patterns, whether there is cyanosis with respiratory accessory muscles (Skl.)

Q2C: Wear a stethoscope correctly and choose the right membrane mask to listen to high-frequency sound (Skl.)

Q3A: Identify the right upper, middle and lower, left upper and lower lobe position from body surface (Skl.)

Q3B: Able to assess the breath sounds of corresponding parts and identify the location of the lower, middle and upper right lobe, and left upper and lower lobe in an appropriate manner.

Q3C: Listen to breath sounds of the patient while patient is lying (Skl.)

Q2D: Correctly distinguish abnormal breath sounds (Cog.)

Q3E: Be tell what abnormal breath sounds means (Cog.)

Q3F: Perform management of abnormal breath sounds (Skl.)

Aff.: Affective aspect; Cog.: Cognitive aspect; and Skl: Skills aspect

Impact of 12-week moderate intensity exercise on cardiorespiratory changes in MMP-9 and VO2max in elderly women

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Abstract - Background: Sedentary elderly lifestyle and aging can decreased the function of cardiovascular system may lead reduction of body performance. Exercise moderate intensity (EIM) can changes matrix metalloproteinase–9 (MMP-9) are decreased. MMP-9 is a potential marker the structural and function of the heart and its association with collagen degradation of blood vessel. VO_{2max} is an indicator of body performance. The aims this study was to investigate the effects of exercise moderate intensity on MMP-9 level and its relation with $VO2_{max}$ on sedentary elderly women. **Method:** The research was quasi experimental. Statistical sample included 42 sedentary elder women aged 65.86 ± 5.21 years were divided in two groups: 21 subject experimental group (EG) and 21 subject control group (CG). The exercise program is *EIM*, 3 times a week for 12 weeks, 50–85% HR_{max} during 30 minutes. The variable was examined at 0, 6 and 12 weeks. MMP-9 were measured by ELISA and predicted VO_{2max} by 6 minutes walk test (6 MWT). Data were processed by Unpaired t-test and Pearson test. **Results :** Δ MMP-9 level was significantly decreased on EG (p = 0.014) and predicted VO_{2max} was also significantly increased on EG (p = 0.000) Our data showed negative correlation between MMP-9 level and predicted VO_{2max} at 12 weeks (r = -0.224, p = 0.041). **Conclusion**: Exercise moderate intensity during 12 weeks can improve cardiovascular system and body performance through decreased of MMP-9 level and elevate of VO_{2max} in elderly.

Keywords: MMP-9, Exercise moderate intensity(EMI), VO_{2max} and Elderly women

I. INTRODUCTION

Sedentary elderly lifestyle and aging can decreased the function of cardiovascular system may lead reduction performance. Engaging in any activity such as housework, shopping, is better than living a purely sedentary lifestyle, but participating in a planned exercise program will get even more cardiovascular benefits especially for elders. Walking may be an ideal exercise for elders because it is safe, cheap, easy to do [1,2]. Aging a major risk factor the development of arterial stiffnes and cardiovascular disease. Matrix metalloproteinases (MMPs) are family of nine or more highly Zn^{++}, in the circulation are thought to modulate the activation of growth factor, cytokines and angiogenesis facilitating physiological adaptations to exercise training [3,4]. The MMP families of enzymes contribute to both normal and pathological tissue remodelling. Each MMP target a specific substrate, thus appropriate MMP must be released in a time and location- specific manner to orchestrate membrane remodelling and adaptation [5,6].

The patophysiology mechanisme underlying vascular remodeling include the processes regulate extra cellular matrix collagen [7]. In recent years, scientists have studied many biomaker of matrix remodeling that closely reflect the ongoing process of continuous matrix breakdown and synthesis [8]. MMP-9 is present in developing cardiac tissue in human and rodents, and is expressed between 16 and 18 days of embryogenesis [9,10]. Also reported to paly a significant role in neovascularization through the proteolytic degradation of the protein in basal lamina of the blood vessel and a release of the biologically active form of vascular

endothelial growth factor [11]. MMP-9 robustly increases several cardiovasculare diseases, including hypertension, atherosclerosis and myocardial infarction (MI). Human vasuclar endothelium contain several type of colllagen. Plasma MMP-9 is a type IV and V colllagen, which is found in subendothelial basement membrane. Gelatinase B or MMP-9 is secreted by a wide number of cell types, including neutrophils, macrophages and fibroblast. MMP-9 is synthetized during granulocyte differentiation in the bone marrow. In human but not rodents, neutrophil MMP-9 is covalently linked with lipocalin, which protects it from proteolytic degradation[12,15].

Hence, it has been proposed that dimished activity of MMP-9 is associated with accumulation of extracellular matrix in the resistance arteries, thereby contributing to hypertension. MMP-9 degrades the extracellular matrix (collagen type IV dan V) in normal physiology process, Higher MMP-9 concentrations was related with greater risk to a higher hypertension because these marker reflect vascular remodelling that accompanies the evalution of high blood pressure [16]. Therefore examination of arterial stiffness is an important determinant of cardiovascular risk. Elastin is main elastic component of the arterial wall and can be degraded by enzymes such as serine protease and MMP [17].

There are three general activation mechanisms of MMPs, including the pro-MMP cleavage, phosphorylation, and oxidative stressors. MMPs can also be activated by oxidative stressors such as homocysteine (Hcy), nitric oxide (NO), and hydrogen sulfide (H_2S). Hcy is a metabolite of the amino acids cysteine and methionine that activates MMPs by the extracellular signal-regulated kinase pathway [18,19]. The three MMP regulators mentioned above can give more insight on how MMP levels can be regulated in ways that can benefit the human body against diseases. Based on the previously published studies, the responses of MMPs to resistance training are more likely related to duration of exercise training. Resistance training lasting from 5 to 12 weeks may increase MMP-2 and -9 in both animal and human subjects[20], whereas acute bout of resistance training may decrease these MMPs [(21)]. The impact of aerobic exercise training on MMPs may be related to duration of exercise. In general, the long-term aerobic exercise training lasting up to 12 weeks may decrease both MMP-2 and 9 [22,23], while these MMPs increase following acute bouts of exercise [24]**.**

Aging progressively associated with high levels of oxidative biomolecules that react with free radicals causing increased damage to proteins, fats and DNA. Oxidative stress is a term of cell damage caused by an imbalance between prooxidants (RONS) and antioxidants. ROS is an oxygen-generated free radical and is most widely produced in mitochondria[25]. Increased oxidative stress due to chronic sedentary in elderly will cause oxidative damage of mitochondrial tissue especially complex I, complex II and ATP synthesis complex so that the ability of energy formation and mitochondrial matrix to produce antioxidant. Moderate intensity exercise done continuously will lead to adaptation with increased antioxidants through the formation of mitochondrial ROS [26].

Data collection VO_{2max} previous studies in Indonesia, the mean VO_{2max} elderly with sedentary lifestyle was obtained in the range of 6.73-25.103 $mLO_2.kgbb^{-1}.min^{-1}$, and after the lifestyle became more active then the average range VO_{2max} range of approximately 18.48-25.24 $mLO_2.kgbb^{-1}.min^{-1}$ [27]. VO_{2max} is an indicator of the ability to exercise aerobic exercise and daily activities optimally [2,28], One of the adaptation processes including increased antioxidant capacity marker (GPx, CAT) by activation of NRF2 and decreased oxidative stress markers among which are TBARS and malondialdehyde (MDA [29,31).

The aims this study was to investigate the effects of exercise moderate intensity 12 weeks on changes matrix metalloproteinase-9 (MMP-9) level and its relation with $VO2_{max}$ on sedentary elderly women.

II. METHODS

Material and Methods

Subjects. The research was quasi experimental (*control group pre test post test design)* study was participated by 42 subjects sedentary elderly women with age 65.86 ± 5.21 years, were divide in two groups each 21 subject experimental group (EG) and 21 subject control group (CG). Each person was selected based on inclusion were determined through interview and ADL Bartel score > 12, pedometer > 5000 step per day, is good balance and cognitive status cooperative. Physical examination (Body weight, height, blood pressure and heart rate regular 60-100 beats per minute). Drop out criteria did not discipline in research program.

Material and Equipment, consists of; sphygmomanometer, stethoscope, weigh scale, heart rate monitor, spirometer, stop watch, pulse oximeter, pedometer.

Protocol experiment. Before starting exercise, subject 5 minutes warm up and stretch and after exercise 5 minutes cooling down. Design exercise moderate intensity (50-85% HR max), three time in a week for 12 week, 30 minutes per session, type exercise aerobic walking [31] monitoring during period of training necessary pulse rate monitor every 10 minutes. Predicted VO_{2max} by 6 minutes walk test (6 MWT).

Study ethics. Complaint during exercise will be activity such as specific treatment until the complain loss. Subject explained about the procedure and aim the study before program. Informed consent if confirmed.

Biochemical analysis. Basal blood draws were collected at basaline at 5 minute before exercise and 24 hour after exercise via venepuncture. Blood sample centrifuged 3000 rpm for 30 minutes and plasma 1.5 ml store was frozen at – 20^0 C until assay. All sample were measured MMP-9 using ELISA method and *TBARS Assay Kit*.

Statistical analysis. Data were analysed using SPSS package program version 20.0. Unpaired t-test and Pearson test compare mean Δ MMP-9 level and predicted VO2max between CG and EG at 0 and 12 weeks after exercise. All analyses were performed using SPSS 20.0

III. RESULTS

As shown in the table 1. Baseline characteristic subject no difference such as ages, weight, height, BMI, pedometer and ADL between CG and EG. (p > 0.05)

1. The characteristic subject

Tabel 1. Data physical and physiological characteristic subjects

Test/unit	Control group (CG) n = 21 mean ± SD	Experimental group (EG) n = 21 mean ± SD	Evaluation *p*
Age (yr)	65.29 ± 4.84	66.71 ± 4.99	0.181[a]
Body Weight (kg)	55.51 ± 12.15	56.67 ± 10.17	0.739[a]
Height (cm)	147.19 ± 4.78	150.09 ± 4.28	0.098[b]
BMI($kg.m^{-2}$)	25.48 ± 4.76	25.14 ± 4.36	0.811[a]
Pedometer (step)	2850.05 ± 1338.43	3448.67 ± 1231.78	0.139[a]
ADL	19.24 ± 0.76	19.47 ± 0.68	0.300[b]

[a] t- test unpaired
[b] Mann-Whitney U test
*Value *p* > 0.05 → significance differences two groups (homogen)
ADL Barthel : *activity daily living*

Table 1 summarizes the characteristic of subjects in this study. All 42 subjects between control group (CG) dan experimental group (EG) complete exercise the same treatment no difference.

2. Changes in plasma matrix metalloproteinse-9 (MMP-9)

Tabel 2. The comparison of the difference Δ variabel between Control group (CG) and Experimental group (EG)

Variabel	Control group (n=21) mean ± SD	Experimental group (n=21) mean ± SD	Evaluation p
MMP9	56.47 ± 156.49	-51.41 ± 113.47	0.015*
VO_{2maks} ($ml.kg^{-1}.min^{-1}$)	0.973 ± 3.81	3.946 ± 2.52	0.005*
BPS	-1.667 ± 7.66	-8.762 ± 8.09	0.006*
BPD	-1.571 ± 8.46	-5.143 ± 6.21	0.127
GPx (U/mg)			
0 week	284.53 ± 149.21	107.65 ± 57.67	0.000[a*]
12 weeks	231.86 ± 73.32	184.79 ± 64.73	0.015[a*]

[a] Uji Mann Whitney (nilai *p* Shapiro Wilk < 0.05)
[*]Uji t-test unpaired (p<0.05)
*value Δ = the difference absolute value between 0 and 12 weeks exercises

The result research obtain matrix metalloproteinse-9 (MMP-9), blood pressure systolic (BPS) decrease significance and prediction VO_{2max} increased significance, the subject exercise aerobic intensity moderate prolonged 12 weeks.

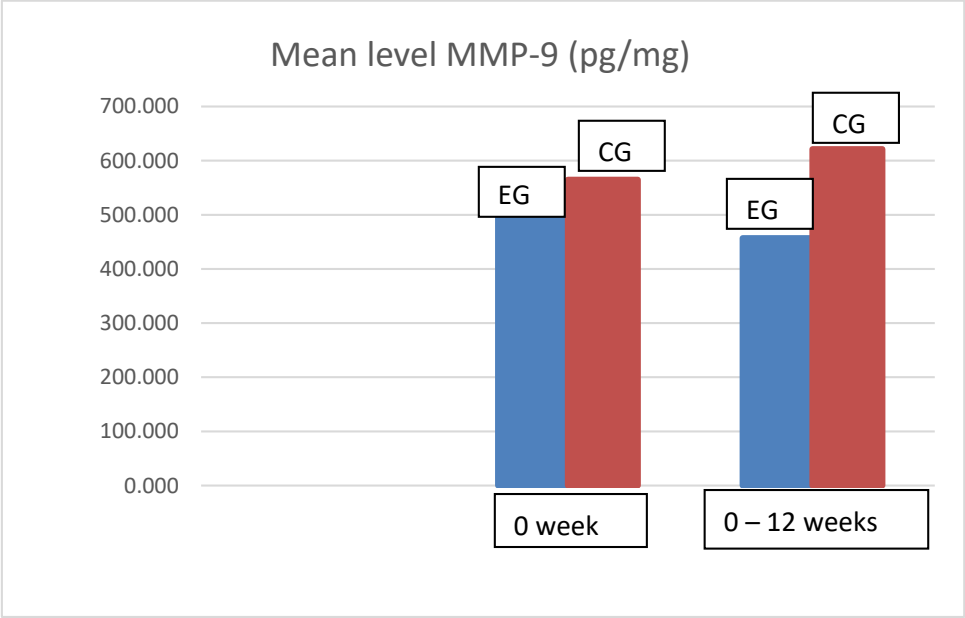

Figure 1. The comparison of the difference mean level MMP-9 between Control group (CG) and Experimental group (EG)

Then conducted a correlation between research MMP-9 and other research variable found matrix metalloproteinse-9 (MMP-9) significance negative correlated between prediction VO2max (r= - 0.311, p= 0.045), while blood pressure systolic (BPS) is correlation positive (r =0,221) and other variable no correlation. Level thiobarbiturate acid reactive substance (TBARS) in 0 weeks (1.13 ± 0.17 nmol/mL) and 12 weeks (1.05 ± 0.12 nmol/mL), difference level between 0 and 12 weeks seen a downward trend TBARS 7.08%.

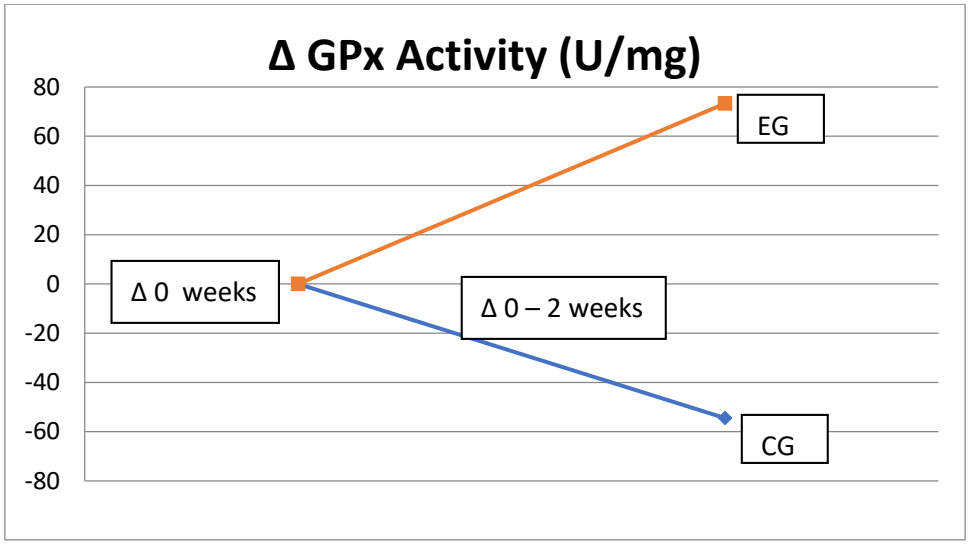

Figure 2. The comparison of the difference changes Δ GPx activity between Control group (CG) and Experimental group (EG)

The results showed a decrease in plasma GPx control group by 7.40% at week 12 while the experimental group showed a significant increase in plasma GPx activity by 40.16% after 12 weeks (start 0 weeks : 107.65 U/mg and 12 weeks: 184.79 U/mg). Because the initial data of the study did not show equality ($p < 0.05$), data processing was performed using Δ between 0 and 12 weeks of training and the percentage change. 0–12 weeks GPx activity obtained by the control gro7up was found to decrease by -52.67 U/mg and the treatment group increased by 77.14 U/mg ($p = 0.003$).

IV. DISCUSSION

The predominant exercises aerobic intensity moderate to able decreased matrix metalloproteinse-9 (MMP-9) play role degradation collagen type IV in wall endothelium blood vessel. Increased level matrix metalloproteinse-9 (MMP-9) related with hypertension due to with remodelling blood vessel [15]. Arterial stiffness is an important determinant of cardiovascular risk. Elastin is the main elastic component of the arterial wall and can be degraded by enzymes such as serine proteases and MMP. Serum MMP-9 levels associate with arterial stiffness and predict cardiovascular risk [17]. MMP-9 play a role in the formation and destabilization of plaque that are biomarker of *acute coronary syndrome*. Inhibition of MMP-9 production may lead to decreased plaque formation and decline the cardiovascular disease[32]. Our finding suggest that the decline of MMP-9 in this study represent another alternative pathway for changes in cardiovascular adaptation due to exercise in elderly. Decreased of MMP-9 improves the extracellular matrix by inhibiting the degradation of collagen tipe IV and V lamina basalis to form cardiovascular adaptation by improving the elasticity of blood vessels thereby decreasing BP in elderly. it prevent cardiovascular disease in elderly. The elevated MMP-9 level occur in CAD patients. MMP-9 can predict an increase mortality in CAD patient[33].

Free radicals can increased degradation collagen (decreased synthesis collagen) through increased activity matrix metalloproteinase-9 (MMP-9) [34]. To our study, additional measured TBARS level to know free radicals due to prolonged exercise. Apparently found a tendency to decreased TBARS level of 7.8% this indicate moderate aerobic exercise can reduce free radicals be able to affect the decrease in levels of matrix metalloproteinase-9 (MMP-9) in the body, which improve the body's circulation work. One that affect the increase in VO_{2max} is by improving the circulation to increase oxygenated blood flow in the circulation VO_{2max}.

In this study also increased the antioxidant (glutathione peroxidase) of 40.16% after 12 weeks, increased in glutathione peroxidase

signifies the improvement of mitochondrial function because it is mostly found in the mitochondrial matrix. Glutathione expression increases through nuclear factor erythroid 2 (Nrf2) activity due to the process of long-term intensity moderate aerobic exercise adaptation. The role reactive oxygen species (ROS) in activation of the transcription factor Nrf2, the master regulation of antioxidants enzymes and celullar stress resistance. Moderate-intensity aerobic exercise increases oxidative stress at optimal levels thereby increasing ROS with the optimal amount which does not cause damage to mtDNA. Glutathione peroxidase serves to counteract free radicals in the mitochondria [35]. Therefore, this type of exercise will further increase the levels of antioxidants (glutathione peroxidase) which serves to reduce the free radical formed is marked by the visible decrease in levels of TBARS week-12 exercise. Thus, the elderly is strongly encouraged to continue doing moderate intensity exercise regularly to control the production of free radicals with more optimal.

V. CONCLUSIONS

Moderate intensity aerobic exercise for 12 weeks has been show changes in matrix metalloprotein-9 (MMP-9) is decreased, play role degradation collagen in wall endothelium blood vessel. Increased level matrix metalloproteinse-9 (MMP-9) related with hypertension due to with remodelling blood vessel. Arterial stiffness is an important determinant of cardiovascular risk. Affect the decrease in levels of matrix metalloproteinase-9 (MMP-9) which improve the body's circulation work. One that affect the increase in VO_{2max} by improving the circulation to increase oxygenated blood flow in the circulation $VO_{2max.}$ Certainly the decline of MMP-9 as well as a significant correlation with predicted VO2max thus can improve cardiovascular system and increase body performance that will delay the aging process of the body.

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Size-Wise Back Off Period for CSMA/CD Protocol

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Abstract- In the current Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol, a back off algorithm is followed upon encountering a collision between two frames sent by different systems. This algorithm involves the generating of random numbers in both the stations whose messages collided. If a re-collision occurs, the numbers are chosen from a larger range of integers. The station then has to wait for that much amount of time before retransmission.

This paper proposes a different approach to refine this process and lower the probability of collisions, by selecting the waiting period or time duration which is directly proportional to the size of the packets transmitted by the system. This will bring down the overall probability of collisions, and even avoid Ethernet Captures.

Index Terms-
Contention Window, CSMA/CD, Ethernet Capture, MFS (Maximum Frame Size), NFS (Net Frame Size), Random.

I. Introduction

The CSMA/CD algorithm follows this procedure for the transmission of messages on a channel accessed by multiple nodes. It first listens to the channel for detecting current transmissions on the line. If the channel is free, the node is allowed to transmit the message. But in the event of two systems transmitting a message at the exact same time, the algorithm detecting no current transmission on the channel will allow both systems to send the message, thus resulting in a collision.

The collision in a channel, results in a voltage displacement, which is detected by systems in the network. Upon detecting this collision, the CSMA/CD approach involves both the systems picking a random number from a range of integers (contention window) and waiting for an amount of time directly proportional to the number chosen before retransmitting their messages. If further both the systems generate the same random number, the range of the integers (contention window) is increased. Thus, the range of the contention window is directly proportional to the number of collisions occurred for a particular frame (*0 to 2 raised to the power of number of collisions occurred minus 1*).

The contention window ranges for different number of collisions is given in the following table:

Table 1

No of Collisions	Contention Window
1	0 to 2^1-1
2	0 to 2^2-1
3	0 to 2^3-1
4	0 to 2^4-1
5	0 to 2^5-1

The probability of a frame not facing collision increases after every collision.

Whatever number is chosen here (randomly), from the contention window, is multiplied by 512-bit times. Then this amount of time is spent before the node tries to retransmit the packet.

The Problem with the existing approach:

The number of collisions is limited to a maximum of 10. After which the system does not attempt to send that message again. The event of two frames choosing the exact same random numbers 10 times does seem unlikely, but the problem arises when one or more of the systems have a really large message to be sent. Consider the following case;

Two systems (say A and B) attempt sending a message at the exact same time. One of the systems (say A) has a very large size of packets. Upon collision both the systems enter into the back-off phase and wait for a randomly generated amount of time. There is only a 25% chance that B (the system with the smaller packet size) will win, i.e be allowed to transmit its packet before the system A. In case A wins, i.e starts transmitting its message, the channel will be held up for a very long period of time. This results in the channel being busy whenever the B is ready to transmit and thus the waiting time for B keeps getting longer until finally, the B loses the message it was going to transmit. This problem arises from a combination of phenomena called Ethernet Capture and Lost Node.

Thus, a system with a large amount of data will not only monopolize the channel for a long time and delay transmission of shorter frames but also may result in the complete loss of the shorter frames.

Proposed Solution:

My solution proposes two new variable nfs (net frame size) which keeps the track of the size of the frames/packets to be transmitted, and mfs (max frame size), which holds the maximum allowed size of a packet or a frame in a network.

The mfs can be set to an ideal value depending on various attributes of the network by the network administrators.
As seen in the previous sections, the usual procedure followed is: A random number is chosen from the contention window whose range keeps increasing with the increasing number of collisions faced by the particular frame. Then an amount of time directly proportional to that random number is spent before another attempt to retransmit.
But here, instead of waiting for a random amount of time, I propose that the wait time in the back-off phase is made to be directly proportional to nfs.

Formula:

Wait time = H + { (nfs/mfs) x 512-time units x M }

Nfs: Net frame size
Mfs: Maximum frame size
H, M: constants

The values for mfs and the constants M and H are determined beforehand. These values can be kept constant or can be modified according to the necessity.
The value of mfs can be increased if the network has to carry larger frames. If the network is expected to carry short messages but with a fast speed then the value of mfs can be made smaller.
The constant value of M can be increased if there are many nodes trying to send a frame and a longer range of wait time is required. The value of M can be made smaller if the wait time has to be reduced and a faster network is needed.
The constant value of H, is the minimum wait time, for which the system has to wait. This can either be decided by network authorities or the system itself. By default, H is to be 0 for all systems on the network.
The value of nfs is variable and can be only determined by the system transmitting the frame.

Advantages:

Thus the waiting time of the back off phase instead of being a randomly generated time unit, is a value that is directly proportional to the frame size to be transmitted.
This new formula would enhance the current CSMA/CD protocol in the following ways:

1. Lowering the probability of collisions: Every frame being transmitted will have different size. The sizes may not always be unique, but the probability of two frames which transmit at the exact same time and also have the exact same size is fairly low. This will bring down the number of re-collisions by a large extent.
2. Avoiding Ethernet Capture and Loss of Frames: Since the waiting time is to be directly proportional to nfs (the message size), this algorithm makes sure that in most cases, the system with the smaller packet/frame size, gets a chance to utilize the channel. Since a smaller message will take less time for transmission and propagation, it will release the channel faster and let other systems transmit their messages. This ensures that an Ethernet Capture doesn't occur in the channel.
3. Lower Waiting time: The range of the contention window in the original CSMA/CD protocol was 0 to 2^n with n being the number of collisions. With this algorithm the range of values can be made much smaller. That is done by making sure that the M value is set to less than 2^n.
4. Completely customizable range of wait time: The constant values of H and M can be altered and the duration of the back off period can easily be changed to any value.
5. Prioritizing important messages: The network administrator decides which messages are potentially important and can alter the H and M values of that node to a minimum to ensure that potentially important messages don't have to wait for a longer period of time. None of the previous algorithms allow the prioritizing messages.

All these factors will play a major role in the smooth functioning of a channel. This algorithm however has some disadvantages that need to be worked upon.

Disadvantages:

1. If 2 frames have the same size, some anomaly may be caused in their transmissions. Even though the probability of 2 frames with the exact same size trying to transmit at the same time is fairly low, such an even is still possible.
2. A message that has a large frame size will have to wait for a longer time if a collision occurs. If that frame happens to carry any crucial information, then it may be delayed.
3. The above two shortcomings can be completely overcome by varying the constants in the formula. But it requires continuous surveillance by the network administrators.
4. In the formula given above, anomalies would be caused if the size of a particular frame (nfs) happens to be larger than the estimated maximum frame size (mfs).

II. CONCLUSION

From the given disadvantages, the first two can be easily dealt with by the network administrator varying the constants H and M in the formula. But this would require the network administrators to continually monitor the entire process.
But with the continuous advancements in the fields of Machine Learning and Prediction Models, these drawbacks too can be replaced by machine learning algorithms that learn to handle the constants in the systems, and set them to an ideal value, and ensure faster functioning of the network.

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Application of Firefly Algorithm in Finding Optimal Parameters

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Abstract**—**Fireflies that attract all other fireflies or be attracted to other fireflies which are of higher brightness is the basis of the firefly algorithm. It is an optimization algorithm of calculating objective functional values. In this paper with the use of discrete wavelet transform the implementation of firefly algorithm is done and the experimental results of using certain number of initial and randomly allocated fireflies are used to calculate certain parameters which gives the ratio between the maximum signal power and maximum noise power, bit error rate(BER), coefficient measuring the degree of similarity(Corr), the normalized cross correlation(NC) between the watermarked image and original image. The mean objective functions are calculated using the parameters mentioned above.

Keywords**—***Firefly, dwt, haar, localization, optimization.*

INTRODUCTION

Swarm Intelligence (SI) is one of the topics under artificial intelligence (AI) which has become very popular in the last decade. The socialistic behaviour of bees, worms, bird groups, and flying ants were the major influence for SI.The fireflies flashing behaviour was the inspiration for Xin-She Yang and he proposed a metaheuristic firefly algorithm at Cambridge university. Many optimization problems can be solves easily using this algorithm. Luminary flashing activities like attracting the partners and risk warning for predators are the characteristics of this algorithm. This algorithm is mainly used for optimization of nonlinear functions. Attractiveness is assumed to be directly proportional to the brightness level of individual fireflies.

Particle Swarm Optimization mimics the flocking behaviour of birds and gives an optimum solution. Memetic Algorithm was inspired by Dawkin's theory of evolution where a set of memes are considered to form chromosomes. Shuffled frog leaping algorithm is inspired by leaping and shuffling behaviour of frogs to exchange information among them in order to search for food. Artificial Bee colony algorithm imitates the foraging behaviour of honeybees. The Biogeography based optimization algorithm is based on migrating behavior of species in habitat. Cuckoo search algorithm is inspired by breeding of cuckoo bird; they select their home nest by taking over the nest of some other birds. The fertilization process of flowers has inspired the flower pollination algorithm.

Two level transform of discrete wavelets using singular value decomposition(SVD) method is used to watermark the image using another cover image. DWT provides good spatial localization and multi resolution characteristics in digital image watermarking technique. A dwt is a transform in which there is direct sampling of wavelets.

LITERATURE REVIEW

A. Biological foundations

Fireflies are appealing insects. The flashing of light are the major characteristics of fireflies. Bioluminescence which is a biochemical process is the reason for flashing character. The mating of these fireflies are majorly characterised by the flashing light behaviour which serve as primary pursuit signals. Besides mating, the light may serve as warn off to their potential predators. The light is produced by their organ called lantern.

B. Discrete Wavelet Transform (DWT)

DWT is the type of transformation in which there is discrete sampling of the wavelets. The local information and frequency information both can be found out using DWT which one of the major positives of this transform. DWT is used to de-noise and provide good compression technique, they also provide information about the abrupt changes which can't be found out using Fourier transform. In this paper DWT transform is used with 'haar' wavelets, which was the first DWT invented. Assuming the size of the image to be K*L, the DWT transform method of watermarking will divide that image to 4 sub bands with size K/2*L/2

comprising of all the combination of low frequency and high frequency vertical and horizontal components. The working DWT based watermarking where the high frequency components are those redundant pixels in the image, hence these are neglected and image with minimal amount of information needed to define that image is placed on the cover image. Two levels of DWT is applied and SVD decomposition to each block is performed.

C. Assumptions

There are three main assumptions in firefly algorithm.

1. An individual firefly is considered to be unisexual so that they can be mingled with other fireflies and attract them.
2. As the gap between two fireflies becomes more and more, the attractiveness and brightness reduces. These parameters brightness and attractiveness are directly related to each other. The brighter firefly attracts the lighter firefly and there can be random movement if there is no difference in intensity levels.
3. The objective functions are those which determine the brightness parameter. The functional values of the objective functions are simplified to be the brightness of that particular firefly at that point.

METHODOLOGY

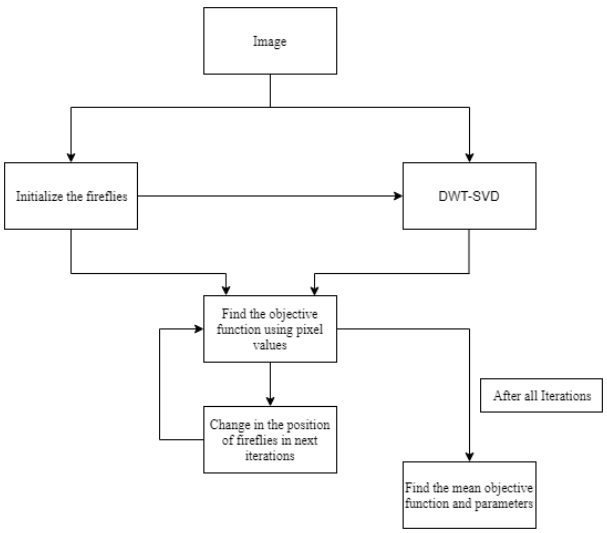

Fig (1) – Proposed methodology

The DWT-SVD method is used to watermark the Fig1 using Fig2 to get watermarked image Fig3.

Fig (2) –Original Image

Fig (3) – Image used for watermarking

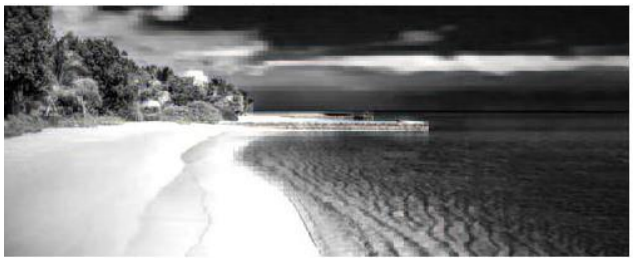

Fig (4) –Watermarked image.

The constants like randomness, absorption coefficient, and randomness reduction coefficient are initialized for better converging in case of functions. Converting to fig1 into binary image and allocating 'n' number of initial randomly allocated fireflies on the image, the same number of fireflies are allocated in random manner in watermarked image fig3 as well. The values of the points in which firefly is randomly allocated is taken between the regular and watermarked image and the performance parameters like PSNR, BER, NC, correlation coefficient is also calculated using the formulas.

By using these parameters f (PSNR, BER) and f (PSNR, NC) are calculated and tabulated. This procedure is repeated for 5 iterations for different values of initial number of fireflies allocated and the experimental results are tabulated.

$$PSNR(X,Y) = 10log_{10}\frac{MN \cdot X_{max}^2}{\sum_{m=1}^{M}\sum_{n=1}^{N}[X(m,n)-Y(m,n)]^2} \quad (1)$$

$$NC(X,Y) = \frac{\sum_{m=1}^{M}\sum_{n=1}^{N}X(m,n)\cdot Y(m,n)}{\sqrt{\sum_{m=1}^{M}\sum_{n=1}^{N}[X(m,n)]^2}\cdot\sqrt{\sum_{m=1}^{M}\sum_{n=1}^{N}[Y(m,n)]^2}} \quad (2)$$

$$BER(X,Y) = \frac{\sum_{m=1}^{M}\sum_{n=1}^{N}X(m,n)\oplus Y(m,n)}{M\,X\,N} \quad (3)$$

$$f = PSNR(X,X^W) + 30\cdot\sum_{i=1}^{N}BER(w,w_i') \quad (4)$$

$$f = \frac{PSNR(X,X^W)}{100} + \sum_{i=1}^{N}NC(w,w_i') \quad (5)$$

Fig (5) – Formulas

APPLICATIONS

Firefly algorithm is used in many fields. It is used in satellite image classifications and to find faulty elements in array of sensors. This algorithm is also used for radiation pattern synthesis for linear array with non-uniformity in spacing between each antenna composed of isotropic antennas with isoflux distribution. Firefly algorithm is used in optimization of 3*3 planar antenna array. In medical field, this algorithm is used for watermarking of medical images. Owner identification, fingerprinting and copy protection can make use of this algorithm. In E-Commerce industry, watermarking can be used for transaction tracking and content archiving. Multimodal design problems along with many highly nonlinear design problems or equations can be solved using Firefly algorithm. Firefly algorithm takes least possible time for digital image compression.

EXPERIMENTAL RESULTS

Correlation coefficient used is 0.0185

Table 1 –Mean BER Values

Number of fireflies initialized	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Iteration 5	Mean BER
10	$0.2*10^{-4}$	$0.4*10^{-4}$	$0.6*10^{-4}$	$0.7*10^{-4}$	$0.7*10^{-4}$	$0.52*10^{-4}$
50	$2.4*10^{-4}$	$2.5*10^{-4}$	$1.9*10^{-4}$	$2.7*10^{-4}$	$2.4*10^{-4}$	$2.38*10^{-4}$
100	$3.7*10^{-4}$	$3.7*10^{-4}$	$4.8*10^{-4}$	$4.3*10^{-4}$	$4.3*10^{-4}$	$4.16*10^{-4}$
1000	0.0046	0.0046	0.0046	0.0048	0.0046	0.0046
3000	0.0141	0.0137	0.0145	0.0141	0.0143	0.0141
5000	0.0235	0.0231	0.0236	0.0238	0.0233	0.0235

Table 2 – Mean PSNR Values

Number of fireflies initialized	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Iteration 5	Mean PSNR
10	46.9897	43.9794	42.2185	41.5490	41.5490	43.2571
50	36.1979	36.0206	37.2125	35.6864	36.1979	36.2630
100	34.3180	34.3180	33.1876	33.6653	33.6653	33.8306
1000	23.3348	23.3819	23.4008	23.2057	23.3819	23.3410
3000	18.5171	18.6328	18.3803	18.5201	18.4406	18.4982
5000	16.2893	16.3601	16.2764	16.2288	16.3171	16.2943

Table 3 – Mean NC

Number of fireflies initialized	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Iteration 5	Mean NC
10	0.8660	0.6761	0.5963	0.4629	0.3651	0.5933
50	0.6132	0.5804	0.7084	0.5593	0.6669	0.6256
100	0.7223	0.7218	0.6191	0.6331	0.6631	0.6719
1000	0.6358	0.6315	0.6354	0.6233	0.6316	0.6315
3000	0.6224	0.6452	0.6259	0.6260	0.6271	0.6293
5000	0.6334	0.6370	0.6241	0.6225	0.6319	0.6298

Table 4 – Mean of function of PSNR and BER

Number of fireflies initialized	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Iteration 5	Mean f(PSNR,BER)
10	46.9903	43.9806	42.2203	41.5511	41.5511	43.2587
50	36.2051	36.0281	37.2182	35.6945	36.2051	36.2702
100	34.3291	34.3291	33.2020	33.6782	33.6782	33.8433
1000	23.4740	23.5196	23.5379	23.3491	23.5196	23.4800
3000	18.9392	19.0438	18.8159	18.9419	18.8702	18.9222
5000	16.9943	17.0537	16.9835	16.9437	17.0176	16.9986

Table 5 – Mean of function of PSNR and NC

Number of fireflies initialized	Iteration 1	Iteration 2	Iteration 3	Iteration 4	Iteration 5	Mean f(PSNR,NC)
10	1.3359	1.1159	1.0185	0.8784	0.7806	1.0259
50	0.9752	0.9406	1.0806	.9161	1.0289	0.9883
100	1.0655	1.0650	0.9510	0.9697	0.9997	1.0102
1000	0.8692	0.8653	0.8694	0.8553	0.8655	0.8649
3000	0.8075	0.8316	0.8097	0.8112	0.8115	0.8143
5000	0.7963	0.8006	0.7869	0.7848	0.7950	0.7927

CONCLUSION

In this paper, the performance metrics are evaluated between an image and watermarked image. Watermarking is done using discrete wavelet transform based on singular value decomposition. The performance parameter BER is directly proportional to the initial number of fireflies initiated and PSNR goes on decreasing with the number of fireflies initiated increases. The objective function values depend on initial number of fireflies and the performance parameters. The f(PSNR, BER) decreases with increase in the initial value of firefly but on the other hand f(PSNR,NC) depends more on the NC value in determining the functional value .With random allocation of positions of fireflies in the original image the function value for different iterations may vary ,hence the average values are also tabulated. The BER values obtained is better for the initial number of fireflies greater than 1000 as compared to [1]. PSNR values obtained are better when the number of fireflies initiated is low and those PSNR values are better compared to [1] for initial number of fireflies which are less than 50.It is difficult to obtain a high BER and a high PSNR at the same time, hence the number of fireflies initiated to be chosen based on the requirement of application.

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Government Financing of Public Secondary Schools in Kenya: Perceptions about Unit Cost of Education (UCE) to Students' Performance in Kenya Certificate of Secondary Education (KCSE). Must the Government Strain?

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Abstract- Attainment of education related millennium development goals in Kenya is largely hinged on availability and appropriate use of unit cost to acquire supportive inputs to the education process. The introduction of capitation in secondary schools was aimed at providing the economically disadvantaged with an opportunity to benefit from government sponsored education provision. However, there are indications that providing this education is now beyond the scope of Kenya's ordinary education budget, owing to 95% transition in the year 2019. Challenges arising from the pressure placed upon available unit cost in national schools have been steadily growing. In spite of the new measures that government is undertaking to strike a balance between unit cost and quality learning in recent years, it is worth examining government financing of public national secondary schools in Kenya: perceptions about UCE to students' performance in KCSE in public National schools. Must the Government Strain? The study adopted descriptive survey research design. Objective of the study was to determine effect of UCE to students' performance in KCSE in public National schools in Kenya. The target population was principals, school bursars/accounts clerk in national schools and Sub-county Director of Education in Kenya. Convenience sampling procedures was used to sample 5 National schools where 5 principals, 5 bursars and 5 Sub -County Directors of Education who were used as respondents in the study. Data was collected using questionnaires that comprised of closed and open ended test items. Interview schedules were used to get information from Sub-county Director of Education. Data analysis was done using thematic approach and descriptive statistics. Descriptive statistics used frequency counts, means and percentages. The study concluded there is inadequate financing which in turn affect students' performance in KCSE in secondary schools. The study recommends that the current fees in national schools put at Khs 81,673 up from Ksh 75,798 an increase of Kshs 5,875 while the government to provide for infrastructure vote head of Kshs4, 000 without reduction of other vote heads to put capitation at Kshs 26,244.

Index Terms- Government Financing, Quality Learning, Public Secondary Schools, Capitation, Unit cost, Ministry of Education

I. Background Information

Quality learning entails learners who are well-nourished, ready to participate and learn, healthy, and supported in learning by their families and communities. The content also should be reflected in relevant curricula and materials for the acquisition of basic skills, especially in the areas of literacy, numeracy and skills for life, and knowledge in such areas as gender, health, nutrition, HIV/AIDS prevention and peace. This will reduce disparities and outcomes that encompass knowledge, skills and attitudes that are linked to national goals for education and positive participation in society (UNICEF, 2000).

UNESCO (2012) indicate that the big challenge for secondary education in Latin American and East Asian countries in the context of increased primary school enrollment rates, which puts pressure on increased resources as demand for secondary education increases. The major challenges that these countries are encountering are inadequate resource allocations, constraints of expansion and increasing the quality of secondary education.

World Bank (2005) describes secondary education as the crucial link between primary schooling, tertiary education, and the labour market. Nearly all countries in Sub Saharan Africa have implemented policies to ensure free universal primary education particularly through waiver of direct costs to households. This has resulted in an increase in enrollment and completion rates and has brought increased demand for access to secondary education. With the increased enrollment in secondary schools, African countries must deal with issues of funding, quality learning and relevance of teaching and learning.

Kenya's Vision 2030 is the country's new development blue print; it aims to transform Kenya into a newly industrialized country by the year 2030. The Vision is based on three ―pillars‖: the economic, the social and the political. The policies of the first and second pillars are equally anchored on an all-round adoption of education as an implementation tool. One of the key areas in realizing vision 2030 is quality education and training. Improved secondary education is fundamental to the creation of effective human capital in any country. The launch of Free Day Secondary Education (FDSE) in 2008 was initiated in order to promote pupil transition from primary to secondary schools, and retention and completion in secondary schools without discrimination. The

Government intended to remove major obstacles that have stood in the way of children who need to join and complete secondary education (Republic of Kenya, (2005). The government of Kenya, through Sessional Paper No.1 of 2005, made a commitment to increase transition from primary to secondary school from 49 to 70% by the year 2010. This would be made possible by the government supplementing parents' efforts in meeting education costs at secondary level. The government supported the poor and needy students through bursaries. Further, tuition free secondary education policy was implemented in 2008 with the government's commitment to pay tuition fees for all students enrolled at secondary level. With the government efforts, transition rate to secondary level of education has since increased from 59.6% in 2007 to 90% in 2019.

Implementation of Subsidized Secondary Education (SSE) in Kenya was a major step in expanding access to education to majority of students from poor background. This was further reinforced by the international agreement on Education for All. The government provided subsidies towards funding SSE, however there were other costs that were not catered for by SSE but were to be catered for by the parents. Concerns have however been raised over effective implementation of this programme, and the impact of SSE on quality learning in national secondary schools following structural factors including inadequate and delayed disbursement of subsidies to school, shortage of human resources, limited physical and instructional resources. This research utilizes primary and secondary data to critically examine government financing of public national secondary schools in Kenya: perceptions about unit cost of education on KCSE performance. Must the Government Strain?

Statement of the problem

Fuelled by an historic convergence of globalization, knowledge-driven economies, human rights-based development and demographic trends, it has become clear that educational attainment is not only vital to the economic well-being of individuals but also for that of nations. In order to achieve the national goals of education, it is necessary to increase access to education, improve quality of learning. The first step toward a quality learning system is to ensure adequate resources, allocated in a healthy balance across core system parameters. Without this, few other policy objectives and programs can be implemented or sustained. Estimation of the unit cost of basic education makes an important contribution towards marshalling adequate resources and ensuring the sustenance of quality learning system. Secondary schools have been categorized into National schools, Extra County schools, County schools and Sub-County schools. National schools have been further grouped into various clusters depending on enrolment, location, length of stay and infrastructure. The various categories of schools have unique needs depending on enrolment, location, and its establishment with the high students' enrolment, high teacher: student ratio and overstretched facilities specifically in national schools amid standard fee guidelines by Ministry of Education. This contradicts Government policy on quality learning provision that has shown an increasing interest of attaining 100% access to secondary education, but many challenges remain. Quality learning provision in secondary schools could be compromised and even derail the free day secondary program due to inadequate financial resources and delayed disbursement of subsidies to schools. This study seeks to explore Government UCE to students' performance in KCSE in public National schools in Kenya: stakeholders' perceptions about capitation for quality learning.

Research Objectives

The study was guided by the following objective:
Effect of Unit Cost of Education to students' performance in KCSE in public National schools in Kenya.

Research Questions

In order to achieve the above objective, the following question will be addressed:
What is effect of the UCE to students' performance in public national secondary schools in Kenya?

Research Design

The study used a descriptive design that attempts to describe what was or what is in a social system. Its purpose is to use qualitative results to assist in explaining and interpreting the findings.

Sample Size

The study adopted convenience sampling technique. This is also known as availability sampling. It is a type of sampling where the first available primary data source will be used for the research without additional requirements. It involves getting participants wherever you can find them and typically wherever is convenient. In this way the desired sample in the study was satisfactory to the desired needs. The sample constituted of 5 sampled public National secondary schools.

Sampling Procedure

Convenience sampling procedures was used to sample 5 National schools where 5 principals, 5 bursars and 5 Sub -County Directors of Education who were used as respondents in the study.

Research Instruments

The research used questionnaire for principals, and accounts clerks/ bursars to collect secondary data for the study and interview schedule for Sub- county director to collect information that cannot be accessed from respondents.

Validity of the Instruments

To ensure validity of the questionnaire, assistance was sought from the expert judgment of researcher's supervisors. They were also arranged from simple to complex for easy understanding. The researcher also took representative questions from each of the sections of the unit and then evaluated them against the desired outcomes. In addition, a detailed verbal descriptions and clear instructions were provided during the group administration, which the researcher personally conducted.

Reliability of Instruments

To ensure the reliability of the questionnaire, the split half method was used. This was done by assigning the odd numbered items to one half and the even numbered items to the other of the test.

Data Analysis

This research yielded data that required qualitative and quantitative analyses. Quantitative analysis entailed analyzing numbers about a situation by choosing specific aspects of that situation. Descriptive statistics was used to analyze the quantitative data obtained using frequency counts, percentages and means. The results of data analysis were presented using frequency distribution tables. Data from interviews was analyzed using the thematic frame work and the research followed the principles of thematic analysis. The qualitative data obtained in this study was analyzed by using excerpts responses.

II. FINDINGS, INTERPRETATION AND DISCUSSION

Findings on Relationship between Unit Cost of Education (UCE) to Students' Performance in Public National Secondary Schools in Kenya

The adequate provision of facilities for better performance has a strong relationship with Unit Cost of Education because such facilities cannot be provided or planned for without establishing the unit cost of sustaining a student until completion of the course.

Table 4.4: National schools' KCSE Mean Standard Score – MSS, (2014-2018)

School	MSS-2014	MSS-2015	MSS-2016	MSS-2017	MSS-2018
A	9.28	9.74	7.33	5.61	5.84
B	-	-	9.89	7.69	6.87
C	7.89	7.33	6.16	5.61	5.63
D	10.56	10.64	9.23	8.73	8.55
F	9.93	9.65	9.23	8.12	7.98

Source: Survey data (2019)

Table 4.4 shows national schools' KCSE Mean Standard Score (MSS) for the years between 2014 -2018.National schools of all clusters admit highly scored pupils at an average of 350 out 500 marks in K.C.P.E. This is an average minimum score of 10.00 (B+) which should be maintained at K.C.S.E score. It's a pity that the general performance trend from table 4.2 above specifically in the years 2017 and 2018 show less MSS than their entry behavior. There were wide variations in KCSE performance among national schools since some schools attained a mean score of 8.55 (B) while others attained a low score of 5.63 (C) in 2018.Worsestill a principal of one school was unable to produce records of their KCSE mean score for two consecutive years.

MoEST (2012) points out that to attain better performance it requires adequate human and physical resources as well as sound school management. One of the principals asserted that:

"Physical resources such as classrooms, laboratories and playground go a long way to facilitate teaching-learning and are one of the prerequisites for achievement of better grades in KCSE examinations. To obtain there sources; finances are required such as government grants, school fees, donations and contributions from the community to meet these costs incurred byschoolstosustainteaching/learning."

"A severe shortage of teachers has hit national schools countrywide, threatening the quality of learning and compromising confidence in public education. Coupled with congestion in classes, dormitories, dining halls and even toilets as a result of the government's 100 per cent transition drive from primary to secondary, principals are struggling to maintain order and security while keeping operations going"EO5.

Shortfall continues to rise as government insists on 100 per cent transition from primary schools. Government hopes to achieve 100 per cent transition, and official figures indicate it had reached 95 per cent, which means more than one million more learners have joined form one in the year 2019. The commission is aware of the strain this is causing teachers and is asking for patience and creativity in handling the situation as the government works out strategies and interventions including employing interns to ensure no child is left without a teacher.

"While the average student to teacher ratio is 1:45, my school is operating with a rate of 1:60 or more, leading to a stressed-out learning environment with minimal teacher to student individual contact. Though the TSC has been hiring about 10,000 each year, it has been unable to match the attrition rate as teachers retire, leave for greener pastures, are dismissed due to indiscipline and other reasons, or die" P4.

On the whole, inadequate preparation of candidates is perhaps the main cause of poor performance in examinations in Kenya. This arises out of inadequate provision of teaching and learning materials especially teacher as resource, laboratory facilities. Poor performance especially in sciences could have resulted from theoretical teaching. One of the Principals was asked to comment on the relationship between unit cost and students' academic performance noted:

"Unit cost influences the condition (quality) and adequacy (quantity) of physical facilities in schools such that if it is high in relation to the fees collected the schools can buy or maintain the facilities. Adequate facilities and in good condition is a prerequisite for better performance in KCSE. With 100 % transition hence increased enrolment, little time seems to be spent on practical lessons because of overstretched facilities and this affects the overall performance in the final examination."(P5)

The Kenya Certificate of Secondary Education (KCSE) examinations are administered nationally to test a wide range of subjects as stipulated in the secondary school curriculum. Thus academic performance is highly emphasized in Kenya as it is used for certification and selection to tertiary institutions andevenemployment. One of the education officers made this observation when asked about inadequate facilities in relation to KCSE score in national schools:

"KCSE mean scores in national schools indicate that those schools with inadequate facilities performed lower than those with adequate facilities. Hence, there is a positive relationship between KCSE mean scores and the availability of physical facilities in school."EO4

It is noted that the well to-do parents in Kenya strive to secure form one places for their children in the a few but well established national schools leaving the so unpopular dilapidated day schools which perform poorly to Kenyans. In addition, the cost of schooling varies with the location of the school although; on average high quality institutions are more expensive than other

government schools. These revelations, however, do not give the real UCE of national secondary schools. An education officer asserted that:

"*There is need to come up with the unit cost of national secondary schools. This will assist in designing more appropriate policies on cost and financing of education and training. To come up with actual UCE requires that the components of the costs be properly articulated and estimated.*"EO2

Unit Cost of Education in Kenya has not been established because expenditure per student in national schools has not been determined to enable one to properly calculate UCE. However, comparing data on spending per student can provide a starting point for evaluating the UCE of secondary education. The total amount of costs national schools incur to run and facilities available are met by or match their venues payable to the school more so from parents and the government. This implies that the revenues payable may be higher or lower than the UCE implying that schools may either have excess or inadequate resources to run schools.

Table: Government Regulated Fee Charges in National Secondary Schools and the Actual UCE

NO	VOTE HEADS	PARENT FEE CHARGES K shs	GOVERNENT CAPITATION K shs	TOTALFEES K shs	ACTUAL COST PER SCHOOL K shs					Average actual cost K shs
					A	B	C	D	E	
1	BES	30,385	4,792	35,177	37,560	38,677	37,935	38,656	38,735	38,313
2	Personal Emolum.	8,450	5,755	14,205	15,585	15,465	15,689	15,975	15,695	15,002
3	RMI	2,000	2886	4,886	5,262	5,486	5,235	5,535	5,345	5,863
4	EW&C	5,370	2151	7,521	7,925	7,835	7,872	7,645	7,668	7,789
5	LT&T	2,885	1833	4,718	4,870	4,785	4,875	4,975	4,976	4,896
6	Activity	798	1,256	2,000	2,245	2,135	2,154	2,355	2,465	2,270
7	Admin, cost	3,666	1572	5,238	5,435	5,345	5,543	5,465	5,495	5,457
	Medical	-	1,999	1,999	2,054	2,115	2,050	2,045	2,150	2,083
	GRAND TOTAL	53,554	22,244	75,798	80,936	81,843	79,553	82,651	82,529	81,673

Source: Survey Data (2019)
Key – A, B, C, D and E – Sampled National Schools

Table 4.5 shows government regulated fee charges in national secondary schools and the actual UCE as indicated by the five sampled schools as noted by the principals and bursars in their respective schools. This survey has indicated that the cost of national schools' education per student per year is low. It was indicated in table 4.5 that the average cost per student national schools fees should be raised to K Shs 81,673. An interview conducted in the study by sub-county director of education and in table 4.5 revealed that BES and personal emoluments vote heads are among the unit components that should be increased in public schools. The unit cost was arrived at by dividing the total cost of each school by the number of students in that school. This study agrees with a study by KIPPRA (2006) which found out that Unit cost analysis is important in establishing what actually constitutes any form of investment. Education as an investment good comprises of certain costs that go into teaching and learning.

One of the sub-county directors of education when asked on the view of the ministry policy on allocation of capitation into various vote heads indicated that:

"Schools should be allocated capitation based on their unique characteristics (BOMS), one size fits all approach is not tenable on the ground. Further, each national school is unique. Allocation should be based on individual national school needs. This has impacted academic performance" (EO2)

Public boarding secondary schools of National, Extra-county, County and Sub-County schools receive capitation equivalent to the public day school counterparts. The Students in National schools pay Kshs 53,554 per year. Students in boarding schools and extra county schools in other regions pay Sh. 75,798. All students in public schools were funded to the tune of Sh22, 244 per annum with parents and guardians of students in boarding schools only cover uniform costs, boarding costs and infrastructural projects approved by County Education Board. A principal interviewed on effect of UCE on students' academic performance noted*:*

"Establishing the UCE has been necessitated by the fact that it is determined by the amount of fees payable which in turn influences the financial ability of schools to provide teaching-learning facilities, other educational inputs and conducive school environment which affect students' academic performance. The concern for establishing the UCE in the secondary education sub-sector and its relationship to academic performance has come at a time when the costs of education are rising amid high poverty levels in Kenya to meet the costs of education. School's stable financial base as a catalyst for activities that enhance improved academic performance in schools"P5.

The MoE has issued standard fees guidelines with a view to rationalizing the fees charged by various categories of secondary schools. However, these fees guidelines do not take into account

100% transition from primary to secondary that has resulted to overstretched facilities. Further, it has been observed that these fees guidelines do not take into account the regional disparities in resource facilities endowment and the peculiar needs of national schools. This has led to schools accumulating large deficits which most BOMs are unable to clear, thus negatively affecting the academic performance in these institutions.

One of the principals asserted that:

"Budget deficits are always carried forward to the following year in terms of debts which accumulate yearly. It is my wish that the government allows parents to come together and agree on how to fill the deficit in funding, government capitation in national schools should also be given more compared to current rate and should be consultative with stakeholders on its allocation". Infrastructure should be given special attention" (P5).

The major challenges facing universal education initiative were increased student numbers and delay in disbursement of funds by the government. Free secondary education increased enrolment which has caused overstretching of the available infrastructure. The government has not adequately budgeted for the extra students who enroll which have affected the proper implementation of the program. The Ministry re-adjusted FDSE vote heads to address infrastructure improvement needs. Principals were informed to adjust their budgets accordingly to provide for infrastructure improvement on this specific vote head. The re-adjustment was not adequate for infrastructure improvement as other vote heads were negatively affected. If the amounts allocated for a vote head prove inadequate, then it implies that the amount of expenditure anticipated is less than the actual cost of maintaining a student in school, which in turn affects the provision of the required teaching-learning facilities for better academic performance.

III. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the Findings

In this section a summary of research findings of this research study was presented along research objective.

The findings of the study indicated that the cost of national schools' education per student per year is low and has a negative impact on academic performance. The average cost per student national schools fees should be raised to K shs81,673. It further, revealed that BES and personal emoluments vote heads are among the unit components that should be increased in public schools to improve academic performance.

Conclusion

The study further concludes that government capitation left out some key areas that make learning to improve academic performance in schools. Such areas include infrastructure development and provision of meals. However, the feeling that the government provides free education has led to unwillingness by many parents to make any payments to the schools. There is need to increase the issue of infrastructure funding as the rising numbers seem to out match existing facilities. Overcrowding, if not well managed, greatly compromise academic performance.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are made:-

Schools infrastructural development is critical in creating conducive environment for both teachers and learners to engage in their respective teaching/learning activities. It is clear from the fore going that government disbursement of funds by the government to schools should be timely and adequate and should be in harmony with the calendar of schools' activities, in order to avoid schools experiencing lack of purchasing power within certain periods in the year and hence reduce the increase of prices by suppliers due to the delayed payments**.** However, government capitation provide Kshs 4000 to support infrastructure vote head in schools. Additionally, schools seek approval from parents through their representatives (Parents Association Committees) before approaching County Education Board to ratify charging infrastructure levy of which they get resistance from parents.

The study revealed that development of schools infrastructure remains a big challenge in schools, it requires extra funding and most affected area is sanitation. It was also highlighted that government is taking almost half of Ksh 22,244 capitation allocated to each student, yet debts are piling in schools and infrastructure development has collapsed. It was noted that BES and personal emoluments vote heads are among the unit components that should be increased in public schools. The study recommends that fees be increased since the current fee charged in schools is highly inadequate as schools are operating on a shoestring budget under overstretched facilities. The study recommends to the government to consider fee increment proposal The study recommends that the current fees in national schools put at Khs 81,673 up from Ksh 75,798 an increase of Kshs 5,875 while the government to provide for infrastructure vote head of Kshs4,000without reduction of other vote heads to put capitation at Kshs 26,244

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Impact of Creativity towards the Performance of Undergraduates of Rajarata University of Sri Lanka

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Abstract: The purpose of this study was to investigate the Impact of Creativity towards the Performance of the Undergraduates in Rajarata University of Sri Lanka. Creativity was considered as the independent variable and the performance of the undergraduates was considered as the dependent variable. Researcher used eight creative talents which includes in the model developed by Lynne C. Levesque as the independent variables. The sample was 100 which selected from two faculties in the university including 4th year undergraduates. A questionnaire was used to collect the data from the undergraduates. Respondents were asked to indicate their agreement or disagreement on Five Point likert Scale as the scaling method. The measurement scale for independent and dependent variables were "interval". The data was analyzed using Statistical Package for Social Sciences (SPSS) version 21.0. Mean Score and Standard Deviation were used for all the variables for univariate analysis and correlation coefficient was used for bivariate analysis. The hypotheses were tested using the Correlation and regression analysis. The results indicated that the Creativity and the performance of the Rajarata University undergraduates were in moderate level. The Creativity and the performance of the Rajarata University undergraduates have not been changed according to the gender, faculties, and District. The results of correlation analysis illustrated that the undergraduate students Creativity was positively and significantly correlated with the performance of the undergraduates. A weak positive and significant relationship was found between Navigator, Visionary creative talents and the performance of the undergraduates. A Strong positive and significant relationship was found between Adventure, Pilot, Inventor, Poet creative talents and the performance of the undergraduates. The Explorer and Harmonizer creative talents were not significantly correlated with the performance of the undergraduates.

Key words: Creativity, Performance, Undergraduates

01. Introduction

Education is a basic requirement for the existence of all humans. A large number of people in current world do not receive a proper education. Approximately 260 million of children in the world can't read and write (WorldBank, 2017). By the passage of time education has treated as one of the most important human need and the poor people were able to obtain education. Now a day's education is considered as the most powerful weapon to the future. The formation of a knowledge-based society is a global process, and elements of a knowledge-based society develop in a country regardless of its capabilities and resources. (Singh, 2013).

The university plays a particular set of roles in the global knowledge economy. It acts as a provider of both private and public goods in terms of education and research, as well as playing historically well-established roles in terms of applied problem-solving. The university also acts as a conduit for the wider societal impacts linked to and co-evolving with the other three roles and facilitating integration into the wider social and innovation system (Diaco, Hughes, & McKelvey, 2012). Sri Lankan education system consists of 15 universities, 7 post graduate institutes, 10 other higher education institutes and 1138 technical and vocational education and training institutes (Liyanage, 2014). Rajarata University of Sri Lanka, located in the historic city of Mihintale, which is situated 14 kilometres away from the east of Anuradhapura, was established on 31 of January, 1996. It envisages highlighting the city, Mihintale, which marks the inception of the Sri Lankan social development, as one of the most prominent centre of the present academic arena in the Sri Lankan history. Through this, it is expected to produce virtuous, intellectual and competent citizens for the needs of the 21st century (Rajarata University).

Undergraduates are products of universities. Upon graduation, they become the source of manpower for developing the country's economy. However, students who dropped out from the university would not only find it difficult to search for jobs, they could also, in a way, hinder the development of the labour market. Therefore, students' performance in universities should be a concern not only to the academics and educators, but also to corporations which are often said to be the "end user" in the supply chain of graduates for the labour market (Alfan & Othman, 2005). Performance of undergraduates is important because it is strongly linked to the positive outcomes we value. Adults who are academically successful and with high levels of education are more likely to be employed, have stable employment, have more employment opportunities than those with less education and earn higher salaries, are more likely to have health insurance, are less dependent on social assistance, are less likely to engage in criminal activity, are more active as citizens and charitable volunteers and are healthier and happier. But the performance of the undergraduates are poor than that they were at the A/L's in all aspects of performance. Academic achievement is the prior factor that an undergraduate should focus on. But at the current situations the academic achievement is under the true potential of the undergraduates. And also the thinking style, personality, innovation is not at to the standard level that can be expected from an undergraduate. A small scale study held by Gammie, (1999) has suggested that students are not very proficient in predicting their honors degree classification at the beginning of their final honors year. Mostly the weaker students over performed their performance and stronger students underperformed their performances. As university students they all have the requirements needed to compete in same levels. As they all have completed their A/L's with flying colours they all have same level of knowledge. And also they all attend same lecture series and the supervision from the lectures is also same. And the hostel, library, laboratory facilities are also same. So that the level of performance has to be same. But the performance of the undergraduates is not as expected as they need to be.

Investigation of factors related to the academic performance of university students become a topic of growing interest in higher educational circle. Many recent studies were carried out to explore factors that affecting university student's academic performance (Shahzadi & Ahmad, 2011). The performance of undergraduates in university is influenced by many factors. According to O'Connor,(2007) students' learning styles, prior academic results, levels of motivation, spatial ability, self-efficacy, personality factors and Creativity have an impact on performance of undergraduates.

Research Questions

1. What is the level of creativity of the undergraduates?
2. What is the level of performance of the undergraduates?
3. What is the relationship between creativity and the level of performance of undergraduates?
4. Is there any relationship between creativity and the gender of the undergraduates?
5. Is the creativity of undergraduates differs from faculty to faculty?
6. Is the creativity of undergraduates differs from district to district?

Research Objectives

1. To examine the levels of creativity of the undergraduates.
2. To investigate the level of performance of the undergraduates.
3. To examine the relationship between creativity and the level of performance of undergraduates.
4. To investigate the relationship between creativity and the gender of the undergraduates.
5. To identify the way creativity differs from faculty to faculty.
6. To identify the way creativity differs from district to district.

02. Literature Review

The university students' performance plays an important role in producing the best quality graduates who will become great leader and manpower for the country thus responsible for the country's economic and social development (Ali, et al., 2009). Successful undergraduates have higher self-esteem, self-confidence have lower levels of depression and anxiety, are socially inclined (Regier, 2011). Undergraduates who do well in universities are better able to make the transition into adulthood and to achieve occupational and economic success. Given the specialization required for many jobs these days, young people who are entering the job market do need a substantial base of knowledge and, in many cases, specialized skill. Not only academic performance, undergraduates need to have Aesthetic and sports performance in order to achieve their ultimate success.

There are many enduring factors which influence undergraduate student performance at university (Lynch, Seery, & Gordon, 2011). These variables include students' learning styles, prior academic results, levels of motivation, spatial ability, self-efficacy, student personality factors and creativity (Cornor, 2007). Most of the time academic performance was based on such issues like gender difference, teacher's education and teaching style, class environment, socio economic factor and family education background (Mushtaq & Khan, 2012). Educators have expended remarkable exertions in the studying the personal factors on academic achievement of students. Sex related issues have contributed greatly to the creation of gender crisis by providing unequal opportunities for males and females.

For thousands of years people have tried to understand creativity and the creative process. We have striven to unravel the mystery behind the concept and answer a number of pressing questions: Where does creativity come from? What makes creative people creative? Is there any way to be more creative? The number of questions that have arisen around creativity points to the importance that creativity plays in our human lives (Gerlovina, 2011). Creativity is what happens when an individual produces something that is novel as well as appropriate, generative or influential (Stokes, 2006). Kim & Kim, (2007) stated that Creativity is an influential factor to change the world for enhancing the quality of human life in cultures, economics, technology, the arts, and beyond. Creativity is a topic of wide scope that is important at both the individual and societal levels for a wide range of task domains. At the individual level, creativity can lead to new ways of dealing with a job or daily life, and solving problems in a non-traditional way; at the societal level, creativity can lead to new scientific findings, new inventions, new procedures and social reforms. To educate the knowledge society and innovation economy, educational institutes must provide students with opportunities to engage in creative thinking (Sawyer, 2006).

Empirical evidences

Table 01; Empirical evidences

Date	**Author**	**Source**	**Findings**
2013	(Alia Al - Oweidi, 2013)	Creative Characteristics and Its Relation to Achievement and School Type among Jordanian Students	There are apparent differences in the means between high achievers and average achievers on all creative characteristics
2006	(Premuzic, 2006)	(Creativity Versus Conscientiousness: Which is a Better Predictor of Student Performance?) Journal Applied Cognitive Psychology.	Creative Thinking was positively related To preference for viva voice (Oral) exams, group projects and final dissertation.
1998	(Jurcova, 1998)	Humour and creativity: Possibilities and problems in studying humour	Use of creativity to help students become better interpersonal and intrapersonal problem solvers, although suggestions also range from the use of humour to defuse potentially violent situations.
1998	(Chessick, 1998)	Creativity in the psychoanalytic process	Creativity may serve as a foundation for understanding and applying constructivism to learning and treatment

1996	(Struthers , 1996)	The Effects of Perceived Attributions, Action Control, and Creativity on College Students' Motivation and Performance	Creativity has been found to be significantly related with academic achievement.
2002	(Zhang,2002)	Thinking styles: Their relationships with modes of thinking and academic performance	The relationship between characteristics of creativity and academic performance were significantly positive correlation.

Source; Developed by Author

Creative Talent Profile

Carl G. Jung (1875-1961) defined eight different patterns for perceiving information and decision making (Levesque, 2001). She believed that each of eight patterns differences is equally valuable & equally creative Based on Jung's model of philosophy Katharine Briggs & Isabel Myers developed Myers- Briggs Type Indicator (MBTI) personality inventory. The MBTI is an instrument which has been designed to make the theory of psychological type, developed by Jung, both understandable and usable (Myers & McCaulley, 1998). Thus, eight combinations or creative talents can impact on our creative results & contributions.

Four of these creative talents are used to perceive or collect data and information.

- The Adventure (Extraverted sensation)
- The Navigator (Introverted sensation)
- The Explorer (Extraverted intuition)
- The Visionary (Introverted intuition)

Other four of creative talents help evaluate data & information & make decisions.

- The Pilot (Extraverted thinking)
- The Inventor (Introverted thinking)
- The Harmonizer (Extraverted feeling)
- The poet (Introverted feeling)

Adventure

The Adventure talent helps the individuals see the external world in terms of concrete sensations, facts, and events that are happening now. People with this talent are creative in the way they quickly and responsively improvise to solve immediate problems. Their natural strengths are in the investigation of the situation and the facts surrounding it and in improvising resolutions. They keep their team grounded on the practical, in the here and now. They promote playful ways of dealing with the situation and add curiosity, flexibility, and adaptability to any project effort If a team doesn't have an Adventurer as one of its members, team members may miss out on the fun of finding creative, practical solutions through the realistic assessment of facts, flexible and emergent approaches to the challenge at hand, and truly successful and enjoyable implementations, by developing their implementation focus, slowing down to examine all sides to an issue, and opening up to possibilities, Adventurers can make even more contributions to the creativity of the organization.

Explorer

Explorers add energy and enthusiasm to any effort. Without an Explorer the team would miss patterns, trends, and future possi bilities. It might have a harder time generating many options and alternatives. Explorers are creative in the way they discover and generate new and different ideas. They have great instincts for new trends and connections. They provide passion, possibility thinking, and inspiration and will test the limits of the team's imagination. They can be wonderful catalysts for change and inno vation. By developing their abilities to organize and execute and by teaming with and appreciating others with different talents, E xplorers can be even more effectively creative.

Navigator

Without a Navigators creative talent, a team could get lost, like a ship without a rudder. The Navigator talent helps a group be astute observers and recorders of what is going on in the world and what has gone on in the past, assuming that their incredible memory bank is put to use in solving problems. Knowledge of facts and events and a sense of history are important in making sense out of new situations and bringing invaluable experience to bear on problems. Navigators can build on what others have done to find new ways of solving the challenge or situation. They will also ensure that a change effort is well planned and carefully implemented. Navigators need to learn to appreciate their own creative contributions and their own creative process. Taking small steps away from safe shores, opening up to the possibilities and opportunities of the future, and sharing perspectives and opinions can help optimize their creative contributions.

Visionary

The Visionary's creative talent brings vision and far-reaching imagination to any challenge or problem. It allows the team to a void staying stuck with too narrow boundaries. The Visionary looks at long-range trends and patterns. The Visionary talent gives the team an eye to the future and an uncanny sense of what can possibly happen. These ideas and images are based o n a variety of known data from many different sources and data they often don't know how they know. Visionaries add m uch to the creativity of the organization through their insight into the future and their unusual perspectives and connections. Further developing the ability to effectively communicate ideas and to work with details and a group will heighten a Vis ionary's creative contributions at work.

Pilot

Without a Pilot, the team can start to flounder and waste valuable resources. Pilots provide structure, leadership, goals, and objecti ves. They get things going and keep the team working together toward the goals. They ask tough questions and challenge the t eam to see the situation differently. Pilots come up with new designs for working together and new strategies for getting thing s done. They provide energy, enthusiasm, and a positive attitude for the team. Through their careful, analytical thinking and th eir strong ability to focus, they can help ensure that the right problem is being addressed and that an implementation plan is developed and followed. Pilots can optimize their creative contributions to the organization by developing their inte rpersonal skills; making sure that they take time to look at different perspectives, ideas, and opinions; and strengthening the abilit y to lead more participatively.

Inventor

Inventors are excellent problem solvers and valuable contributors in any work effort. They are questioning, independent, and u nconventional. They are curious about new ideas flexible, and tolerant of others. They can be fun and quite playful in their curiosity and in their quest for the truth. Through their support of the exploration of the facts and possibilities, they help the tea m arrive at innovative solutions to problems and make important contributions to the creativity of the organization. F urther development of their social and organizing skills and their ability to find "both-and" solutions will help them more truly an d effectively creativity.

Harmonizer

Without the Harmonizer, the team may suffer from lack of concern for people during the development and implementation of cre ative solutions. A nurturing, safe environment where team member’s needs, values, and feelings are considered may al so be missing through their support and high energy. Harmonizers help team members build the self-esteem they need to be truly creative. Harmonizers use their organizational skills to ensure that the team finds creative solutions. They also ensure that t he team looks at context and circumstances, keeping them away from black andwhite thinking, instead focusing on integrating co nflicting opinions. Their communication and political skills are extremely important in managing people through change. By focusing on proper boundary and conflict-management skills, finding support when analysis and critique are required,

and making sure they have considered diverse points of view before making decisions; Harmonizers can become even more effectively creative.

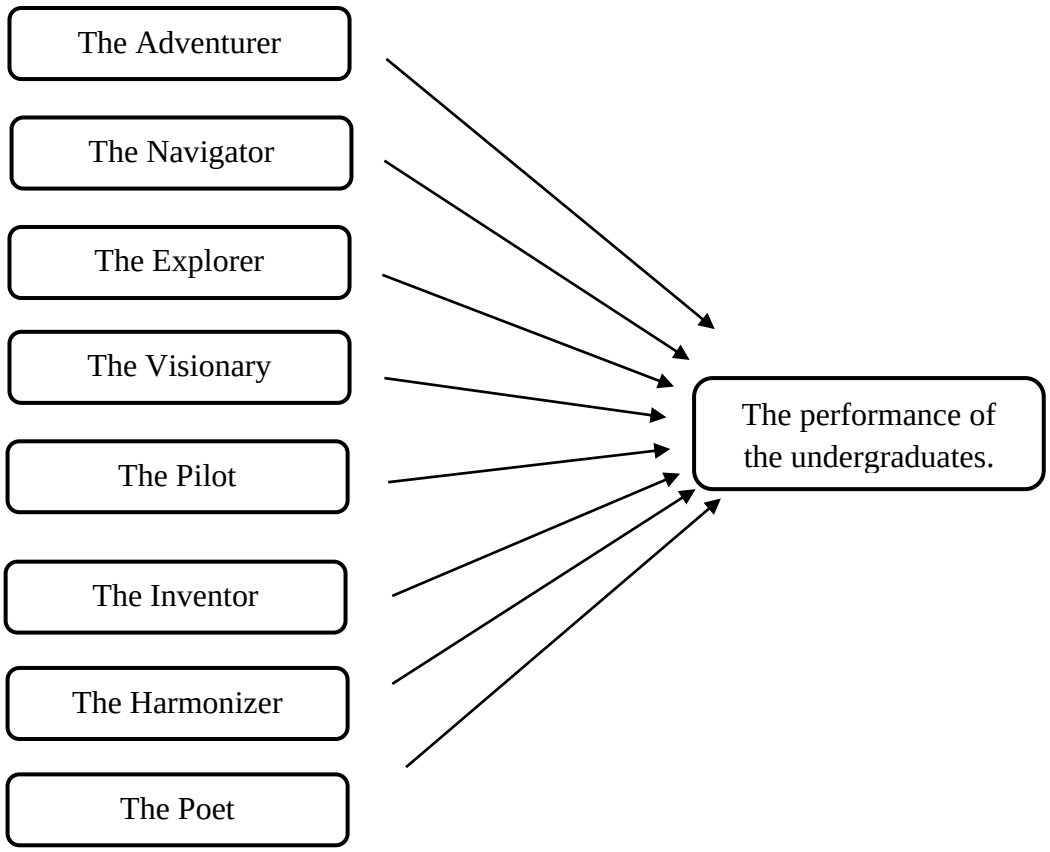
Poet

The Poet's creative talent provides a reflective perspective for making decisions based on personal values that are usually people f ocused, quietly supportive, and nurturing: Without a Poet's creative talent on the team, the team's effort might suffer from a lack o f focus on people issues, lose some grace and beauty, and fail to incorporate values into the problem-solving and decision-makin g processes. The team also may not stay open to see contextual issues and additional opportunities as they emerge. To bring out the best in Poets, the team needs to respect the unique perspectives Poets bring and allow them the time and space they need to make their contributions. If Poets take the time to listen to information that may conflict with their values and to speak out, share opinions, and learn to manage conflict, they can optimize their creative contributions to the organization.

03. Methodology

Through this research researcher aims to test the '8 Creative Talents from Breakthrough Creativity Profile' which develops by Levesque, (2001). Under her findings The Adventurer, The Navigator, The Explorer, The Visionary, The Pilot, The Inventor, The Harmonizer, The Poet are the creative talents that influences on students' performance. Thus, the conceptual framework is illustrated as follows to implement the relationship among variables.

Figure 01; Conceptual Framework



Source : Developed by Author

Thus following hypothesis can be developed.

$H_{1:}$ There is a significant relationship between the Adventure creative talent and the performance of the undergraduates.

$H_{2:}$ There is a significant relationship between the Navigator creative talent and the performance of the undergraduates.

$H_{3:}$ There is a significant relationship between the Explorer creative talent and the performance of the undergraduates.

$H_{4:}$ There is a significant relationship between the Visionary creative talent and the performance of the undergraduates.

$H_{5:}$ There is a significant relationship between the Pilot creative talent and the performance of the undergraduates.

$H_{6:}$ There is a significant relationship between the Inventor creative talent and the performance of the undergraduates.

$H_{7:}$ There is a significant relationship between the Harmonizer creative talent and the performance of the undergraduates.

$H_{8:}$ There is a significant relationship between the Poet creative talent and the performance of the undergraduates.

This study falls into the category of basic research. The primary purpose of such a basic research is to generate a body of knowledge and understanding of the phenomenon of interest and build theories based on the research results. In this study, the researcher tries to find the impact of Creativity towards the performance of undergraduates. Therefore, this study is a hypothesis study that seeks to build the relationship between variables. The objective of this study is to examine the impact of Creativity on the performance of undergraduates in Rajarata University of Sri Lanka. A model developed by Levesque, (2001) called Breakthrough Creativity Profile which is considered to be an important model in creativity models used in this research to investigate how creativity affects to the undergraduates' performance. No artificial environment was created by the researcher to test the effect. The respondents were made to answer the questions from where they are by imaging the circumstance tested. Therefore the interference caused by the researcher is minimal in this research. The type of the investigation used by the researcher is correlation. The study was conducted using the correlation research design because the study was intended to investigate the relationship between Breakthrough creative talent profile and the performance of undergraduates. According to Fraenkel & Wallen (1988) correlation research describes an existing relationship between variables. The study took the quantitative approach because it was based on variables measured with numbers and analysed with statistical procedures.

This research is focused on deciding the relationship between the eight creative talents (The Adventurer, The Navigator, The Explorer, The Visionary, The Pilot, The Inventor, The Harmonizer and The Poet) and academic performance of the undergraduates in the Rajarata University of Sri Lanka. Data was collected from all the fourth year undergraduates in faculty of Management studies and faculty of Social Sciences and Humanities in Rajarata University of Sri Lanka. Therefore, the unit of analysis in this study is individual. Questionnaires are an efficient data collection mechanism when the researcher knows exactly what is required and how to measure the variables of interest. Questionnaires can be administered personally, mailed to the respondents, or electronically distributed (Sekaran, 2006).In this study researcher administered questionnaires personally.

Population and Sampling

Table 02 ; Population and Sampling

Faculty	Academic Year	Population		
		Male	Female	Total
Faculty of Management Studies	2013/2014	155	209	364
Faculty of Social Sciences and Humanities	2013/2014	49	316	365
Total		204	525	729

Faculty	Academic Year	Sample		
		Male	Female	Total

Faculty of Management Studies	2013/2014	21	28	49
Faculty of Social Sciences and Humanities	2013/2014	8	43	51

Source : Developed by Author

As per the sample that builds upon stratified sampling technique 49 undergraduates from Faculty of Management Studies and 51 undergraduates from Faculty of Social Sciences and Humanities were selected in order with a combination of gender to achieve the research objectives as mention in the sample design. The researcher personally handed over the questionnaire to the undergraduates and collected the necessary information.

The following tables indicate the measurement scales that can be used to measure each variable.

Table 03 ; measurement scales

Variable	Level of measurement
Demographic factors	Nominal
Dependent variable	Ordinal
Independent variable	Ordinal

Source : Developed by Author

In this research, descriptive statistics and inferential statistics were used to justify the quantitative nature of the data collection. Descriptive statistics usually involved measures of central tendency (mean, median, mode) and measures of dispersion (variance, standard deviation, etc.) and Inferential statistics involved to measure Multiple Linear Regression, Correlation Coefficient, ANOVA and Independent sample T-test was used to test the hypotheses. Correlation explains the relationship between variables. The study used correlation analysis to measure the relationship between dependent and independent variables. Statistical Package for Social Science (SPSS) version 16.0 software used to analyze the both descriptive analysis and inferential analysis.

04. Results and Discussion

For the research study, has considered 100 undergraduates as the sample of the research. According to the records of the Faculty of Management Studies and Faculty of Social Sciences and Humanities 729 undergraduates are registered for the academic year 2013/2014 who currently in the final year. At the 95% confident level and confident intervals at 5% for a population of 700, sample size should be 248 (Sekaran (2006). But considering time limitations and other restrictions sample size selected as 100.

Reliability Analysis

Table 04 ; Reliability Analysis

Variables	Cronbanch's Alpha
Adventure	0.734
Navigator	0.705
Explorer	0.792
Visionary	0.780
Pilot	0.778
Inventor	0.693
Harmonizer	0.817

Poet	0.707
Student Performance	0.721

(Source: Survey Data 2018)

Cronbanch's alpha is computed in terms of the average inter correlations among the items measuring the concept (Sekaran & Bougie, 2013). Cronbanch's alpha should be greater than its' minimum value of 0.700 and considered questions in the questionnaire can be accepted. According to the above table questions in the questionnaire can be accepted in terms of all the variables. However as the questions used for accessing the inventor creative talent shows a Conbanch alpha which is very close to 0.700 and its reliability is relatively acceptable. In the aspect of undergraduate researches the minimum value of cronbunch alpha is allowed up to 0.600.For all the other variables Conbanch's alpha range from 0.693 to 0.817.

Descriptive statistics for independent variables

Table 05 ; Descriptive statistics for independent variables

	Mean	Std.Dev	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std.Error	Statistic	Std.Error
Adventure	3.8125	.71631	.138	.241	-.864	.478
Explorer	3.2825	.67761	.077	.241	1.651	.478
Navigator	3.1975	.58635	.248	.241	.250	.478
Visionary	3.3225	.48630	.127	.241	.400	.478
Pilot	3.4375	.57667	-.746	.241	1.128	.478
Inventor	3.4875	.71983	-.319	.241	1.205	.478
Harmonizer	3.5400	.54323	-.005	.241	.185	.478
Poet	3.3550	.63483	.192	.241	.601	.478

Above table describes descriptive statistics of responses of respondents related with independent variables of the study. According to the above table, mean value for Adventure indicates that Adventure creative talent among the undergraduates of the Rajarata university is significantly high (M=3.8125.46, SD=0.71631). And in case of Harmonizer creative talent it also shows a high significance (M=3.5400, SD= 0.54323) towards the performance of the undergraduates. Mean value of Pilot creative talent (M=3.4375, SD=0. 57667) and Inventor creative talent (M=3.4875, SD=0.71983) too are high indicating that both variables are favourably impacting towards the performance of the undergraduates. And in case of Visionary (M=3.3225, SD=0.48630) and Poet (M=3.3550, SD=.63483) is high indicating that those two variables have high impact on the performance of the undergraduates. Explorer (M=3.2825, SD=0.67761) andNavigator (M=3.1975, SD=0.58635) are having significantly high impact towards the performance of undergraduates whereas the impact is relatively low than other variables.

Descriptive statistics for dependent variable

Table 06 ; Descriptive statistics for dependent variables

	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Students Performance	3.4356	.40955	-.066	.241	.776	.478

(Source: Survey Data 2018)

According to the data presented in table above, the respondents of sample shows high level of overall performance of the undergraduates. Researcher has taken two aspects of the performance both academic performance and extracurricular activities together. According to the above table the performance of the undergraduate is significantly high (M=3.4356, SD= 0.40955).

Gender comparison

Table 07 ; Gender comparison

Gender	Mean	Std. Deviation	t value	Sig.
Female Male	3.5220 3.2241	.41981 .29529	-3.790	.599

(Source: Survey Data 2018)

According to the above table, both female and male have taken higher mean values respectively (M=3.5220), (M=3.2241). The results of t-test further reveals that there is no significant difference between these two groups on the performance of the undergraduates (t= -3.790, p>0.05).

Faculty Comparison

Table 08 ; Faculty comparison

Gender	Mean	Std. Deviation	t value	Sig.
Faculty of Management Studies	3.2870	.42002	-3.481	.577
Faculty of Social Sciences and Humanities	3.5784	.34683		

(Source: Survey Data 2018)

According to the above table, both faculties have taken higher mean values respectively (M=3.2870), (M=3.5784). The results of t-test further reveals that there is no significant difference between these two groups on the performance of the undergraduates (t= -3.481, p>0.05).

District Comparison

Table 09 ; District comparison

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.956	17	.115	.644	.847
Within Groups	14.649	82	.179		
Total	16.605	99			

(Source: Survey Data 2018)

According to the above table sig. value is higher than 0.05 (0.847) so that there is no significance difference between districts when regarding to the performance of the undergraduates.

Correlation and Regression Analysis

In regression analysis students' performance was entered as dependent variable and Adventure, Explorer, Navigator, Visionary, Pilot, Inventor, Harmonizer, Poet as the independent variables. The results are produced in following tables.

Table 10 ; Overall model fit

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate

1	.918[a]	.843	.829	.16923

(Source: Survey Data 2018)

The Adjusted R Square value is 0.829 which means 82.9% of the factors affecting on the performance of the undergraduates can be explained by the Adventure, Explorer, Navigator, Visionary, Pilot, Inventor, Harmonizer, Poet creative talents.

Table 11 ; ANOVA result

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	13.999	8	1.750	61.104	.000[b]
	Residual	2.606	91	.029		
	Total	16.605	99			

(Source: Survey Data 2018)

The P value from the ANOVA table is less than 0.001, which means that at least one of the eight variables Adventure, Explorer, Navigator, Visionary, Pilot, Inventor, Harmonizer and Poet can be used to model the impact on performance of the undergraduates.

Table 12 ; Coefficient results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.426	.222		1.920	.058
	Adventure	.173	.033	.303	5.299	.000
	Explorer	.035	.049	.057	.706	.482
	Navigator	-.062	.031	-.089	-1.999	.049
	Visionary	.077	.036	.091	2.110	.038
	Pilot	.385	.032	.542	12.116	.000
	Inventor	.133	.059	.234	2.244	.027
	Harmonizer	.021	.032	.028	.654	.515
	Poet	.094	.047	.145	1.995	.049

(Source: Survey Data 2018)

According to the table P values for Explorer and Harmonizer are 0.482, 0.515 respectively. Hence, these creative talents are not significant predictions to effect on the performance of the undergraduates in the faculties of Management Studies and Social Sciences and Humanities in Rajarata University of Sri Lanka. The P values for the Adventure, Navigator, Visionary, Pilot, Inventor and Poet are 0.000, 0.049, 0.038, 0.000, 0.027 and 0.049 respectively. Thus these variables are significant predictors effecting on the performance in the faculties of Management Studies and Social Sciences and Humanities in Rajarata University of Sri Lanka. According to the results of the Correlation and regression analysis the final findings can be developed as follows.

Table 13 ; Final findings

Hypothesis	Correlation Analysis		Accept/ Reject	Regression analysis		Accept/ Reject	Findings
	R	P		β	P		
H1:Adventure creative talent has an effect on the level of academic performance of	0.610	0.000	Accept	0.173	0.000	Accept	Accept

Undergraduates.							
H_2: Navigator creative talent has an effect on the level of academic performance of Undergraduates.	0.101	0.318	Reject	-.062	0.049	Accept	Accept
H_3: Explorer creative talent has an effect on the level of academic performance of Undergraduates.	0.622	0.000	Reject	0.035	0.482	Reject	Reject
H_4: Visionary creative talent has an effect on the level of academic performance of Undergraduates.	0.322	0.001	Accept	0.077	0.038	Accept	Accept
H_5: Pilot creative talent has an effect on the level of academic performance of Undergraduates.	0.645	0.000	Accept	0.385	0.000	Accept	Accept
H_6: Inventor creative talent has an effect on the level of academic performance of Undergraduates.	0.678	0.000	Accept	0.133	0.027	Accept	Accept
H_7:Harmonizer creative talent has an effect on the level of performance of the undergraduates.	-.035	0.729	Reject	0.021	0.515	Reject	Reject
H_8: Poet creative talent has an effect on the level of performance of the Undergraduates.	0.649	0.000	Accept	0.094	0.049	Accept	Accept

Discussion of the study

The main purpose of the research was to identify the creative talents that are most likely to impact on the performance of the undergraduates of the faculties of Management Studies and Social Sciences and Humanities in Rajarata University of Sri Lanka. Eight hypotheses were established and six of those accepted while two hypotheses were rejected.

The first hypothesis of the study proposed a significant relationship between Adventure creative talent and the performance of the undergraduates. The results of the correlation analysis identifies that there is a significant (P= 0.000) as well as relatively a strong positive relationship (R= 0.610) between the dependent and independent variable. In here Adventure creative talent was tested in

the spheres of information gathering, predicting the future, usage of skills and blindside identification. This means the performance will be increased if the adventure talent is increased among the university students.

The second hypothesis considered in the thesis was that there is a significant relationship between Navigator creative talent and the performance of the undergraduates. The correlation results showed that there was a positive relationship but regression results found that a no significant relationship between the two variables. A strong literature background has established by the researcher by basing on the Lynne C. Levesque's Breakthrough Creativity Profile book to the relationship and it was proved in the regression analysis which builds up in the current study.

The third hypothesis established was that there is a significant relationship between explorer creative talent and the performance of the undergraduates. And this hypothesis was also able to accept in the sample considered in the current study though correlation analysis. The empirical evidences from Lynne C. Levesque's Breakthrough Creativity Profile book was highlighted that there is a strong impact of Explorer Creative talent and the performance, but the relationship was unable to build up in the present study.

As the researcher has developed the fourth hypothesis in the thesis, there is a significant relationship between Visionary creative talent and the performance of the undergraduates. This hypothesis too was accepted revealing there is a significant positive relationship between the considered two variables.

The relationship between Pilot creative talent and the performance of the undergraduates was developed as the fifth hypothesis. As the results of the correlation analysis a positive correlation was build up to this hypothesis (R=0.645, P=0.000). And it was proved by the regression results indicates that there is a significant relationship between these two variables. As the Lynne C. Levesque's empherical evidences pilot creative talent was tested by using aspects such as problem solving method, dynamic energy, aggregate view, conventional thinking. This means that the performance of the undergraduates will be increased if the pilot creative talent is increased among the university students.

The sixth hypothesis established in this research was there is a significant relationship between Inventor creative talent and the performance of the undergraduates. As per the results of both correlation and regression analysis it did show there is a significant relationship between the dependent and the independent variable. A strong positive correlation (R=0.678, P=0.000) was resulted while the relationship has proved through the regression analysis also. So that the performance of the undergraduates can be increased if the pilot creative talent is increased among the university students.

The relationship between Harmonizer creative talent and the performance of the undergraduates was developed as the seventh hypothesis. But the hypothesis was not accepted as both correlation and regression results were not met the significance values. In the correlation analysis the correlation of these two variables showed a negative relationship but this is not a significant relationship. As in the regression results also the relationship between these two variables was not significant. Hence the hypothesis was rejected.

The final hypothesis of this study is developed as there is a significant relationship between Poet creative talent and the performance of the undergraduates. The poet creative talent was tested using the dimensions self-knowledge, uniformity, personal values and sensitivity. The correlation result for this hypothesis showed that there is a positive relationship between these two variables (R=0.685, P=0.000). And the regression result approved that there is a significant relationship. So the hypothesis was accepted.

05. Conclusion and Recommendations

Conclusion

This study was conducted in order to find out whether there is an impact on the creativity towards the performance of the undergraduates in Rajarata University of Sri Lanka. As creativity is a significant factor which affects to the performance of the undergraduates, researcher has used creativity among many factors that performance is affected. It was proved in the chapter two and furthermore researcher has illustrated different types of creativity models from previous research findings. Among those models researcher chooses 'Breakthrough creativity Profile' by Levesque (2001) as the model which is going to test through this study.

The researcher identified eight creative talents that are most likely to impact on the performance of the undergraduates through reviewing the model of 'Breakthrough creativity Profile' in order to achieve the first objective of the research. In this model of

creativity eight creative talents were described as Adventure, Explorer, Navigator, Visionary, Pilot, Inventor, Harmonizer and Poet.

The second objective of the study was to measure the creativity level of the undergraduates. It was done by using descriptive statistics. The results were mentioned in the demographic factor analysis in the fourth chapter and the creativity levels of the undergraduates were high as per the results. By that second objective was accomplished.

The third objective of the study was to identify the level of performance of the undergraduates. Using the mean values which was taken through descriptive statistics it was cleared that the performance of the undergraduates were high. Hence the third objective was accomplished.

By using the appropriate statistical package it is found that Adventure, Navigator, Visionary, Pilot, Inventor and poet are the creative talents that mostly influencing on the performance while creative talents like Explorer and Harmonizer are not significantly affect to the performance of the undergraduates. Hence six hypotheses were accepted while two hypotheses were rejected. Thus the hypotheses H_1, H_2, H_4, H_5,H_6 and H_8were accepted whileH_3, H_7 and were rejected. Thus the fourth objective of the research was realized by examining the impact of each creative talent on the performance of the undergraduates.

According to the results the overall performance was considerably high among the undergraduates selected in the sample as well as a significant difference was not exhibited among male and female undergraduates. The fifth research objective of the study was accomplished by that.

As per the sixth objective of the research it was identified that there is no significant difference among the faculties of Rajarata University of Sri Lanka in regarding to the impact of creativity towards the performance of the undergraduates. As per the results of the study a significant difference was not identified by the researcher. Hence the sixth objective of the study was accomplished.

In the results of the study there was no any significant difference between the districts of the selected sample on the performance of the undergraduates. So the seventh objective of the study was realized by examining the impact of each creative talent on the performance of the undergraduates.

Recommendations

As per the results of the study following recommendations can be produce. The study reveals that students who have the characteristics of the adventure creative talent are having higher performance level in both academic activities and extracurricular activities. Having ability to gather information, predicting the future of entire own journey, usage of skills that you have, identifying the unseen areas of an incident will enhance the performance of the undergraduates. Thus management of the university also needs to make steps to enhance this creative talent within the university students by a proper methodology.

The undergraduates are people who always find new ways to achieve their objectives. And practical adaptation to the situations, fine tuning and building on what others have done enhances their performances too. Developing greater self-awareness, find heroes or role models are ways to enhance the current level of performance and it would rather help not only to enhance the performance in the degree programme but also to achieve greater success in the future activities too. So that the Navigator talent within undergraduates should enhance and the authorities should take necessary steps to enhance the navigator creative talent among the undergraduates in the university. For that workshops to spread the knowledge on the controlling of practical scenarios which meet in day today life can be implemented by the university authority.

Undergraduates whose performance is high have characteristics of visionary creative talent within them. Having far reaching insights, keeping broad perspectives, searching new angles of life is good characteristics where those helps to develop one's entire career. Visionary creative talent is a major factor which can used to achieve greater success in the lives. Adopting and absorbing the features in this talent will influence heavily to the undergraduates and necessary ways and means should be developed by the authority to spread and increase within the undergraduates. Furthermore to enhance this creative talent a certain parts or information can be included to the degree programme about this creative talent.

As the results of the study Pilot creative talent, the students who are with the characteristics of pilot creative talent are having higher performance level. Having proper problem solving techniques, having dynamic energy, looking at an incident with an aggregate view will increase the performance of the undergraduates. Authorities of the university need to take necessary steps in order to uplift this creative talent among the undergraduates.

With regard to inventor creative talent, most of the university undergraduates who are with this shows high performance on their academic and extracurricular activities. Students with a penetrating mind, updated knowledge, having own ways to achieve the goals are more likely to enhance their performance in the university. The necessary measures should take from the university management to enhance this creative talent within the students in the university.

Poet creative talent complies with much more mental characteristics than other creative talents. It is an aesthetic appreciation for grace and elegance in solutions. Voicing your opinions in mind, set boundaries for yourself within the mind, accessing to your unconscious are ways to develop not only the mind but also the physical strength within a person. In undergraduates aspects it is

very much necessary to have this creative talent so that it helps to enhance the performance. As the authority steps and procedures should be implemented in order to enhance this creative talent among the undergraduates.

As an overall the authorities of the organizations are capable to uplift the creative talents within undergraduates. Mostly this can be done through the inauguration period of the undergraduates. The management of the university can establish training programmes, workshops, advisory services, practical scenario discussion sessions on these creative talents and it would enable the undergraduates to enhance these creative talents within them. And furthermore within all the academic years of the university these programmes needed to be held so that the better results for all the undergraduates could be obtain.

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In Vitro Antibacterial Effect Of Decoction Of *Thrikatu Kalinga Katuka* Against *Streptococcus Pyogenes*

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ABSTRACT

In clinical practice many herbal preparations have been using in the management of Tonsillitis (*Thundikeri*). *Thrikatu kalinga katuka* is a famous decoction prescribed only by some of the renowned physicians according to their experience. Its efficacy against *Streptococcus pyogenes* is not proved by laboratory investigations up to now. This study was carried out to determine the antibacterial effect of the above decoction against the laboratory specimen of *S. pyogenes* and to determine the most effective concentration against the organism. Methodology was based on anti-bacterial susceptibility test by using laboratory specimen of *S. pyogenes* in Agar well diffusion method. The drug was prepared according to the *Kwatha Paribhasha* of *Sharangadhara Samhita*. First all the ingredients were identified correctly and then measured the required amounts of each drugs. After cleaning the ingredients 3 samples for different decoctions (4-1, 8-1, and 16-2) were prepared. Amoxicillin (01 mg/ml) was used as standard positive control, while distill water was used as negative control. Anti-bacterial activity was obtained by determining the zone of inhibition (ZI) around the well and it was compared with standard drug. Mean ZI values of those three decoction levels were significantly different from each other. According to T-test the p value < 0.05 and null hypothesis was rejected at 0.05 level of significance. It revealed that the most effective decoction (16-2) was not as much as effective than the amoxicillin. It can be concluded that the decoction *Trikatu Kalinga Katuka* is significantly effective against *Streptococcus pyogenes* at the concentration of 16-2 according to the study carried out.

Keywords: Tonsillitis, *Streptococcus pyogenes*, Herbal decoction, Antibacterial activity

INTRODUCTION

Ayurveda medical system is a one of great medical system which can cure and prevent many diseases of humans in world wide. *Ayurvedic* medicines are becoming popular day-by-day and demand for its usage is increasing not only in the country but also worldwide the inherent quality of Ayurveda treatment of having negligible side/after effects, has made great potential for its production. *Ayurvedic* medicines are based on plants, animals extract and minerals both in single ingredient drugs and compound formulations [Devgan et al., 2014].

Many hundreds of herbals worldwide are used in traditional medicine as treatments for bacterial infections. Some of these have also been subjected to in vitro screening but the efficacy of such herbal medicines has seldom been rigorously tested in controlled clinical trials. Conventional drugs usually provide effective antibiotic therapy for bacterial infections but there is an increasing

problem of antibiotic resistance and a continuing need for new solutions. Although natural products are not necessarily safer than synthetic antibiotics, some patients prefer to use herbal medicines. Thus healthcare professionals should be aware of the available evidence for herbal antibiotics.

Antibiotics are one of our most important weapons in fighting bacterial infections and have greatly benefited the health-related quality of human life since their introduction. However, over the past few decades, these health benefits are under threat as many commonly used antibiotics have become less and less effective against certain illnesses not, only because many of them produce toxic reactions, but also due to emergence of drug-resistant bacteria. It is essential to investigate newer drugs with lesser resistance. Drugs derived from natural sources play a significant role in the prevention and treatment of human diseases. In many developing countries, traditional medicine is one of the primary healthcare systems. Herbs are widely exploited in the traditional medicine and their curative potentials are well documented. About 61% of new drugs developed between 1981 and 2002 were based on natural products and they have been very successful, especially in the areas of infectious disease and cancer. Recent trends, however, show that the discovery rate of active novel chemical entities is declining. Natural products of higher plants may give a new source of antimicrobial agents with possibly novel mechanisms of action. The effects of plant extracts on bacteria have been studied by a very large number of researchers in different parts of the world.

Streptococcus pyogenes is a species of bacteria. Like other streptococci, it is clinically important in human illness. It is an infrequent, but usually pathogenic, part of the skin flora. It is the sole species of Lancefield group A and is often called group A streptococcus (GAS), because it displays streptococcal group A antigen on its cell wall.

Group A streptococcal infection can cause illness, which typically produces small zones of beta-hemolysis, a complete destruction of red blood cells. (A zone size of 2-3 mm is typical). It is thus also called group A (beta-hemolytic) streptococcus.

Streptococcus pyogenes is a round bacterium. The name derives from the Greek word 'streptos,' meaning 'twisted chain,' because streptococcal cells tend to link together in chains, which resemble a string of pearls when viewed under the microscope. Streptococci are catalase-negative and gram-positive. *S. pyogenes* can be cultured on blood agar plates. Under ideal conditions, it has an incubation period of about 1 to 3 days.

It causes numerous infections in humans including Pharyngitis, Tonsillitis, Scarlet fever, Cellulitis, Rheumatic fever etc. But people have to face more complications due to careless of those infections. Tonsillitis is an inflammation (swelling) of the tonsils presenting with features of difficulty in swallowing, ear pain, fever, sore throat, tenderness of the jaw and throat.

It is called as *Thundikeri* in Ayurveda medical system. Some Ayurveda physicians use the decoction of *Trikatu kalinga katuka* by their experience to cure Tonsillitis. So there should be antibacterial effect, but it is not proved scientifically.

MATERIALS AND METHODS

Ingredients of decoction of Trikatu kalinga katuka

त्रिकटु कलिन्ग कटुका हरीतकी विभीतकामलकैः
ध्वंशयति कन्टकुब्जं व्रश रजनीद्वय संयुतः कषायः

(Sri Dewamiththa, 1994, page 36)

Viyali iguru - *Zingiber officinalae*
Gammiris - *Piper nigrum*

Thippili - *Piper longum*
Kelida sahal - *Holarrhena antidysentrica*
Katukarosana - *Picrorhiza kurroa*
Aralu - *Terminalia chebula*
Bulu - *Terminalia bellerica*
Nelli - *Phyllanthus emblica*
Adathoda - *Adhatoda vasica*
Viyali kaha - *Curcuma longa*
Venival geta - *Coscinium fenestratum*

Material	**Part used**
Zingiber officinalae	Rhyzome
Piper nigrum	Seeds
Piper longum	Seeds
Holarrhena antidysentrica	Seeds
Picrorhiza kurroa	Roots
Terminalia chebula	Pericarp
Terminalia bellerica	Pericarp
Phyllanthus emblica	Pericarp
Adhatoda vasica	Leaves, Bark
Curcuma longa	Rhyzome
Coscinium fenestratum	Bark

Table 1 – Part used of each ingredient for the decoction

Drug preparation

The drug was prepared at the the pharmacy of GWAI, University of Kelaniya, under the supervision of *Bhaisajya Kalpna* Unit, Dept. of *Dravyaguna Vignana* by using original ingredients. The research drug was prepared under the instructions in authenticated text, *Kashaya Sangrahaya.*

Authentication of raw materials

All the ingredients were collected from the market at Gampaha district, Sri Lanka on 02nd June 2016. The materials were authenticated by Dept: of *Dravyaguna Vignana*, GWAI, University of Kelaniya, Sri Lanka.

Preparation of the Decoction

The drug was prepared according to the *Kwatha Paribhasha of Sharangdhara Samhita.*

Preparation method

- First all the ingredients were identified correctly and then measured the required amounts of each drugs.
- Sample C - 60g of drug, 960ml of water, boiled under moderate heat to obtain 120ml of the decoction.
- After cleaned the ingredients prepared 3 samples for different decoctions.
- Sample A - 60g of drug, 240ml of water, boiled under moderate heat to obtain 60ml of the decoction.
- Sample B - 60g of drug, 480ml of water, boiled under moderate heat to obtain 60ml of the decoction
- Prepared the positive controller (+VE) by dilute 10mg of Amoxicillin into 1ml of distilled water.

Sample	Raw material amount	Water amount	Obtain amount
A (4 -1)	60g	240ml	60 ml
B (8-1)	60g	480ml	60 ml
C (16- 2)	60g	960ml	120ml

Table 2 - Preparation method of the decoction

Disc Preparation for ABST

All of glass wears were sterilized with aluminum foil wrapping by using hot air oven at least 2hr of 160℃. All of aqueous solution were prepared with sterile distilled water. Medias and distill water were sterilized by autoclave with steam at a pressure about 15 psi; temperature 121℃ in 15 minutes before experimental procedures.

Preparation of MHA plates

17.5g of MHA (CM0337, Oxoid ltd, England) mixed in a conical flask with 250ml of sterile distilled water and boiled the mixture up to dissolve the medium completely. Then the media was sterilized non absorbable cotton wad as mentioned in above. The sterile media allowed to cool up to 45℃ in water bath for 15 minutes and poured in to sterile petri dishes up to 4mm in height in a sterile environment without bubbling and transferred to the refrigerator for ambient temperature at 4℃ for 18hrs.

Preparation of nutrient media

The standard *S. pyogenes* bacterial culture from laboratory specimen slants at MRI was used in the present study. With the help of a sterile inoculating loop, loopful of bacterial culture was inoculated in a laminar unit to rejuanate, in a sterile 100ml flask containing sterile nutrient agar (NA) broth (CM0003, Oxoid ltd, England) at 37c for 18hrs to ensure the proliferation of test organism. This culture was used for susceptibility test and then stocked at 4c prior to sub culture. The inoculum size of the bacterial culture was standardized according to the National Committee for clinical laboratory standard guide lines of USA. The turbidity of the inoculums was attained with 0.5 McFarland units of turbidity to comparable with suspension of bacterial solates 1.5×10^8 CFU/ml as approximate cell density. (Tambekar & Dahikar, 2010)
Sensitivity of S. pyogenes in each decoction samples was measured in terms of IZ using modified Well Diffiution Assay (MWDA). (Almazeb et al., 2013)

Preparation of the inoculum

Prepared the dilution series using the broth which are the maximum growth of *Staphylococcus pyogenes.*

- -1 dilution series
  put 1ml broth into 9ml of peptone water
- -2 dilution series
  put 1ml -1 dilution series into 9ml of peptone water
- -3 dilution series
  put 1ml -2 dilution series into 9ml of peptone water

According to the (0.5 McFarland standards) selected the -1 dilution series for the ABST test.

Seeding the plates

All of MH plates were allowed to warm up to room temperature before seeding from the refrigerator. Hence any excess moisture will be absorbed into the medium.

From nutritional broth, 18hr old bacterial culture was taken and the inoculum were seeded over the solidified MHA plates using a sterile cotton swab in order to get a uniform microbial lawn. Then the plates left on a sterile area for excess fluid to be absorbed. (Murray et al., 2007)

The wells were bored using sterile copper cup borer of 5mm in diameter, 4mm in deep and about 3cm apart from each well. There were four wells in some plates and 3 wells in others.

A bacterial positive controller and antibiotic control were kept for comparative study. Amoxicillin (01 mg/ml) was used as a standard drug and served as positive control, while distill water was used as negative control. (NCCLS 2002). The plates were left at ambient temperature for 15 minutes to allow excess pre-diffusion of extract prior to incubation at 37℃ according to the optimum temperature required for *S. pyogenes* culture. Approximately 100μl of the decoction samples were transferred into each well which filled them respectively to fullness by using homogenous micropipette. The setups were allowing to stabilize for 3hr before being incubated at 37 for 18hr as described previous.

Anti-bacterial activity was obtained by determining the zone of inhibition around the well and it was compared with standard drug.

OBSERVATION

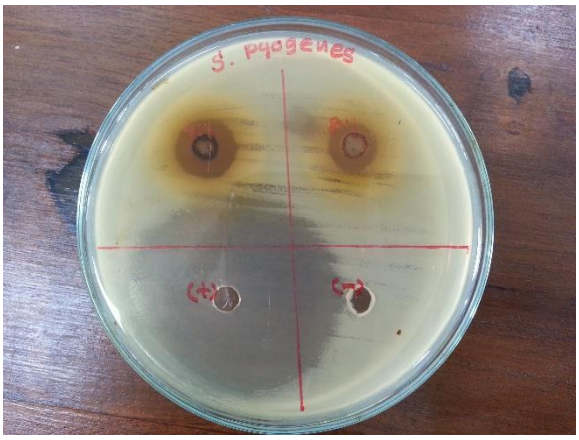

Figure 1 - ZI of sample A (60g/240ml) & sample B (60g/480ml)

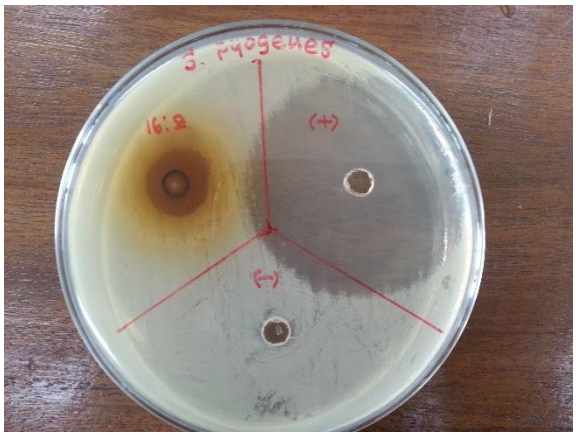

Figure 2 - ZI of sample C (60g/960ml)

RESULTS

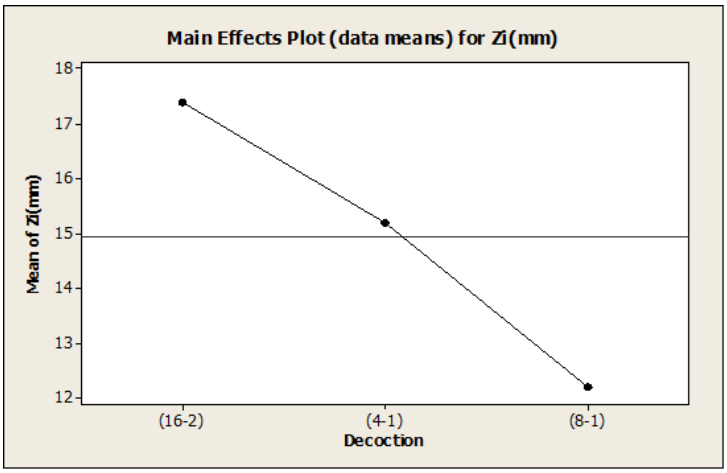

Chart 1 - Mean values of the decoctions

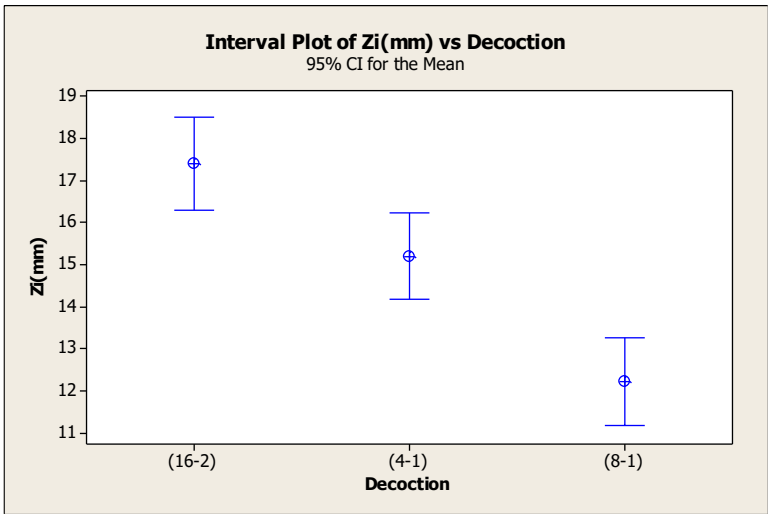

Chart 2 - Mean intervals of each decoctions

According to Tukey multiple comparisons, mean effects plot and interval plot can be concluded that decoction (16-1) gives the higher ZI value, decoction (16-1) is the most effective decoction.

The most effective decoction levels out of these three concentrations

Analytical results for comparison of three concentration of the decoction from each other given below chart.

Compared concentrations	P value
16 – 2 Vs 4 – 1	0.0042
16 – 2 Vs 8 – 1	0.0000
4 – 1 Vs 8 – 1	0.0004

Table 3 – Comparison of P value of each decoction

T test to compare the effect of Amoxicillin and the most effective decoction

Drug	Mean	Standard Deviation
Amoxicillin	36.400	0.548
Decoction (16 – 2)	17.400	0.894

Table 4 - Comparison of most effective decoction versus Amoxicillin

DISCUSSION

Anti-bacterial properties of medicinal plants are being increasingly reported from different parts of the world. The World Health Organization estimates that plant extract or their active constituents are used as folk medicine in traditional therapies of 80% of the world population.

In the present study, the decoction of *Trikatu Kalinga Katuka* shows significant activity against tested bacteria. The results was compared with standard antibiotic drug. In this work, the decoction of *Thrikatu Kalinga Katuka* was found to be effective against the organism. And also 16-2 concentration of the decoction was found as the most effective concentration than others. 16-2 sample was not effective as much as the positive control (Amoxicillin). It may be due to the low diffusion of the herbal water extract throughout the Agar medium or the heavy thickness of the 16-2 decoction.

CONCLUSION

It can be concluded that the decoction *Trikatu Kalinga Katuka* is significantly effective against *Streptococcus pyogenes* at the concentration of 16-2 according to the study carried out.

SUGGESTIONS

According to the study carried out it is obvious that the selected decoction is effective against the tested micro-organism. Considering the *Ayurvedic* medicinal properties revealed by the literature review there is a high potential of introducing a novel

antibiotic out of this decoction after some further developments. And also another concentration such methanol or ethanol extractions of the decoction can use for the test.

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Computational calculation potency of petunidin and peonidin as photosensitizer in dye-sensitized Solar Cell

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Abstract- Computational calculations for two compounds of anthocyanidin group, petunidin and peonidin have been conducted in ethanol phase. Purpose of this calculation is to get optimized geometry and electronic properties from petunidin and peonidin, which have potency as photosensitizer in dye-sensitized solar cell. The calculations were done for ground state and excited state. Ground state geometry optimization were using Density Functional Theory (DFT) and excited state single point calculation were using Time Dependent-Density Functional Theory (TD-DFT). All the calculations used B3LYP functional and 6-31G(d) as basis set. All the calculations were conducted in ethanol phase. Geometry optimization calculations show that the optimized structure of two anthocyanidins are same. Petunidin and peonidin has planar structure. Petunidin absorption wavelength is same with peonidin's. The display of HOMO-LUMO of petunidin and peonidin are spread throughout in molecule. LUMO is only in one anchoring group, hidroxy (-OH). Based on electronic properties and HOMO-LUMO display, both of petunidin and peonidin has potency as photosensitizer for applying in dye-sensitized solar cell (DSSC).

Index Terms- DFT, DSSC, Ethanol, Petunidin, Peonidin.

I. Introduction

Renewable energy is the promising source of energy for the future. One of renewable energy is solar cell. Solar cell which use an organic dye is called dye sensitized soar cell. Anthocyanin is one of organic dye which found in plant tissue such as fruit, leaves, pericap. Anthocyanin consists of anthocyanidin and glycoside. Anthocyanidin has conjugated structure that gives color to anthocyanin. The color is determined by functional group bond to anthocyanidin. Petunidin and peonidin are anthocyanidin which found naturally [1]. The structure of petunidin and peonidin are shown in Figure 1.

Petunidin and peonidin are antioxidant [2] because have potential break radical. Besides for health issue as antioxidant, petunidin and peonidin can be used in renewable energy field as photosensitizer in dye-sensitized solar cell. There are research use petunidin and peonidin which applied in dye-sensitized solar cell experimentally. Kimura *et* al. (2017) [3] use pure petunidin 3-O-glucoside as sensitizer in DSSC and give high conversion efficiency about 1.42 %. Sinopoli, *et* al. (2017) [4] investigated peonidin and other anthocyanidins for DSSC in water as solvent and get conversion efficiency about 1.05 %. The low conversion efficiency of petunidin and peonidin encourages computational calculations to be carried out to determine the real potency this two compound as photosensitizer in dye-sensitized solar cell.

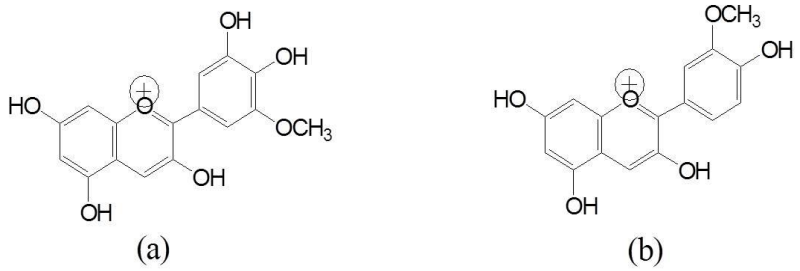


Fig. 1. Structure of petunidin (a) and peonidin (b).

Petunidin and peonidin were calculated and analyzed computationally before. Most of computational calculation for investigating petunidin and peonidin for its antioxidant properties [5,6]. There is research have studied petunidin and peonidin as photosensitizer in dye-sensitized solar cells. Sinopoli, *et* al. (2017) have been investigated peonidin and other anthocyanidins computationally too as photosensitizers in dye-sensitized solar cells computationally using B3LYP/6-31G(d,p) for ground state and TD-DFT B3LYP/6-31G(d,p) for excited state in gas phase and water [4]. Recent, there is no computational study of petunidin and peonidin in ethanol

phase as photosensitizer for application in dye-sensitized solar cell, so this research about computation calculation of petunidin and peonidin in etanol as photosensitizer in Dye-Sensitized Solar Cell. The computational calculation were conducted to get stable structure, electronic properties and also to predict which one from petunidin or peonidin, give better potency as photosensitizer in dye-sensitized solar cells.

II. METHODOLOGY

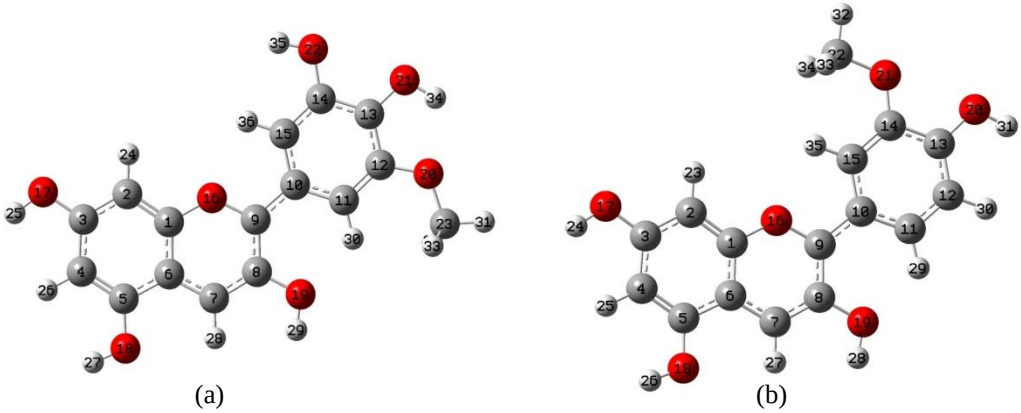
Computational calculation using DFT (Density Functional Theory) for geometry optimization and TDDFT (Time-dependent Density Functional Theory) for excited state. Both of the calculation using functional B3LYP and basis set 6-31G(d). Geomtery optimization have done for petunidin and peonidin in cation form. Geometry optimization and excited state are in ethanol phase using the polarizable continuum model (PCM).

III. RESULT AND DISCUSSION

3.1. Optimized geometry

Petunidin and peonidin have same backbone, namely flavilium. The only difference between these two compounds is the functional group attached to one of the phenyl rings of the structure. In petunidin, there are two hidroxyl (-OH) and one methoxy ($-OCH_3$) bond to phenyl ring. In peonidin, there are one hidroxyl (-OH) and one methoxy ($-OCH_3$) bond to phenyl ring. In acidic condition, that backbone become cation flavilium. Optimized geometry of petunidin and peonidin are shown in Figure 2.

The different functional group between petunidin and peonidin causing different bond length and bond angle of both them. Bond length $R_{9\text{-}10}$ for petunidin and peonidin are same, this indicated that the substitution of functional group is not affect atom which not bond direct to it. Bond length $R_{13\text{-}14}$ for peonidin is shorter than petunidin about 0.015 Å. Whereas bond length $R_{12\text{-}13}$ for peonidin is longer than petunidin. The bond angle of three atom $A_{12\text{-}13\text{-}14}$ for peonidin is greater than petunidin about 0.035°. Based of dihedral data, petunidin and peonidin are planar, because dihedral about 0°. Optimized geometry parameter for petunidin and are shown in Table 1.



(a) (b)

Figure 2. Optimized geometry of petunidin (a) and peonidin (b).

Table 1. Optimized geometry parameter petunidin and peonidin

Molecule	Phenyl rings				
	Bond length (Å)			Bond angle (°)	dihedral (°)
	$R_{9,10}$	$R_{12,13}$	$R_{13,14}$	$A_{12,13,14}$	$D_{16,9,10,15}$
Petunidin	1.4442	1.4111	1.4075	119.661	0.0
Peonidin	1.444	1.3963	1.4237	119.696	0.0

3.2. Electronic properties

3.2.1. Chemical descriptors

Chemical descriptors (Table 2) are HOMO energy and LUMO energy which use to calculate other electronic properties from petunidin and peonidi such as ionization energy (I), affinity (A), energy gap (Egap). Over all, number of petunidin and peonidin are same each other.

Table 2. Chemical descriptor

Molecule	HOMO (eV)	LUMO (eV)	I= -EHOMO (eV)	A= -ELUMO (eV)	Egap (eV)	η=(I-A)/2	μ= -(I+A)/2	ω= $\mu^2/2\eta$
Petunidin	-5.981	-3.309	5.981	3.309	2.672	1.336	-4.645	8.074
Peonidin	-6.039	-3.287	6.039	3.287	2.752	1.376	-4.663	7.902

3.2.2 Vertical excitation

Vertical excitation can be investigated from transition energy and transition percentage. Lower transition energy means easier electron movement to higher energy level. Transition energy of petunidin and peonidin are similar about 2.5 eV. Petunidin and peonidin have absorption wavelength that almost same, differences is just about 8 nm. Transition from HOMO to LUMO for this two molecules has same number about 93%. Petunidin in its absorption wavelength has two vertical excitation types, HOMO to LUMO and HOMO-2 to LUMO. Peonidin has three vertical excitation types, HOMO to LUMO, HOMO-1 to LUMO, and HOMO-2 to LUMO. The first vertical excitation parameter are shown in Table 3.

Absorption wavelength of petunidin and peonidin from calculation are shorter than wavelength from experiments. Absorption wavelength from experiment for petunidin and peonidin respectively about 530 nm and 538 nm [7] whereas from calculation are 503 nm and 495 nm. This different number of wavelength causing by different phase are used. The experiment used methanol-HCl phase while calculation are in ethanol phase.

Table 3. The first vertical exxcitation parameter.

Molecule	λ (nm)	*f*	Transition precentage	Transition Energy (eV)
Petunidin	502.57	0.695	HOMO→LUMO (93%)	2.467
			HOMO-2 → LUMO (7%)	
peonidin	494.90	0.623	HOMO→LUMO (93.4%)	2.505
			HOMO-1→LUMO (3%)	
			HOMO-2→LUMO (3.6%)	

3.3. HOMO-LUMO display

The display of highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) are shown in figure 3. The display of HOMO and LUMO shows how density of molecular orbital for each molecule spread. HOMO of petunidin and peonidin spread in entire backbone molecule. LUMO of two molecules are overlap with HOMO. The display of LUMO for petunidin and peonidin spread in entire backbone molecule too. Overlap between HOMO and LUMO make electron can excitation easily, but reverse process difficulty. LUMO of petunidin and peonidin are just in on hydroxy, as anchoring group. The anchoring group is functional group which bond directly to photoanode. The HOMO of petunidin and peonidin overlaps with the LUMO, only in hydroxy (-OH). This overlap indicates the ease of electron transfer from the photosensitizer to the anode.

3.4. Infrared spectrum

Infrared spectrum of petunidin and peonidin are almost same (Figure 4). There are peak at ~ 3700 cm^{-1} refers to stretch C-O for alcohol. This number is shifting from experiment [8], which alcohol stretching vibrations can be observed in the ranges of 3600 cm^{-1}-3200 cm^{-1} and 1700 cm^{-1}-1565 cm^{-1}. The shifting phenomenon because in experiment petunidin and peonidin was mixed together with other anthocyanidins in raw extract. Peak for C=C aromatic about ~ 1450 cm^{-1} and for C-H benzene about 300 cm^{-1}. Petunidin has a sharp peak at about ~1200 cm^{-1}, refers to stretch C-O (eter) which C-O-C.

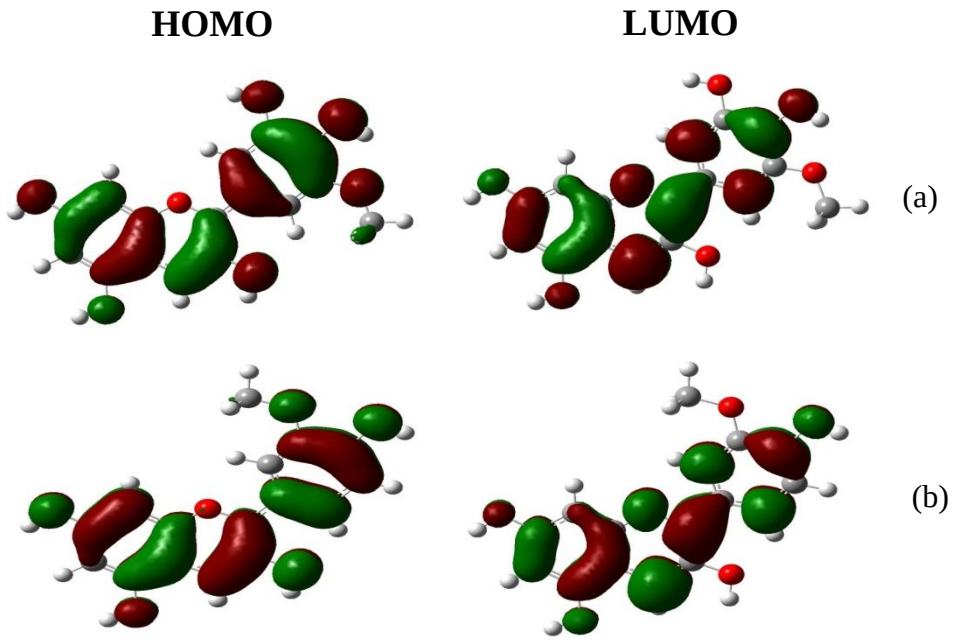


Figure 3. The display HOMO LUMO of petunidin (a), and peonidin (b)

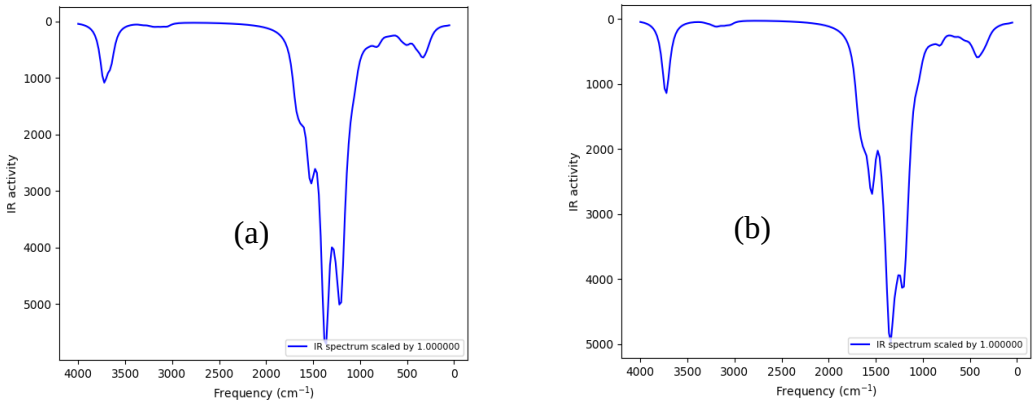


Fig. 4. The infrared spectrum of petunidin (a), and peonidin (b)

IV. CONCLUSION

Based on DFT calculation geometry optimization, both of petunidin and peonidin has planar structure. Based on excitation energy, excitation composition, and display of HOMO-LUMO, both of molecules, petunidin and peonidin have potential as photosensitizer for applying in dye sensitized solar cell.

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Clinical review of 2 rare cases of papillary thyroid carcinoma with parapharyngeal metastases

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Abstract: Papillary thyroid carcinoma is the most common thyroid carcinoma .Usually there is a high rate of metastases and micrometastases to the cervical lymph nodes, typically affecting the paratracheal and jugular lymph nodes. Papillary carcinoma rarely presents metastases to parapharyngeal and retropharyngeal lymph nodes. In well-differentiated thyroid cancers the incidence of parapharyngeal lymph nodes metastases was reported as 0.43 to 2.5%.Here we present two cases of papillary thyroid carcinoma with lymph node deposits in parapharyngeal space. The diagnosis was suspected by imaging studies (CT and MRI) but not confirmed until histological examination.

Key words: Parapharynngeal mass,. Papillary thyroid carcinoma, Nodal metastases

I. INTRODUCTION

Neoplasm of the thyroid gland is the most common endocrine malignancy. Papillary carcinoma is the most common histological variant in thyroid neoplasms. It usually metastases to lymph nodes [1] but the spread to retropharyngeal lymph nodes or parapharyngeal lymph nodes is rare. Around 112 cases of parapharyngeal and retropharyngeal node metastases have been reported in the literature till now and the incidence of parapharyngeal lymph node metastases of well-differentiated thyroid cancers varies from 0.43% to 2.5%[2-4].
Here in we report 2 cases of thyroid papillary carcinoma with parapharyngeal metastasis. One case is a recurrence and another case presented with primary lesion in the right lobe of thyroid and metastasis to lateral cervical lymph node.

Case report 1

A 19year old man presented to our ENT opd with the history of thyroid swelling since 6 months. Physical examination revealed thyroid swelling with no palpable cervical lymph nodes. FNAC was done which confirmed the diagnosis as papillary thyroid carcinoma .CT scan was done but no parapharyngeal and cervical lymph nodes were traced. The treatment planned was total thyroidectomy and the histopathological examination of the thyroidectomy specimen showed the existence of multifocal microscopic centers of papillary deposits within the gland, which confirmed papillary carcinoma of thyroid. The patient had been free of disease for approximately 10 years.

The patient again presented at 30 years of age with multiple enlarged cervical lymph nodes. FNAC from the nodes showed papillary deposits indicating recurrence of the papillary thyroid carcinoma. There was elevated thyroglobulin. The patient was sent to CT with contrast for further evaluation and CT showed multiple cervical lymph nodes along with a parapharyngeal lymph node. The patient then underwent a selective neck dissection, total thyroidectomy and a transcervical approach to the parapharyngeal node. There were no complications after the surgical procedure. The histopathological diagnosis of resected parapharyngeal lymph node confirmed metastasis of papillary thyroid carcinoma. Post operatively radioiodine ablation was done . We followed the patient for 5 years and there was no recurrence reported till now and the patient is doing well.

Case report 2

This a case of a 40yr old female who presented with thyroid swelling since 2 years with an enlarged level 3 cervical lymph node. The patient also had the history of dysphagia and on examination there was medial displacement of tonsil . Ultrasound was done which showed enlarged right lobe of thyroid gland with nodules and enlarged level 2 and 3 cervical lymph nodes on right. CT with contrast was performed which showed an enlarged parapharyngeal lymph node and the surgery was planned considering the parapharyngeal lymph node as a metastatic node. A total thyroidectomy with selective neck dissection and a transcervical approach for the removal of parapharnyngeal lymph node was performed. Post operative radio iodine ablation was done. Histopathology confirmed the presence of papillary deposits in the parapharyngeal lymph node. Patient was on follow up for 3 years and the patient is free of disease till now.

II. DISCUSSION

Thyroid neoplasms present the most common endocrine malignancies. The common histological variant is the papillary carcinoma.The incidence of papillary carcinoma is frequent in women (2.3:1) aged between 20 years and 50 years[5].The common risk factor for this cancer is exposure to ionizing radiation during childhood. Reports from the literature depicted that one third of individuals exposed to radiation develop thyroid nodules and one third of them are malignant[6]. The common presentation of this tumor is as an asymptomatic thyroid nodule. Though the prognosis of this carcinoma is good small subgroups of patients have poor outcomes due to metastasis. The route of spread is through the lymphatics and vascular spread is rare. The metastasis to the bone, brain, lungs, and soft tissue occurs by vascular spread and is rarely reported. The incidence of lymphatic metastasis reported was 30% to 40% and haematogenous metastasis was 10 %.[7]The tumor can infiltrate internal jugular vein and recurrent laryngeal nerve in the neck. Though the involvement of cervical lymph node is common it is very rare for the parapharyngeal lymph node to involved. The literature [2] reported that only 0.43% of thyroid papillary carcinomas had parapharyngeal node metastasis. A recent study [4] demonstrated 25 parapharyngeal node tumours in a series of 5381 thyroid cancers which accounts to 0.43%. Kainuma [8] et al described recurrent cases of retropharyngeal and parapharyngeal lymph node metastasis. In a recent study Wang et al[4] evaluated 25 patients with thyroid malignancies with 22 papillary carcinomas, 2 medullary carcinomas, and 1 follicular carcinoma. In their study ,Parapharyngeal node metastases presented as nodal relapse after previous surgical treatment in 64% of patients, cervical and parapharyngeal node involvement during the initial presentation of thyroid carcinoma in 20 percent and only parapharyngeal lymph nodal involvement in initial diagnosis in 16% of cases.The authors concluded that neck dissection and wide spread cervical node involvement can alter the direction of lymphatic drainage and increase retropharyngeal drainage resulting in metastasis of parapharyngeal nodes.

Rouvier [9] in his study described a lymphatic connection between the upper pole of the thyroid and the retropharyngeal lymphatic system. He demonstrated this in one fifth of the cadaver dissection specimens and this lymphatic vessel was called the postero-superior collecting vessel. He observed the communication of retropharyngeal space with the parapharyngeal space through a dehiscence of the superior constrictor fascia that results in parpharyngeal metastasis from thyroid carcinomas.

In our patients radiological imaging with CT with contrast provided a key to the diagnosis of parapharyngeal metastases from thyroid carcinoma as the parapharyngeal area cannot be evaluated clinically or with ultrasound. Treatment was done with surgical resection and postoperative radioiodine ablation.

III. CONCLUSION

CT with contrast or MRI is mandatory to evaluate parapharyngeal lymph nodes as they cannot be detected clinically and by ultrasonography. Radiological imaging provide guidance in patients who have undergone a previous neck dissection. Surgical resection with postoperative beam radiotherapy or radioiodine ablation are is the main stay of treatment for papillary carcinoma of thyroid to avoid recurrence. Parapharyngeal lymphnodes should be evaluated at the time of diagnosis of thyroid carcinoma even if their occurrence is rare and the differential diagnosis of a mass in the parapharyngeal space should include metastasis from thyroid carcinoma.

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Co infection of dengue virus and chikungunya virus at Bhavnagar, Gujarat, India

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Abstract- Background & objectives –
Dengue virus and chikungunya virus are two common mosquito borne infections at Gujarat in present scenario.
Objectives :

1. To know existence of coinfection of chikungunya and dengue virus infection at Bhavnagar district, Gujarat, India
2. To know incidence of chikungunya virus infection at Bhavnagar district, Gujarat, India
3. To know incidence of dengue virus infection at Bhavnagar district, Gujarat, India

Methods:
The present study was done on 182 patients having various signs and symptoms of either dengue and or chikungunya over a period of three years (2013 to 2016). Diagnosis was done by seroprevalence of Dengue and Chikungunya using detection of IgM antibodiesfrom serum samples. Mono-infection was defined as a positive IgM assay for only one of these virus infections. Co-infection was defined as a positive IgM assay for both of these infections.
Result:
Out of total 182 serum samples tested for presence of IgM type of antibody against dengue & chikungunya virus,31.31% samples were positive for dengue virus & 1.09% samples were positive for chikungunya virus. Co infection of dengue & chikungunya virus was observed in 1.09% of patients in bhavnagar. In present study - no monoinfection of chikungunya virus was found.
Interpretation & conclusion:
In present study 57 (31.31%) samples were positive for dengue virus & 02 (1.09%) samples were positive for chikungunya virus. In other studies of india - dengue positivity rate was 59% [21] from mumbai, 26.4%[22] pune & chikungunya positivity rate was 2% [21] from mumbai ,14.8% pune. Co infection of dengue & chikungunya virus was observed in 1.09% of patients in Bhavnagar, while comparison 6.7%[21] & 6.8%[22]. In present study highest positivity was observed in age group of 21 - 30, while in other studies of india it was between 31-45[21] & 29 years and 26 years[22]. Present study shows presence of dengue & chikunguya virus co infection in local commnity of Bhavnagar, Gujarat.

Numbers of studies showing coinfection of dengue & chikungunya virus are less. In present study - coinfection of dengue & chikungunya virus was 1.09%, which was lesser than 6.7% & 6.8% observed in other studies of india[21, 22].

Index Terms- chikungunya, co infection, dengue

I. Introduction

Dengue and chikungunya are two important mosquito-borne viral infections in India. Dengue virus and chikungunya virus are transmitted by the same species of mosquito - Aedes aegypti. Initially- both viruses cause acute febrile illness however as infection progress symptoms of both infections differ. Infections like malaria, dengue, chikungunya and filariasis caused by mosquito bite are major burden on the health-care system in country like India.

Dengue virus have been classified in the Flaviviridae family while chikungunya virus belongs to the genus Alphavirus of Togaviridae.[1]Dengue virus has worldwide distribution and is present in all tropical countries. Dengue viruses are responsible for about 50-100 million annual infections. Out of these 500000 have dengue hemorrhagic fever and death occurs in more than 30000. [2] The name Dengue was originated from the word Swahili for "bonebreaking fever". During the Jin Dynasty (265–420 AD) in China - first probable case of dengue fever was recorded. Shortly after the identification and naming of the disease in 1779 by BenjaminRush - first recognized epidemics occurred almost simultaneously in Asia, Africa and North America in the 1780s.[3]There are four serotypes of Dengue virus. The four dengue virus types (DENV-1–4), called dengue virus serotypes, form a phylogenetic group and differ in nucleotide sequence from each other. Dengue 1 serotype was first isolated in 1943 and other serotypes were isolated between 1944 and1957.[4] These are closely related to one another rather than to other flaviviruses and form an antigenic complex of their own. The following subtypes or genotypes are also detected within each serotype, based on their phylogenetic analysis of the genomic region in the envelope gene.[5,6]
DENV-1: three
DENV- 2: two (one non human primate)
DENV- 3: four
DENV- 4: four (one non human primate)
Immunity against the infecting serotype is lifelong but it lasts only for 3–4 months against the other serotypes. If second infection

occurs after this period then it results in severe disease. Spread of dengue virus was explosive in the early 1900s, and was accompanied with the movement of people across continents because of the slave trade and the two World Wars; India was also one of the major areas affected.[7]

Chikungunya virus is an Alpha virus that belongs to the family Togaviridae. Chikungunya virus was first described by Robinson and Lumsden in 1953.[8]It was isolated from Tanzania in 1956.[9] The word chikungunya derived from "kungunyala" which is Swahili word for the contorted posture of patients. It was first described by Robinson and Lumsden in 1953.[8] Subsequently epidemics were noted in the Philippines ,Thailand, Cambodia, Viet Nam, India, Myanmar and Sri Lanka.[10] In India - Kolkata witnessed a major epidemic in 1963 . Subsequently epidemics were noted in Pondicherry (1965), Tamil Nadu, Andhra Pradesh, Madhya Pradesh and Maharashtra and in Maharashtra again in 1973.[11] Afterwards, sporadic cases continued to be noted in Maharashtra during 1983 and 2000.[12] Resurgence of chikungunya outbreaks occurred in the islands of the Pacific Ocean, including Madagascar, the Comoros, Mauritius and Reunion Island since 2003.[13] There was a very large epidemic of chikungunya in Reunion Island in January 2006 which quickly spread in India too.[14] Cases of chikungunya fever were approximately about 1.3 million in India.[15] Various factors responsible for resurgence of chikungunya include globalization, increase in the mosquito population, loss of herd immunity and the mutation A226V in the E1 gene causing a significant increase in CHIKV infectivity for Ae. albopictus. [13]

II. Materials and Methods:

The present study was carried out over a period of three years (September 2013 to august 2016) to know co-infection of Dengue and Chikungunya virus. Mono-infection with chikungunya virus and dengue virus were also identified. Positive IgM assay for only one of these virus infections was defined as mono infection while Co-infection was defined as a positive IgM assay for both of these infections. Approval was taken from Ethics Committee.

Total 182 serum samples were collected from patients with symptoms like sudden onset of high grade fever, severe headaches, retro orbital pain, severe joint pain or muscle pain, fatigue, nausea, vomiting, joint swelling and skin rash. All samples were tested for detection of IgM type of antibodies against Dengue and Chikungunya virus by Enzyme linked immunosorbent assay.

III. Results:

Out of total 182 serum samples tested for presence of IgM type of antibody against dengue & chikungunya virus, 57 (31.31%) samples were positive for dengue virus & 02 (1.09%) samples were positive for chikungunya virus.Two samples positive for chikungunya virus were also positive for dengue virus IgM antibody - indicating presence of both viral infections in a same host - indicating co infection of dengue & chikungunya virus in 1.09% of patients in bhavnagar. In present study between september - 2013 to august - 2016; no monoinfection of chikungunya virus was found - indicating absence of chikungunya mono-infection in local community during this period.

Following is corelation of platelet count in patients who were positive for dengue and chikungunya IgM antibody.
Platelet count

10,000-20,000	20,000-50,000	50,000 - 1 lac	More than 1 lac	Not tested
04 (7%)	24 (42.1%)	17 (29.8%)	7 (12.2%)	05 (8.7%)

Highest number of positivity was observed in patients having platelet count of 20,000-50,000 - 24 (42.1%). Patient with dual infections of dengue & chikungunya virus was also between 20,000-50,000 platelet counts.

Following is correlation with sex in patients who were positive for dengue and chikungunya infection.

Sex	Male	Female
Total samples – 182	136	46
Positive	42 (30.88%)	15 (32.6%)
Negative	94 (69.11%)	31 (67.3%)

Positivity rate was nearly same in male & female; however co-infection of dengue & chikungunya virus is seen only in male patients.

IV. Discussions:

Out of total 182 serum samples tested for presence of IgM type of antibody against dengue & chikungunya virus, 57 (31.31%) samples were positive for dengue virus & 02 (1.09%) samples were positive for chikungunya virus. In other studies of india - dengue positivity rate was 59% [16] from mumbai, 26.4%[17] pune & chikungunya positivity rate was 2% [16] from mumbai ,14.8% pune.Co infection of dengue & chikungunya virus was in 1.09% of patients in bhavnagar in comparison 6.7% [16] & 6.8% [17]. Present study shows presence of dengue & chikunguya virus co infection in local commnity of Bhavnagar, Gujarat.

V. Conclusions:

Number of studies showing coinfection of dengue & chikungunya virus are less. In present study - coinfection of dengue & chikungunya virus was 1.09%, which was lesser than 6.7% and 6.8% observed in other studies of India. [16,17] Present study also found less incidence of chikungunya infection in Bhavnagar district during period of 2013-2016.

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Regime of Linguistic Conflict: Understanding the Assamese Language Movement and the Current Political Scenario in the State

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Abstract- India is unique because of its diversity. The Indian census of 1961 recognized 1652 different languages in India including languages which are not native to this land. But recently the move made by the central government to impose Hindi all over the country is yet another attack on the Assamese community in particular and also on other linguistic groups in general. The Assamese Language Movement was started from the southern tip of Assam a little more than 50 years ago. The agitation started just after the Assam Official Language Bill was introduced on 3rd March 1960. There was a movement in support of the Bill in the Brahmaputra Valley on one side, whereas on the other side the hill districts and Bengali speaking districts witnessed a massive protest against the bill. Now the introduction of the Citizenship Amendment Bill is a déjà vu for the people residing in Assam because the Assamese and Bengali speaking communities are seen coming and protesting for and against the bill. So language is a terrain contestation between the two communities.

Among the major issues that affected Assamese culture and ethnicity, the issue of language was the most prominent one. With the help of this article I would like to draw a connection between the Assamese Language Movement and the current political scenario of Assam.

Index Terms- Ethnicity, Linguistic, Assamese, Bengali, Protest

I. INTRODUCTION

India's unity lies in its diversity. According to A.R. Desai, "India presents a spectacle of museum of tongues."George Abraham Grierson in his linguistic survey of India has noted that India is home to 179 languages and 544 dialects. On the other hand, the census of 1971 reported that 1652 languages are spoken in India as mother tongue. The reorganisation of states in India was carried on in 1956 with linguistic boundaries that had its own script. The then Home Minister of India, Sardar Vallabhbhai Patel played a crucial role in the reorganisation of states on the basis of language. The Government of India has taken numerous steps till date to safeguard the linguistic minorities and to maintain the linguistic pluralism in India. But the country has also witnessed a number of instances when the government itself tried to undermine the linguistic pluralism in India by giving preference to a particular language. Pritam Singh in his article Hindu Bias in India's 'Secular' Constitution: probing flaws in the instruments of governance mentions about Article 343 and 351 which imposes Hindi in Devanagari script as the official language of the Union of India and also gives directive for the development of the Hindi language. The importance accorded to Hindi language and especially to Devanagari script and the Sanskrit language in the constitution reflects pro-Hindi and pro-Hindu bias of a very powerful section among the constitution. Recently the move made by the central government to impose Hindi all over the country is yet another attack on the various linguistic groups present in India and the Assamese community in particular. With the help of this article I would like to draw a connection between the Assamese Language Movement and the current political scenario of Assam

II. BACKGROUND

Before connecting the present political scenario of Assam with the language movement of 1960s, I would like to briefly discuss about that phase when the Assamese language was eclipsed by the Bengali language. After the British took controlover Assam, the Bengali language was imposed over Assamese. The British brought with them many Bengali clerical and technical workers to work in Assam with the motive of imposing Bengali in schools and colleges and also for official purposes. The imposition of Bengali as the court language over the Assamese language frustrated the Assamese society. Printing of Assamese books was not encouraged and hence the Assamese literature suffered to a great extent. This is regarded as one of the main factors behind the conflicts that emerged in the following decades between the two communities. Initially, this imposition was not much protested by the Assamese people. Rather it

was used by the Assamese elite class for speaking and writing. But when more and more Bengali people were recruited in the government services, the unemployment rate among the Assamese people increased. These people had their own culture, tradition, language etc and their presence in the state was seen as a clear threat to the culture, economy, political status and language of Assam.

III. Citizenship amendment bill,2016

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The Citizenship Amendment Bill, 2016 was introduced on July 19, 2016 with the motive of granting citizenship to illegal immigrants on the basis of religion. The bill attempted to accommodate "Hindus, Sikhs, Buddhists, Jains, Parsis, and Christians from Afghanistan, Bangladesh and Pakistan'. It was very interesting to note that the bill had no provision for Shia Muslims and Ahmadiyas in Pakistan who are persecuted minorities there. Waves of protests against the CAB, 2016 were witnessed in various parts of North-East. Various political parties, student and other unions in Assam were seen leading the protests because they felt that the bill neglects the Assam Accord of 1985.

- Clause 5 of the Assam Accord says that: "Foreigners who came to Assam after 1.1.1966 (inclusive) and up to 24th March, 1971, shall be detected in accordance with the provisions of the Foreigners Act, 1946, and the Foreigners (Tribunals) Order 1964."

The names of these foreigners "will be deleted from the electoral rolls" and such persons would have to register themselves under the Registration of Foreigners Act, 1939, and the Registration of Foreigners Rules, 1939. Also, foreigners who entered Assam on or after March 25, 1971, "shall continue to be detected… and expelled".

According to the amendment, if a Hindu illegally enters India on December 30, 2014 he/she will just have to show that he/she have resided in India for six years, which means it would be December 30, 2008.

IV. The connection

Some Bengali organizations openly came out and supported the bill. The JPC (Joint Parliamentary Committee) visited North-East for knowing the views of people regarding the CAB(2016). The hearings clearly showed that while most of the people from the Brahmaputra valley were protesting against the bill, in the Barak valley-the reverse happened. This reminds me of the Assamese language movement of the 1960's when the majority of thepeople in Brahmaputra Valley were supporting the state government's decision to make Assamese the state language whereas waves of protests were witnessed in the Barak valley and in the hill districts of Assam. The non-Assamese speakers led a procession in Shillong to oppose the government's decision to make Assamese the official language. This procession led by non- Assamese speakers was opposed in Upper Assam (Sivasagar, Dibrugarh, Jorhat, Golaghat) where the people supported the acceptance of Assamese as an official language. The only difference between these two events is that in the 1960's the Assamese speaking people were supporting the government's decision and the Bengali speaking population protested against the bill whereas in the case of CAB (2016) the Bengali speaking people from Barak were seen supporting the government's decision i.e. the bill while the Assamese speaking people protested against it. The credit for the creation of these two events which changed the political scenario of Assam goes to both the government and to their hegemonic mindsets.

V. Current political scenario in the state

The lapse of the Citizenship Amendment Bill might have given some amount of relief to the people of Assam and other parts of the North-East but the centre is again set to introduce a new Citizenship (Amendment) Bill in the winter session of the Parliament. He also said that under the leadership of Home Minister Amit Shah and Prime Minister Narendra Modi the government will prepare a new NRC. After the bill lapsed in Rajya Sabha, Himanta Biswa Sarma termed it as the defeat of the people of Assam. According to him the bill is the only way to protect the interests of the indigenous Assamese people. After this declaration by Himanta Biswa Sarma, The All Assam Bengali Youth Students' Federation came out and said that only someone like Himanta Biswa Sarma can protect the insecure Hindu Bengali community of Assam. The Federation's President expressed his support for Himanta Biswa Sarma by saying "Sarma is more vocal about issues concerning the people. He at least addresses the people and expresses discontentment over issues. We have seen him speaking on NRC-related issues. We can see that he understands the emotions of the people. So, we want him as the CM". On the other hand, this particular bill is seen by the Assamese people as an obvious threat to their identity. The way Central government is getting ready to introduce the bill again is something to worry for. The state has already witnessed wave of protests against the CAB(2016) and now if the government introduces the bill again, it might bring some serious consequences with it. The BJP is just trying to protect the Hindu identity by neglecting the Assamese identity. Their prime motive is to promote their ideology and to create a vote bank among Bengali Hindus which is not at all a hidden agenda and this can again widen the gap between the peace loving Assamese and Bengali people living in Assam since decades.

VI. CONCLUSION

Religion is used as a tool by many to promote and profess their radical ideologies. Religious scriptures are interpreted in a wrong way

which encourages individuals to discriminate and carry out violent activities against those who follow a different religion. This is seen in a country like India where people belonging to different religion, caste, race, and creed live together. It must also be noted that in India, we still have places which are known for its communal harmony. In India, the relationship between religion and politics is a complicated one. The political parties are often seen using religious symbols, values, ideas and institutions to achieve their political goals. The main motive of the political parties, as seen in the recent past is to create divisions or widen the gap between various religions especially between Hindus and Muslims. This has resulted in loss of many lives, peace and harmony. India is a developing country with a staggering population of 1.3 billion. There are many important issues starting from unemployment to a downtrodden economy which are often neglected by the political parties. Hence it is very important for us to recognise and reject the vote bank politics of these political parties. These political parties divide the population into sections to achieve their political goals. To live with peace and harmony with all the sections of the society, we will have to unite and reject these communal political parties.

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Does Entrepreneurial Orientation Contribute to Keke Business Performance in Nigeria?

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Abstract- Entrepreneurial Orientation represents the behaviour of entrepreneurs in their lines of business. This study is focused on entrepreneurial orientation and performance of Keke business in Nigeria. The study concentrated on registered members of Tricycle Owners Association of Nigeria (TOAN) in Akwa Ibom State. The study was a survey that involved 387 members of TOAN selected through Taro Yamane's formular from a population of 12,064. Simple random method of sampling wad employed while the primary instrument used was the questionnaire which recorded a response rate of 64%.Data analysis was carried out with the aid of correlation and regression analyses. Findings of the study indicated that autonomy (Beta = 0.038, t= 1.462, P> 0.05) and innovativeness (Beta =0.201, t= 1.558, P> 0.05) have insignificant effect on Keke business performance in Nigeria. However, risk-taking (Beta = .329, t= 3.194, P< 0.05); competitive aggressiveness (Beta = .446, t= 2.492, P< 0.05) and proactiveness (Beta = .317, t= 2.217, P< 0.05) have significant influence on Keke business performance in Nigeria. It was inferred from the study's findings that operators of Keke means of transportation in Nigeria should be proactive, aggressive in competition and be ready to take risk in order to boost their business performance.

Index Terms- Entrepreneurship, Entrepreneurial Orientation, Keke Business Performance, Nigeria

I. Introduction

Entrepreneurial Orientation (EO) is important given any form of business, be it product or service. All businesses are in competition for the same market. Avlonitis and Salavou (2007) see EO as innovativeness, risk-taking disposition and entrepreneur's proactiveness. Entrepreneurial orientation has five dimensions(Lumpkin and Desss,1996). These dimensions are autonomy, risk-taking, innovativeness, competitiveness aggressiveness and pro-activeness. These authors however, say that they might have some differences as a result of the firm in question or the environment of operation. Continued the authors consider entrepreneurial orientation as the process of entrepreneurship reflective of the decision-making styles and practices of managers in acting entrepreneurially. According to Hossain and Deewan (2012), the dimensions of entrepreneurial orientation enhance organizations' capacity to do better than other organizations which do not practice it.

It has been reasoned by writers such as Covin and Selvin (1989), that the level of entrepreneurial orientation of a given organization can be examined through a survey of their senior executives. Miller (1983) explains more on the dimensions of entrepreneurial dimension. According to this author, 'Autonomy' refers to having independence to decide or carry on activities targeted at ensuring achievement of the goals of an organization. 'Innovativeness', typifies the willingness of an entity in introducing novel ideas, and also experimenting the development of services, goods and process. 'Risk-taking' reflects the behavior of an enterprise in areas of making decisions and carrying out actions devoid of worries on the outcomes. 'Pro-activeness' shows the capacity of an organization in seizing opportunities available in the market. 'Competitive Aggressiveness' is used to explain the fighting disposition of the enterprise in an effort to better its position in the market.

The Keke transportation business has come to stay in Nigeria. This model of transportation was introduced in Nigeria during the administration of former President Olusegun Obasanjo, under the National Poverty Eradication Programme (*NAPEP*). Acquiring a brand new tricycle would cost between N600,000 to N800,000. The operation of the business requires prior registration with relevant authorities and unions. The Keke business is found almost everywhere in Nigeria and with the influx of people commuting via road, operators have found in Keke transportation model a very lucrative business with operators' daily income averaging between N3,000 and N5,000.

In Akwa Ibom State, the Keke model of transportation is commonplace. The state government had since banned commercial motor cyclists from operating in Uyo, the state capital, and recently extended the ban to cover Eket and Ikot Ekpene after 6pm ; a major reason adduced for the ban being the activities of trick stars parading as commercial motor cyclists. Thus with the ban coupled with the increasing popularity of this model of transportation, the Keke business has been effectively boosted. This business like any other venture requires appropriate entrepreneurial behaviour.

II. Statement of the Problem

The business environment is dynamic. Developments occur in the business environment daily. The entrepreneurial behaviour of entrepreneurs in respect of these developments captures their entrepreneurial orientation. The autonomy of the entrepreneur in decision -making, innovativeness, risk-taking ability, competitive

aggressiveness as well as proactiveness are basically the concerns of entrepreneurial orientation.

It is not the case that all operators of the Keke model of transportation business are successful. Some appear to be doing better than others but has that any link with their respective entrepreneurial orientations? Is it safe to assume that the management of keke transportation business has a bearing with the operators' entrepreneurial behaviour?

Research Hypothesis

$H_0$1: Autonomy has no significant influence on Keke transportation performance in Nigeria

$H_0$2: Risk-taking has no significant impact on Keke transportation performance in Nigeria

$H_0$3:. Innovativeness has no significant influence on Keke transportation performance in Nigeria.

$H_0$4: Competitive aggressiveness has no significant impact on Keke transportation performance in Nigeria

$H_0$5: Proactiveness has no significant effect on Keke transportation performance in Nigeria

III. Literature Review

An entrepreneurial orientation is taken to represent the process of pursuing and seizing opportunity along defined dimensions. According to Lumpkin and Dess (2001), an entrepreneurial orientation depicts activities of an organization such as making decisions, its practices and its processes that lead to the essential act of entrepreneurship, involving intentions and actions. Entrepreneurial orientation has five dimensions- innovativeness, autonomy, capacity to take risks, being aggressive in competition and being proactive (Lumpkin and Dess, 1996).

Conceptions of entrepreneurship might be considered to be bounded by three dimensions that relate to three questions of why, how and what (Stevenson and Jarillo,1990). These questions relate to psychology and sociology, management, and economics respectively. It is argued that an entrepreneurial orientation might be developed or learned. Deriving from Lumpkin and Dess (2001), entrepreneurial orientation dimensions are said to be behavioural processes capable of being developed or learned and are therefore associated with differing levels of learning.

Innovativeness reflects a tendency for an entrepreneur to support ideas that are new and also experiment creative processes capable of bringing about new processes in technology, products or services. Innovation is critical to entrepreneurial orientation and serves as the needed opportunity for exploitation by the entrepreneur (Lumpkin & Dess, 1996). Proactiveness is concerned with being conscious in taking initiative to put in place plans for the future knowing that opportunities abound in the environment (Lumpkin & Dess, 1996). It involves actions while making projections of issues in the future and possible changes that may occur. Lumpkin and Dess(1996) argue that proactiveness may be crucial to an entrepreneurial orientation as it goes along with entrepreneurial activity. The approach followed by the management of an organization which has relationship with taking risks brings to fore its entrepreneurial orientation (Lumpkin & Dess, 1996). In terms of the owner-manager being the unit of analysis in the aspect of manifestation of entrepreneurial orientation in the business, cognitive orientation in terms of entrepreneurial behaviour is considered with regard to risk taking propensity. A cognitive orientation that minimizes conceptions of regret and reflection may be displayed by entrepreneurs more so than non-entrepreneurial individuals (Baron and Ward, 2004). Brockhaus (1980) sees risk taking propensity as being the picture the entrepreneur has already in terms of succeeding or failing in a given venture prior to deciding venturing while awaiting the outcome of the proposal. In terms of autonomy, Lumpkin and Dess (1996) are of the view that the element supports entrepreneurial success and that it stimulates ideas or vision guiding action from beginning to end inclusive of independence of either the actions to be taken or the decisions to be made. It offers the independence that is needed in materializing a new business idea. Competitive aggressiveness shows an entrepreneur's capacity to battle with its competitors frontally rather than avoiding them using such measures as reducing prices, additionally spending on its programs which may include, marketing, production capacity and the like.

IV. Theoretical Review

This study is based on Schumpeter's Innovation Theory. Schumpeter (1942) describes a process of creative destruction where wealth creation occurs through disruption of existing market structures due to introduction of new goods and/or services that cause resources to move away from existing firms to new ones thereby enhancing new firms' growth. For Schumpeter, innovation is the entrepreneur's specific tool, the channel by which entrepreneurs easily grasp, seeing it as opportunity to venture into a business.

Lumpkin and Dess (1996) see the process of creative destruction as an essential variable that accounts for successful entrepreneurship, hence, the need for innovativeness. Furthermore, Osaze (2003) sees being pro-active as defining goals and future and arriving there as planned; a state of mind and the will, largely driven by consciousness, to sustain a vision and to achieve a specific objective.

V. Empirical Review

Ingrid and Kenneth(2007) investigated entrepreneurial orientation and small and medium enterprise performance using Tanzania as case study. This research made use of a survey research design. Pro-activeness, competitive aggressiveness and risk taking were aspects of entrepreneurial orientation studied. Following analysis of data obtained from the field, it was established that the studied elements of entrepreneurial orientation were influential in the performance of SMEs, hence a strong relationship between studied variables. Findings of the study also indicated that risk-taking and competitive aggressiveness can moderate impact of pro-activeness. The study variables were able to predict 72% of the variance in SME performance.

In Nepal, Hattiban and Gautan (2001) studied entrepreneurial orientation and business performance. The investigation focused on the handicraft industry. The study focused on those involved in the business of handicraft. The

design of the study was survey with questionnaire as the main instrument employed. The method utilized in sampling respondents in the research was simple random technique. The study's population was 397 and its sample size 178. It recorded 90.4% response rate. Business efficiency, its growth, and its profitability served as proxies for performance. Descriptive statistics, correlation and regression analysis were deployed in analyzing data. Outcome of the investigation indicated that risk-taking, autonomy, competitive aggressiveness and proactiveness had positive correlation with performance. Innovativeness was not correlated with performance in the study.

Callaghan and Venter (2011) investigated entrepreneurial orientation and entrepreneurial performance in Johannesburg, South Africa. The study focused on street traders. The study was a survey. The investigation involved 308 traders. The study first considered variables that influenced entrepreneurial orientation. Second, how entrepreneurial orientation contributed to entrepreneurial performance. Outcome of the study showed that entrepreneurial orientation was linked with some contextual and learning factors. This suggested that offering entrepreneurial training was likely to empower informal entrepreneurs. It was also revealed that higher levels of proactiveness and competitive aggressiveness were positively associated with continuance satisfaction.

Duijn (2009) was interested in the entrepreneurial orientation of students in the Netherlands. This study was a survey research and focused on students of tertiary institutions in the country. In the research, analysis of data was done with descriptive analysis. Findings of the study showed that individual entrepreneurial orientation can be seen in proactive personality and risk taking propensity among students. These findings had implications in predicting those likely to display the kind of entrepreneurial behaviour expected of business executives in a dynamic business environment.

VI. Research Methodology

This study employs a survey research design. The study's population comprised all members of Tricycle Owners Association of Nigeria (TOAN) operating in Akwa Ibom State. The population of this group was put at 12,064 registered members as at April, 2019 when this study was conducted. We applied the Yaro Tamane sample size determination formular to arrive at 387. The study recorded a response rate of 64%. The research instrument for this study was the structured questionnaire. Inputs into the questionnaire were taken from an extensive review of relevant literature. The instrument was evaluated for face and content validity. The multiple regression and Pearson's product-moment correlations were used in data analysis at 0.05 level of significance

VII. Correlation Analysis

The correlation between EO dimensions and Business Performance is presented below.

Table 1: Correlation Details between Entrepreneurial Orientation and Keke Business Performance

Risk -taking	.753**
Autonomy	.039
Innovativeness	.373
Pro-activeness	.682**
Competitive Aggressiveness	.601**

*.Correlation is significant at the 0.05 leve (2-tailed).

Table 1 displays details of correlation analysis between entrepreneurial orientation and Keke business performance. The correlation between risk -taking and Keke business performance is significant at .753; for autonomy, the correlation is positive but not significant at .039. Similarity, the correlation between innovativeness and keke business performance is positive but not significant at .373. Also, the correlation between pro-activeness and keke business performance is significant at .682 while that of competitive aggressiveness and Keke business performance is significant at .601. All analyses were done at 0.05 level of significance.

Multiple Regression Analysis

Table 2: Multiple Regression Analysis between Entrepreneurial Orientation and Keke Business Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	ANOVA F-Value	Sig
1	.793[a]	.629	.604	7.207	11.303	0.000

a. Predictors: (Constant), Autonomy, risk-taking, innovativeness, proactiveness, competitive aggressiveness,
b. Dependent Variable: Keke Business Performance

Source: SPSS Computation

Table 2 shows results of regressing entrepreneurial orientation dimensions namely, autonomy, risk-taking, innovativeness, proactiveness and competitive aggressiveness against Keke business performance in Nigeria. The R^2 of 0.629 shows the relationship between dependent and independent variables. The adjusted R^2 = 0.604, indicates that the five dimensions of independent variable, entrepreneurial orientation together explained 60.4 % variation that exist in the dependent variable, Keke business performance. The remaining 39.6% could be attributed to other variables that are not part of the research model.

Table 2: Coefficient of Multiple Regression Model in respect of Entrepreneurial Orientation Dimensions

a.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	83.103	6.305	6.305	6.462	.000
Autonomy	.081	.026	.038	1.462	.042
Risk-taking	.261	.103	.329	3.194	.002
Innovativeness	.174	.129	.201	1.558	.038
Competitive aggressiveness	.233	.179	.446	2.492	.004 .
Proactiveness	.109	.143	.317	2.217	.012

Dependent Variable: Keke Business Performance
Source: Computed from SPSS

From Table 2, it can be seen that autonomy (Beta = 0.038, t= 1.462, P> 0.05) and innovativeness (Beta =0.201, t= 1.558, P> 0.05) have insignificant effect on Keke business performance in Nigeria. Risk-taking (Beta = .329, t= 3.194, P< 0.05); competitive aggressiveness (Beta = .446, t= 2.492, P< 0.05) and proactiveness (Beta = .317, t= 2.217, P< 0.05) have significant effect on Keke business performance in Nigeria. Accordingly, hypotheses one and three are accepted while hypotheses two, four and five are rejected. This analysis indicates entrepreneurial orientation dimensions and their individual strengths in predicting Keke business performance in Nigeria. A further implication of the analysis is that risk-taking, competitive aggressiveness and proactiveness are entrepreneurial orientation dimensions that determine Keke business performance in Nigeria.

VIII. Discussion and Conclusion

In this study, it has been established that as it concerns Keke business performance in the context of Nigeria, the three most important entrepreneurial orientation elements in order of importance are risk-taking, competitive aggressiveness and proactiveness. The outcome of this study strengthens the position of Osaze (2003) who considers being pro-active as the ability of the entrepreneur to define goals and the future and also the ability to arrive there as already planned; a state of mind and the will, largely driven by consciousness, to sustain a vision and to achieve a specific objective. The outcome of this study seems not to be in total agreement with Lumpkin and Dess (1996)who posited independence of the entrepreneur was vital to entrepreneurship and that an inclination towards independence and autonomy was an essential ingredient to entrepreneurial orientation.

The business environment has never been static but dynamic. Developments in the environment requires appropriate response by where way of entrepreneurial behaviour. knowledge of entrepreneurial orientation is useful to all categories of entrepreneurs. For instance, a knowledge of risks enhances ability to predict how successful a business would be if established given the risks in the environment. Being proactive, enables the entrepreneur to be futuristic by putting in place appropriate plans. Competitive aggressiveness energizes the entrepreneur into having and managing a greater market share. Innovativeness and autonomy while still considered important elements of entrepreneurship were not found to be significant in the case of Keke business performance in Nigeria. The findings of this study indicate that operators of Keke means of transportation in Nigeria should be proactive, aggressive in competition and be ready to take risks in order to boost their business performance. Previous studies in this area did not investigate contributions made by entrepreneurial orientation to Keke business performance, a feat achieved by current research effort.

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The Effect of Different Time Interval in Micro-Waved Meat On the Meat Quality

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I. Introduction

Meat is considered a source of high quality proteins. Meat is a very good source of animal protein that consists of essential amino acid, minerals, vitamins and essential fatty acids (Lawrie, 1991*)*. Meat provides calories from fat, proteins and limited quantities of carbohydrate *(*Judge *et al*., 1990*)*. Lean meat contains from 15 to 20% of protein, which varies inversely with percentage of fat. It is also one of the few foods which provide complete protein as well as being rich source of such essential nutrients as iron, niacin and vitamin B_{12} (Lawrie, 1991).

The major poultry meat quality attributes are appearance, texture, juiciness, flavour, and functionality. With increasing trends in further processing, meat functionality has increased in relative importance, especially because of its key role in determining the sensory quality of complex ready-to-eat products (Fletcher, 2002). A quality grade is a composite evaluation factors that affect palatability of meat (tenderness, juiciness, and flavour). These factors include carcass maturity, firmer, texture and colour of lean meat.

Cooking of meat is essential to achieve a palatable and safe product (Tornberg, 2005). There is very little Vitamin A and ascorbic acid in meat. (Mikkelsen *et al.,* 1984). Lean meat from most animal carcass which consist of muscle, connective tissue, fat and bone and some 75% water in proportions depending on species, breeds, size, age, etc (Ainger, 1991). The muscle (lean meat) is relatively constant in composition in a given species and greatest variable in the carcass is the amount of fat which can range from 2% in some free-living animal to 15 - 40% in domesticated animals intensively reared. (Ramaswany, 1980). It will be noted that the lean meat of various species has similar values for micro nutrient and inorganic constituents. The same is true of the vitamins with the beef meat and chicken meat. (Reiter and Driskell, 1985). Method of cooking determines its compositional, processing determinants and sensory attributes especially appearance and colour and juiciness of the meat product. Some researchers have observed that microwave oven cooked meat products had lower moisture content than conventional oven cooking (Salama, 1993; Hoda *et al.,* 2002). Nath *et al.,* (1996) and Mendiratta *et al.* (1998) reported no moisture difference in microwave oven and conventional oven cooked chicken patties. Meats consist primarily of muscular tissues with the amount of fatty tissue varying not only with the breed, age, sex and diet of the animal but also anatomical location. For example, heating temperatures have been shown to affect the texture of the beef muscle. (Herhon and Hulland. 1980).

II. MATERIALS AND METHODS

The experiment was carried out at the animal products and Processing Laboratory of the Department of Animal Production And Health, College of Animal Science And Livestock Production, Federal University of Agriculture, Abeokuta.

Experimental Procedure

Broiler chickens and beef were purchased from a Commercial market, they were slaughtered and dressed and 1kg of each meat types was assigned to the three treatments cooking at 5, 10 and 15 minutes.

Table 1: The meat type and cooking intervals

Meat type	Cooking time (minutes)		
Chicken meat (broiler)	5	10	15
Beef	5	10	15

Determination of Cooking (Microwave) Losses

Each sample was into sizeable portion, weighed and then microwave at about 900wd for 5, 10, and 15 minutes. Cooking losses were then calculated using the formula below.

Cooking loss (g) = Weight of samples before cooking (g) – weight after cooking (g)

$$\text{Cooking Loss (\%)} = \frac{\text{Weight of samples before cooking} - \text{weight after cooking}}{\text{Weight before cooking}} \times 100$$

Determination of Refrigerated Losses

Refrigerated weight losses were determined after the meat types have been microwaved at different time interval (initial weight). Then the microwave meat types were later refrigerated at 4^0c for 24 hours. Refrigerated weight loss was calculated using the formula below:

Refrigerated weight loss (g) =Initial weight (g) - Final weight (g)

$$\text{Refrigerated weight loss (\%)} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Proximate Analysis

Parameter that were evaluated for each meat types were moisture content, crude protein, crude fat, total ash, water , calcium (Ca), iron (Fe) that were determined for each meat types according to the method described by AOAC(1990).

Sensory Evaluation

Sensory evaluation of the microwave beef and chicken meat at different time intervals was carried out using ten trained taste panellist. Some of the meat qualities estimated include colour, juiciness, meaty flavour, tenderness, saltiness, overall flavour and overall acceptability. Bite size portions of the microwave beef and chicken meat weighing 10g each were served at room temperature to the trained panellists who awarded scores using a nine point hedonic scale as described by (Cross *et al*., 1986). Like extremely =9, like very much=8, moderately=7, like slightly=6, neither like nor dislike=5, dislike slightly=4, dislike moderately=3, dislike very much=2, and dislike extremely=1.

A preliminary briefing session was held and the panellists were told as follows: Water was served to them for rinsing of their mouth after scoring each sample. Samples were independent of one another.

Statistical Analysis

All the data generated was subjected to 2x3 Factorial Arrangement in Completely Randomised Design using the statistical package (SAS 2010), while difference between means was determined by Duncan Multiple Range Test (1995)

III. RESULTS AND DISCUSSION

Table 2 show the main and interactive effect of microwave weight loss of broiler chicken and beef meat microwave at different time interval. Considering the interactive effect, the weight loss was observed to be higher in beef than in chicken at the longest time microwave interval of 15 minutes this goes to show that chicken has a higher water holding capacity than beef. Which agree with the finding of (Ruiz *et al.,* 2000). It was observed that the longer the micro-waved time, the higher the cook loss.

Table 2: Effect of microwave weight losses of chicken meat and beef

Cooking interval	Initial weight(g)	Final weight (g)	Wt loss(g)	Wt loss (%)
5minutes	50.35±0.09	28.01±2.23^{a}	22.35±2.30^{b}	44.35±4.51^{b}
10minutes	50.38±0.12	27.783±.55^{a}	22.60±3.58^{b}	44.83±7.10^{b}
15minutes	50.180±.06	16.65±2.23^{b}	33.53±2.28^{a}	66.79±4.48^{a}
Meat types				
Broiler chicken	50.19±0.04^{b}	28.402±.71^{a}	21.79±2.70^{b}	43.42±5.40^{b}
Beef	50.42±0.08^{b}	19.892±.13^{b}	30.53±2.11^{a}	60.57±4.21^{a}
Microwave temp X meat type				
Chicken at 5mins	50.230±.12^{ab}	34.47±0.87^{a}	15.77±0.96^{b}	31.38±1.85^{b}
Chicken at 10mins	50.20±0.06^{ab}	32.94±0.49^{a}	17.25±0.52^{b}	34.37±1.02^{b}
Chicken at 15mins	50.13±0.03^{b}	17.80±1.51^{b}	32.33±1.51^{a}	64.50±3.01^{a}
Beef at 5mins	50.500±.12^{ab}	23.07±0.52^{b}	27.43±0.06^{a}	54.32±1.10^{a}
Beef at 10mins	50.53±0.18^{a}	21.10±4.21^{b}	29.43±4.04^{a}	58.30±8.22^{a}
Beef at 15mins	50.23±0.12^{ab}	15.50±4.61^{b}	34.73±4.72^{a}	69.10±9.26^{a}

Mean along the same column with different superscript are significantly different ($p<0.05$)

Table 3 Shows the main and interactive effect of weight loss of chicken and beef meat microwave and refrigerated after 24hours shows no significant in gram and percentage. There was significant different on final weight. Which agree with the findings of (Whiting *et al.,* 1987). This is as a result of increase in water losses maybe be due to incorrect water gelling.

Table 3: Effect of refrigerated weight losses of micro-waved chicken and beef

Cooking interval	Initial weight (g)	Final weight (g)	Weight loss	Weight loss (%)
5minutes	28.01±2.23^{a}	27.43±2.23^{a}	0.58±0.20^{b}	2.12±0.69^{b}
10minutes	27.78±3.55^{a}	26.09±3.52^{a}	21.64±0.50^{ab}	5.71±1.36^{ab}
15minutes	16.65±2.23^{b}	14.88±2.33^{b}	2.51±0.83^{a}	13.94±4.52^{a}
Meat type				
Broiler chicken	28.40±2.71^{a}	26.33±2.89^{a}	2.07±0.60	8.32±3.00
Beef	19.89±2.13^{b}	19.26±2.44^{b}	1.08±0.38	6.19±2.52
Microwave temp X meat type				
Chicken at 5mins	34.47±0.87^{a}	31.83±0.44^{a}	2.63±0.45	7.58±1.10

Chicken at10mins	32.94±0.49[a]	32.40±0.15[ab]	0.56±0.37	1.67±1.09
Chicken at 15mins	17.80±1.51[b]	14.78±0.06[c]	3.02±1.49	15.71±7.45
Beef at 5mins	23.07±0.52[b]	22.47±0.38[bc]	0.60±0.25	2.57±1.03
Beef at 10mins	21.10±4.21[b]	20.35±5.38[c]	0.65±0.26	3.83±2.11
Beef at 15mins	15.50±4.61[b]	14.97±5.22[c]	2.00±0.98	12.17±6.61

Mean along the same column with different superscript are significantly different ($p<0.05$)

Table 4 shows the main and interactive effect of proximate composition of broiler chicken and beef microwave at different time interval. For moisture content, crude fat, and total ash it was observed that beef was the highest at 15minutes (9.90) 12.83, 1.62, respectively. While chicken was the highest for crude protein and carbohydrate for 15 minutes (79.39) (0.33) which agrees with the findings of (wood *et al.* 2004) this content composition of meat are of major important for consumers due to important for meat quality and nutritional value

Table 4: Effect of proximate composition of chicken and beef meat microwave at different time.

Time interval (minutes)	Moisture content (%)	Crude protein (%)	Crude fat (%)	Total ash (%)	Calcium mg / 100g (%)	Iron /mg/100g
5	9.23±0.20[a]	16.02±0.69[b]	12.20±0.61[a]	1.33±0.77[a]	0.17±0.01[b]	0.09±0.01[b]
10	8.70±0.33[ab]	16.02±0.67[b]	12.02±0.79[a]	1.71±0.23[a]	*0*.29±0.05[a]	0.13±0.02[ab]
15	8.22±0.23[b]	18.30±0.70 [a]	11.40±0.65[a]	1.47±0.12[a]	0.18±0.02[b]	0.19±0.03[a]
Meat types						
Chicken	8.59±0.21[a]	18.69±0.56[a]	10.65±0.22[b]	1.27±0.06[b]	0.23±0.04[a]	0.15±0.02[a]
Beef	8.83±0.28[a]	15.17±0.55[b]	13.10±0.44[a]	1.24±0.14[a]	0.20±0.02[a]	0.12±0.02[a]
Microwave X Meat type						
Chicken at 5mins	9.25±0.38[a]	16.93±1.04[b]	10.90±0.13b[c]	1.18±0.08[b]	0.16±0.00[b]	0.11±0.00[ab]
Chicken at 10mins	8.00±0.06[b]	19.39±0.51[a]	11.07±0.45[bc]	1.32±0.09[b]	0.38±0.52[a]	0.13±0.01[ab]
Chicken at 15mins	8.53±0.09[ab]	19.74±0.15[a]	9.98±0.12[c]	1.32±0.18[b]	0.14±0.02	0.21±0.06[a]
Beef at 5mins	9.20±0.23[a]	15.11±0.60[cb]	13.52±0.35[a]	1.48±0.07[b]	0.18±0.01[b]	0.08±0.00[b]
Beef at 10mins	9.40±0.23[a]	13.53±0.34[c]	12.97±1.41[a]	2.11±0.32[a]	0.19±0.05[b]	0.13±0.04ab
Beef at 15mins`	9. 90±0.40[b]	16.88±0.60[b]	12.83±0.25[ab]	1.62±0.13[ab]	0.22±0.01[b]	0.17±0.00ab

Table 5 shows significant ($p<0.05$) different for main and interactive effect of some sensory properties of broiler chicken and beef meat microwaved at different time interval, the interactive effect of microwave and meat type on colour show that chicken microwaved at 15minutes was scored 6.27 being like slightly while beef at 15minutes was scored 5.70 being intermediate. Juiciness for chicken and beef meat at 10minutes was 6.10 and 4.70 slightly juicy and slightly dry respectively, while at 15minutes was slightly dry. Flavour for chicken at 15 minutes was scored 6.23 being slightly meaty while beef was scored the lowest at 10minutes for 5.03 being intermediate. Tenderness for chicken at 10 minutes was scored 6.40 being slightly tender while beef was scored the lowest at 15 minutes for 3.77 being moderately tough. This agreed with the findings of Obuz *et al* (2003) that the effect of heating rate on the tenderness of meat is greatly influenced by muscle type. The overall flavour for chicken was the highest at 15minutes for 6.50 which were slightly desirable than beef at 5minutes of the lowest of 5.33 intermediate. The overall acceptability for chicken was scored highest of 6.50 at 15minutes like slightly to beef at 10 minutes for 5.30 which was intermediate.

Table 5: Effect of sensory properties of broiler chicken and beef meat micro-waved at different time interval

Time interval	Colour	Juiciness	Flavour	Tenderness	Saltiness	Overall Flavour	Overall Acceptability
5 Minutes	5.42±0.25	4.98±0.24	5.80±0.34	5.33±0.41[ab]	5.0±0.20	5.7±0.26	5.82±0.33
10 Minutes	5.40±0.18	5.40±0.37	5.45±0.37	5.80±0.36[a]	5.10±0.21	5.65±0.23	5.77±0.31
15 Minutes	5.98±0.24	4.50±0.40	5.83±0.25	4.35±0.43[b]	4.93±0.26	6.13±0.26	6.23±0.29
Meat types							
Chicken	5.71±0.25	5.29±0.30	5.96±0.13	5.54±0.33	5.03±0.15	6.16±0.24[a]	6.24±0.30
Beef	5.49±0.13	4.63±0.26	5.43±0.16	4.77±0.38	5.0±0.21	5.50±0.08[b]	5.69±0.16

Microwave Interval X Meat types							
Chicken at 5	5.13±0.47^{b}	5.0±0.50^{ab}	5.77±0.68	5.30±0.53^{ab}	4.80±0.26	6.07±0.43^{ab}	6.0±0.68
Chicken at 10	5.73±0.07^{ab}	6.10±0.38^{a}	5.87±0.70	6.40±0.45^{a}	5.07±0.32	5.90±0.44^{ab}	6.23±0.41
Chicken at 15	6.27±0.43^{a}	4.77±0.43^{ab}	6.23±0.38	4.93±0.49^{ab}	5.23±0.24	6.50±0.46^{a}	6.50±0.61
Beef at 5	5.70±0.10^{ab}	4.97±0.20^{ab}	5.83±0.33	5.37±0.74^{ab}	5.20±0.31	5.33±0.09^{b}	5.63±0.23
Beef at 10	5.07±0.23^{b}	4.70±0.21^{ab}	5.03±0.18	5.20±0.31^{ab}	5.13±0.35	5.40±0.10^{b}	5.30±0.25
Beef at 15	5.70±0.12	4.23±0.75^{b}	5.43±0.12	3.77±0.57^{b}	4.63±0.45	5.77±0.03^{ab}	6.13±0.18

Mean along the same column with different superscript are significantly different ($p<0.05$)

IV. CONCLUSION AND RECOMMENDATION

The higher the microwave time the more the percentage cooking weight losses of broiler chicken and beef meat. Cooking time of meat types in microwaves had little or no effect on crude protein content. Crude fat was more affected by cooking time in beef and independent in chicken meat, while mineral content in the meat types were independent of cooking time in microwaves.

Recommendation

Since cooking time in microwaves has little or no effect on nutrient composition in both meat types, it is therefore, recommended that beef and chicken meat can be cooked in microwaves up till 15 minutes

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In-Depth Analysis of Municipal Solid Waste Management in Kanifing Municipality, The Gambia

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Abstract- Undoubtedly, inadequate municipal solid waste management in most developing countries is one of the major contributing factors to the present environmental pollution and risk to human health. This is influenced by increasing population, urbanization, industrialization, and economic development of a particular place resulting to the rise in waste stream and its complexity.

In the Gambia, Kanifing Municipality is one of most densely area and face with a huge challenge to the increasing volume of municipal solid waste produced and insufficient collection capacity. The generation and composition of MSW of this municipality is influenced by numerous factors, notable rise in the affluence of people and increase in population. The considerable growth of this municipality since 1993 has increased the generation of waste and its composition. As uphold in many research, MSW generation depends on the socioeconomic activities and the size of the population. This proved to be the case of the MSW generation and its composition in Knifing Municipality. Reviews of previous studies and reports indicated that major components of generated wastes were paper/cartons (83%), plastics (80%), organic matter (40%), metals (30%) and glass (27%). Studies also noted that, most of the waste generated by the commercial establishment can be recovered, recycled and more importantly, the generation of hazardous waste by the sector seems very negligible.

This paper investigates and analyze the current status and problems of Municipal Solid Waste Management (MSWM) in Kanifing Municipality based on gathered reports and papers to evaluate to what extent a viable reduction of the MSW can be implemented and management systems to be improved in the near future.

Currently, MSWM status and problems in this municipality is surrounded by an increase in the population couple with upsurge in affluent of inhabitants resulting in huge increase in the generation and composition of MSW. Comparing with the increasing rates of MSW generation, little has been done concerning its management. Therefore, an Integrated Waste Management System should be built in order to improve the holistic approach to enhance the sustainable MSWM system and reduce the impacts of waste to the environment and people at large.

Index Terms- Municipal Solid Waste generation, Solid waste management, Kanifing Municipality

I. Introduction

Globally, pollution caused by solid waste poses a risk to human health and the environment. This has been accelerating in recent decade with higher than expected due to increasing population, urbanization, industrialization, and economic development contribute to the rise in waste stream and to increasing its complexity and riskiness[1]. Due to uncontrolled discriminate dumping and inappropriate waste handling causes a variety of problems, including contaminating water, attracting insects and rodents, and increasing flooding due to blocked drainage canals or gullies [2]. Solid wastes refers to all non-liquid wastes that arise from the activities of both human and animal and are discarded as useless or unwanted[3]. These include both organic and inorganic fractions such as kitchen refuse, product packaging, grass clippings, cloth, bottles, paper, paint cans, batteries, etc.

According to World Bank Report 2018, waste generation is projected to drastically surge from the current generation rate of 2.01 billion tons to 3.40 billion tons annually. Presently, the world is on a course where waste generation will considerably outpace population growth by more than double by 2050. An estimated of 13.5 % of today's waste is recycled and 5.5 % is composted (World Bank Report 2018). The report also estimated that between one-third and 40% of waste generated worldwide is not managed properly and instead dumped or openly burnt. These combine with global financial and economic instability, threats to health, and growing environmental degradation to affect all developing countries. These shared stressors shape national economics and people's livelihoods[4]. The types of solid waste generated in the municipality, includes mixed or similar wastes mainly from urban, peri-urban regions[5]. Municipal Solid Waste (MSW) is a waste that comes from households, garden waste or street sweepings are also considered and contents of litter containers. Solid waste encompasses all heterogeneous mass of throwaways from municipalities known as municipal solid waste as well as homogeneous accumulations from agricultural, industrial, commercial, and construction wastes[2]. However, the Basel Convention defines Municipal Solid Waste (MSW) as "Substances or objects that are disposed of, intended to be disposed of or are required to be disposed of by the provision of law." The management of these waste includes the control of its generation, storage, collection, transfer and transport, processing and disposal in a manner that is in accordance with the best principles of public health, economics, engineering, conservation,

aesthetics, public attitude and other environmental considerations[2].

In most countries especially developing countries, the management of municipal solid waste rest on the shoulders of the local government authorities or municipalities. However, the management of these waste by these authorities has been challenging.

According to Hyman et, 2013, more than 1.3 billion tons of municipal solid waste (MSW) was generated in 2012 and 2.2 billion tons a year is expected Worldwide by 2025. The environmental pollution associated with municipal solid waste is a common phenomenon in urban setting of the world due to improper management practices[6]. To minimize effluence of these waste, national waste management policies and strategies are put in place, and each country try to apply its own particular style of inventiveness to its own complexities[7]. However according to Chung et al., 2013 Municipal Solid Waste Management (MSWM) is a strategic issue that is often limited by resources requires, realities support, time requirement, conformity with expected outcomes and including numerous aspects. It includes several multifaceted and interdependent problems that need to be clarified in as sensible and logical manner, so that it leads to more and better decisions.

The challenges and problems confronted in the municipal solid waste management has been an issue since the creation of the universe[8].The phenomena has been exacerbated since the industrial revolution and several researchers have discussed its issues[9].Many noted that, the population growth, rapid urbanization, and industrialization resulted in increasing problems of solid wastes.

The disposal and handling of these waste lead to environmental degradation, damage of the ecosystem and pose great risks to public health[10].There is a huge linkage between improper management of urban solid wastes and the environmental pollution. This has resulted to a serious environmental degradation such as land, water, and air pollution and public health risk such as skin disease, asthma, diarrhea, and even skin diseases, etc. mainly due to unselective disposal of wastes on streets and other public areas, drainage bottleneck by indiscriminately dumped wastes, and contamination of water bodies closed to waste stream[11].

As mentioned in Sharholy et al. (2008), MSW in urban areas contained large fraction of compostable materials (40–60%) and inert (30–50%). The relative percentage of organic waste in MSW was generally increasing with decrease in socio-economic status; so rural households generate more organic waste than urban households[12]. It has been observed that the physical and chemical components of MSW depends upon a number of factors such as food habits, standard of living, degree of commercial activities, seasons etc. where the total MSW generation depends on total population.

As a basis and precondition for Municipal Solid Waste Management (MSWM) systems, quantification and prediction of solid waste generation is very fundamentals[13]. However, MSW prediction cannot be done directly and depends on so many factors. The effective collection and proper disposal of MSW depends greatly upon accurate prediction of generation of solid waste [14].The waste management measure to adopt will depend on the sources, since waste characteristics and composition differ according to source[15]. The problem associated with solid waste management in developing countries cannot be over-emphasized even though the management of solid waste is an essential public services[16]. In many developing nations, the provision of solid waste management services to inhabitants is not full satisfaction[17]. This is due to the fact that the custodian of waste management system has not fully considered the users of the waste management systems. Waste generation being an intrinsic part of living requires a proper examination of various sources from which waste generated[17].

II. Study Area

The Gambia is a smallest country in continental Africa, bordered by Senegal and extending to Western Coast of Africa between 13^0 and 14^0 N. It covers a total land area of approximately 10, 689 sq. km with a length of about 400km and a width varying from 20 to 48km. It has *Sudano-Sahelian* type of climate, with a short rainy season from June to October and a long dry season lasting from November to May. The average annual rainfall is 900mm and the country witness an average reduction of 275 in annual rainfall since 1951. The mean temperature is lower plateau and upper plateau, with different soil types. The natural drainage is centered on the River Gambia and its tributaries, namely; *Sandougou, Miniminyang, Baobolon, Sofaniama and Bintang Bolong*. The River Gambia, which covers **1130km** long originates from the **Fouta Djallon** highland in Guinea pass through Senegal, the Gambia and empties into the Atlantic Ocean. It has features Sudan Savana woodland vegetation. The Gambia has the following main ecosystem types: forest ecosystems (closed and open woodland ecosystem), agricultural ecosystems (arable and rangeland ecosystems), marine and coastal ecosystems, inland water ecosystem (wetland and terrestrial ecosystems (tree / shrub savanna).

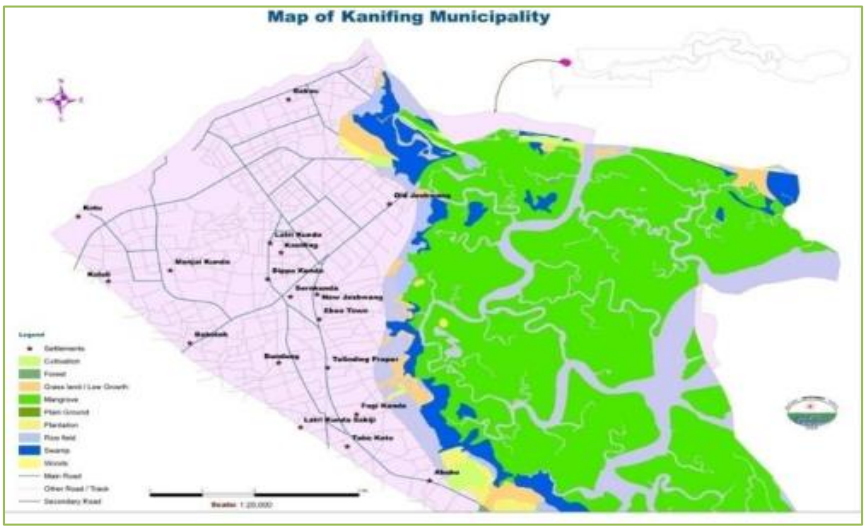
Figure 1. Map of The Gambia

According to the 2013 National Population Census, the Gambia population is estimated at 1, 856, 417 with a population growth rate 3.6% per annum (GBoS, 2013). The country's population density is 174 person per square kilometer. Thus, making the country the 10th most densely population in Africa. It has a population which is relatively young with about 46.2% of the population under 15 years of age while 3.2% is 65 years and above, according to the 2013 census results.

The waste management system in The Gambia is faced with several challenges which include inter alia; high population pressure, inadequate public awareness on solid waste, insufficient funding, inadequate equipment for collection and disposal, lack of appropriate waste disposal facilities, low technical capacity mainly at local government authority level (UNEP-GEF Capacity Building For PCBs and U-POPs Consultancy Report 2018). These to greater extent have ramifications on the quality, aesthetic values and health related issues on the immediate environment in the country. Municipalities/ Area Council Authorities are responsible for MSWM and are required to provide an effective and efficient management plan as enshrined in the Local Government Act 2002. However, these authorities face problems that are beyond their limits due to lacking organization and financial resources[2] and multidimensionality identified as an important shortcomings owing to limited capacity and funding of LGAs.

The aim of this paper is to investigate and analyze the current status of MSWM in the Kanifing Municipality and to analyze to what extent a viable reduction of the municipal solid wastes can be implemented and management systems to be improved in the near future.

Kanifing Municipality is one of the most densely unban settlement in the Gambia. According to 2013 Housing and Population Census conducted by GBoS, revealed that it has a population of 382,096, accounting for 20.3% of the National Population with a population density of 4,274.63 per square kilometer. The Census further indicated that, there are 49,560 households with an average household population size of about 6.50 persons. The population growth stood at 1.7% resulting to 18.39% surge from 322,735 in 2003 and 382,096 in 2013 with a combined land area of 88 sq. km constituting about 0.8% of the total land area of the country.



Pictorial of the study area (Kanifing Municipality)

Solid Waste Collection, Transportation, Disposal and Recycling practice in Kanifing Municipality

As enshrined in the Local Government Act, 2002, Sections 48 - 131 and Local Government Finance and Audit Act, 2004, Sections 8, 12, 14, 20 and 23 and other local government provisions. The responsibility of solid waste management within Kanifing Municipality is on the shoulders of the Kanifing Municipal Council (KMC). Within the Municipality, the department of **Environment and Sanitation** is a body charge with the management responsibility of all waste types. However, only the garbage collection just limited to the markets and business places, restaurants and road, main streets and in some residential areas. The collection is just covering small area and the rest of residential areas without collection services due to lack of fund, facilities e.g.; tipper/compactor trucks to collect the garbage. In addition no participation from private companies to take over residential areas in garbage collection. The municipal's **Environment and Sanitation Department** has six zones /blocks all lies within the area map of Kanifing Municpal Administration. These zones /blocks have coordinators together with environmental officers, public health officers, rate collectors and supervisors who are trusted with responsibility in their management.

For any waste management, the effectiveness and efficient collection and transport of waste are of significant importance in reducing waste accumulation[7]. In Kanifing Municipality, the system of collection is both **door to door** and **station type** where Skips and Trailers are placed in strategic locations for communal collection. For ease of management the municipality is divided into **six collection Zones**, which are further subdivided into Blocks. Refuse collection is divided in two shifts, morning shift (8:00a.m - 3:30 p.m.) and afternoon shift (4:00p.m - 12:00 mid night).

The types of collection systems are, **Door-to-door collections**, the onus is on the households to place their refuse along the route of the collection vehicle (usually contained in sacks and buckets). **Communal collection points** where the residents take their refuse to the collection point (Skip or Trailer). The criteria for adopting either of the two systems is not strictly defined, but in general is guided by the following: -

Population density - door-to-door collection is used in relatively less densely populated middle and mostly high income areas while **communal collection points** are used in the low-income areas and more densely populated areas and where indiscriminate/illegal dumping of refuse is common.

Inception Report for the Development of Five-Year Waste Management Plan for Kanifing Municipal Council, 2015 stated that, the weak financial muscle of the municipality hindered the management operations on solid waste management as result waste management continuous to be the main challenge for this city. It was also reported that, 45% of the vehicle fleet of the municipality used in the collection and transportation of waste were road worthy. Under these circumstances the choice of using a trailer or skip is guided by availability, volume of refuse generated and the existence of door to door services. Despite the efforts of the KMC and other operators, solid waste management in the Kanifing Municipality is inadequate as visually evidenced by the existence of uncollected refuse at various locations within the municipality[18]. There are no sanitary landfills and waste is dumped at official designated dumpsite at Bakoteh. This dumpsite as commonly known as "Bakoteh Dumpsite" is the official dumping ground for all the waste generated within this municipality. However, this site to certain extent pose significant health threat to the residents and the environment as a whole[18]. In general, the Gambia as a country does not have proper infrastructure to deal with the solid waste issues since the colonial era and as such waste is dumped indiscriminately and haphazardly with minimal or no proper management which resort to open burning thus resulting in air pollution.

Study revealed that, Kanifing Municipality generated 79,935 tons of waste, and 8% of the country total wastes. 52,195 tons of this waste or 65.3% is dumped at the Bakoteh dumpsite and 20,805 tons or 26% is burnt at home (UNEP-GEF Capacity Building for PCBs and U-POPs Consultancy Report 2018). A cause for serious concern is that most localities dispose of, and sometimes burn, their waste in random open dumps that do not adherence to health and safety requirements. The municipality also use the burning method for volume reduction for financial reasons. The budget for disposal is very small and does not cover further treatment.

The performance of the disposal services by the municipality continuous to deteriorate due to limited finance.

Solid waste handling in Market place

Source: UN-Habitat/Kanifing Urban Profile, 2011

Currently, reports indicated that Kanifing Municipality does not employ any sorting or recycling processes for waste. Sorted recyclable wastes from households are also uncollected. In addition, specific containers for waste segregation are unavailable. People throw away materials as waste regardless of their possible benefits. These types of waste mainly include iron, aluminum, pipes, plastic bags, plastics, magazines, and newspapers.

Solid Waste Generation in Kanifing Municipality

The quantities of solid waste produced in this municipality are huge and its generation is influenced by the affluence and progress in standard of living of inhabitants. According to the report (GPA, 2002) on Solid Waste Management Study for Kanifing and Brikama, per capita waste generation was estimated at 0.44kg. In addition, the report on Urban Profiling for Kanifing conducted in 2011 by UN HABBITAT indicated that the tonnage of refuse generated on a daily basis per person within this municipality is estimated at 0.44 kg, totaling to 142 metric tons daily. Furthermore, according to the Environment and Sanitation Unit of the Kanifing Municipality the daily waste collection is estimated at 300 metric tons. The seasonal variation contribute daily changes in waste generation of this area. They Unit also informed that during rainy season, the waste generation is higher than the dry season. The socioeconomic indicators as well as the degree of nation's development progress influence the generation of waste in any area of a country, this is the story of the Kanifing municipality. However, the difference in waste generation between cities in developed countries (1.5-2kg/person/day) and those in developing nations generally less than 1kg/person/day This significant difference is due to consumption patterns, as industrialized nations consumes more product and use more packaging[19].

Estimated Solid waste generated by households in 2014/2015 in tons by type of waste and LGA

LGA /Municipality	Papers %	Plastic %	Organic %	Metal & iron %	Textile %	Other %	Total %	Total (in tons)
Banjul	47	18	31	1	2	1	100	6645.74
Kanifing	22	6	46	0	1	25	100	65690.05
Brikama	9	6	76	0	2	7	100	65157.03
Mansakonko	24	4	51	0	1	20	100	7602.60
Kerewan	18	4	48	2	1	27	100	20377.27
Kuntaur	17	27	38	1	6	11	100	6858.50
Janjabureh	24	3	42	0	1	30	100	11611.23
Basse	17	8	53	0	4	18	100	9829.03
Average %	22	9	53	0	2	14	100	193771.45

Source: NEA, 2015

Solid Waste Composition in Kanifing Municipality

According to a consultancy report conducted in February 2018 under UNEP-GEF Capacity Building For PCBs and U-POPs for the Gambia indicated that, solid waste composition in Kanifing Municipality were in various forms and could be classifies into the following among others; sand, Organic matter related waste,

tailoring waste, textiles, batteries cells, Plastics (plastic bags, old plastic containers), Metal (tins, old basins, Pieces of corrugated iron sheets, aluminum cans), old tiers, old floor carpet covering, wood, paper, cartons, electronic waste, disposable baby dippers, insecticide spray can, sponge mattress, medical related waste, empty Rice bags, glasses, vehicle parts, construction waste and abattoir related waste.

The sources of these waste found to be generated from households and commercial sector which includes institutions, super-markets, restaurants, workshops, agricultural material shops, hotels among others also contribute significantly in generating waste within the urban setting. Studies also indicated that principal components of generated wastes among others are paper/cartons (83%), plastics (80%), organic matter (40%), metals (30%) and glass (27%) (GAP, 2002). It can be further noted that most of the waste generated by the commercial establishment can be recovered, recycled and more importantly, the generation of hazardous waste by the sector seems very negligible.

III. Existing Waste management related legislations in the Gambia

The general waste management in the Gambia is the responsibility of the Ministry of Local Government and Lands (MOLGL), which supervises the Municipalities/Area Councils. However, the National Environment Agency (NEA) acts as the regulatory authority under the auspices of the Ministry of Environment, Climate Change and Natural Resources (MECCNAR). The Municipalities/Area Councils are responsible for the collection and disposal of solid waste through their Waste Management Departments/Units and their Environmental Health and Sanitation Departments. The policy framework guiding the management of waste includes the Public Health Act (1990), The Physical Planning and Development Control Act, 1990 and Regulations, 1995; The National Environment Management Act 1994 (Part VI, Section 28; 1&2); The Environmental Protection, Prevention of Dumping Act, 1998 and Anti-littering Regulation 2007. The National Waste Management Bill 2003, which is expected to address the implementation of problems associated with waste management and pollution that could not be addressed by the previous waste related legislation is being reviewed.

The challenges associated with managing the solid waste pollution persists, the government of The Gambia device mechanisms to mitigate the issues by enhancing the abilities of municipalities. The development of legislations that are geared towards developing public infrastructure and services particularly to the poor so that such vital services are available in their various areas is longer overdue.

IV. Evaluation of Waste Collection and Disposal

Currently, MSWM status and problems in this municipality is surrounded by an increase in the population couple with upsurge in affluent of inhabitants resulting in huge increase in the generation and composition of MSW. Comparing with the increasing rates of MSW generation, little has been done concerning its management. However, not only Kanifing Municipal Council is adequate in the sustainable management of the waste generated, but also individuals are key in the effective and efficient management of MSW. Therefore, an Integrated Waste Management System should be built in order to improve the holistic approach to enhance the sustainable MSWM system and reduce the impacts of waste to the environment and people at large.

The main issues in the management is circle around inadequate and inefficient collection and inappropriate final disposal. Other major challenges includes poor infrastructure and institutional framework, limited stakeholders' participation, public attitude towards waste management, lack of technical expertise and no sanitary landfill. Unwillingness of some business owners in paying garbage collection fees, Low salaries for the cleaners and deteriorating economy has made things difficult in the markets, etc.

Therefore, improving solid waste management in Kanifing Municipality coverage of waste collection and final disposal should be of the highest priority to reduce the risk of environmental hazards. The adoption of the Integrated Solid Waste Management (ISWM) approach is pivotal to maximize the efficiency of current systems[18]. The approach sets zero waste generation as a target and consists of a hierarchy of coordinated management options that seek to minimize the amount of waste that will be available for land filling or final disposal[20]. The waste management hierarchies emphasized on certain key elements which include avoid/prevent, reduce/reuse, recycle, compost, incinerate and landfill.

V. Recommendations

1. There is urgent needs to recognize and address the perennial economy crises that symbolizes the waste sector in the Kanifing Municipality. In this esteem, the central government can significantly improve its fund allocation to Municipalities/Area councils in a softer way and fixed schedule in order to avoid delay payments for waste who require funds to meet the operational costs of solid waste collection and disposal.
2. The Municipalities /Area Councils need to be supported through local people to improve revenue mobilization. Such support can be achieved by attracting qualified finance and accounting staff professionals who can identify additional sources of funds, such as taxes on properties and business. Employing such qualified persons can also improve the financial management practices of the authorities by plugging leakages and preventing corruption. Additional revenue can also be raised from clients of waste disposal services.
3. It is fundamental for any supportive policy frameworks, knowledge and capacity to develop plans / systems, proper use of environmentally sound technologies and appropriate financial instruments to support sustainable waste management requires data on present and anticipated situation. Thus, there is need for LGAs or municipalities to generate its own primary data on its present and anticipated waste situation as this could be used to develop plans or systems that will ensure environmentally sound management of waste supported

by appropriate financial instruments and legal frameworks.

4. There is need for collaboration from both public and the government in enforcing waste related legislations to enhance sustainable waste management across the country.
5. To achieve a sustainable MSWM the municipalities must foresee what amount and composition of the generated waste. In addition, the authorities need to incorporate waste management at the center of the city planning to enhance effective and efficient waste management.
6. Public participation in MSWM is insufficient since residents have a relatively low awareness of environmental protection and their participation is very essential to support waste planning and decision making in MSWM. Thus, the need for authorities to improve public awareness of waste separation and recycling to enhance MSWM.

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Prenatal Life Education Based on Family Christian Religious Education

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Abstract: : This study aims to provide an understanding of the task of Christian Religious Education (PAK) so far that only includes students starting from children, adolescents, youth and the elderly while PAK to humans (fetuses) who begin to become living creatures since in the mother's womb (education prenatal) received less emphasis. Therefore this research would like to provide a rationale that PAK life to the fetus must be a priority scale. It means that Christian Religious Education must be given at the beginning of life as a form of responsibility of PAK towards life education. The rationale is that the life of the fetus in the womb is a gift from God and God delegates education to parents in the process of life education starting from the prenatal education phase. This study uses qualitative research with the type of library research. The results showed that prenatal education could be based on Family PAK. Family as the scope of Prenatal education, based on Family PAK. This research gives a logical reason that life education to the fetus can be carried out and can be accounted for in terms of educational sciences including Christian Religious Education.

Index Terms- **:** education, Christianity, family

1. INTRODUCTION

Attention to pregnant women, infants, toddlers and school-age children in the government era President Joko Widodo (Jokowi) received special attention. President Jokowi promised to guarantee the health of pregnant women to school-age children. Through Jokowi's victory speech for the second period (2019-2024) as president, titled Visi Indonesia on July 14, 2019 at the Sentul International Convention Center. Jokowi said "We will give our development priority to the development of human resources (HR). HR is the key for Indonesia in the future ". Development of human resources according to Jokowi, is done by ensuring the health of pregnant women to school-age children in Indonesia. Furthermore, Jokowi emphasized that "the starting point for human resource development is to ensure the health of pregnant women, the health of infants, the health of children under five, the health of school-age children (cnbcindonesia.com, 2019). In order to make a real contribution to the good wishes of the government, now is the time to contribute thoughts to the priorities of HR development. Awareness of the importance of ensuring the health of pregnant women is interpreted from an educational perspective as a deliberate, planned and constructive effort to instill life education to Indonesian people since pregnancy or prenatal life education. The prenatal period is the beginning of the process of human growth and development that is when humans are not yet born or are still in the mother's womb. However, many rural communities tend not to do things that can affect the psychological development of children in the prenatal period, this happens because they assume that the beginning of psychological development begins when the child is born. Yet at this time the determinants and shapers of the character and behavior of children after birth.

Humans experience growth and development, in the process of development of life through several stages, starting from the prenatal period, infancy, then growing into adolescence, adulthood and death. The prenatal period or the period before birth is the initial period of human development that starts from conception, ie when a woman's ovaries are fertilized by a man's sperm until the time of birth of an individual. This period generally lasts for 9 calendar months or about 280 days before birth. Judging from the stages, this prenatal period is the shortest period of human development, but conversely in the current period there is a very rapid development in the individual (Endriani, 2011). Parents want their children to be intelligent children and also have good morals, parents also want their children to succeed and succeed in the life of the world and the hereafter and can be useful for others in the surrounding environment. To realize this, a child needs knowledge and parents must also know how to educate children well in the prenatal period. With the knowledge and education it will facilitate the survival of a child in the world and the hereafter. In addition to general education, religious education also plays an important role in shaping the character of a child, especially in providing religious education during the prenatal period, but many parents who do not have the awareness to provide religious education to children, especially in the prenatal period, because most of them assume that the psychological development of children begins from birth when in fact religious education is the most important foundation in educating children, because it can direct the child to all matters relating to the religion they profess, in addition to religious education, moral education in the environment also has an important influence on children's development. Santoso (2005) states that according to human development, from the time the child was in the womb, he was

able to receive education. When in the mother's womb, the child's feelings and emotions are at one with his mother. So pregnant women can affect the fetus they contain. Therefore, it is very important to provide prenatal education.

Christian Religious Education (PAK) so far only covers students starting from children, adolescents, youth and the elderly while PAK to humans (fetuses) who have started to become living creatures since in the womb of the mother (prenatal education) less attention. PAK to the fetus must be a priority scale. That is, Christian Religious Education must be given at the beginning of life as a form of responsibility of the PAK for life education . The rationale is that during pregnancy this is the beginning of the educational life provided by parents and the community. Christian faith education began in this period. Educating through the mother / father reading the Word, the word of prayer, worship and instill moral values and compassion to the fetus since in the womb as a form of habit (habit formation) the basis of Christian religious education. Santoso, (2005) states that the family has an important role in the education and development of children in general. The PAK education people to creatively develop human life as God's image. Humans as an image of God who lives not only when they become PAK students at the age of children, adolescents, youth and adults, but from the womb (humans become living creatures). PAK of life is understood as a conscious effort by teachers aimed at students, in the learning process that contains Christian teachings based on God's Word to respect life and interpret human life as the image of God the creator. God created humans with glory to build lives that are valuable, for themselves, others and especially for God. In relation to education, human creation essentially intends to emphasize education which is oriented towards humanizing equal and equal human beings before God. This theological basis of education provides the foundation for education for the fetus in the womb as a form of lifelong education.

2. METHODOLOGY

Types of research

This research is a qualitative research that is a literature study (library research) that uses books and other literature as the main object (Hadi, 1995: 3).

Data source

As a library research, there are two kinds of data sources that will be presented as follows:

1.Primary source is a reference that is used as the main source of research reference.
2. Secondary sources are supporting and complementary references for primary sources

Method of collecting data

In library research, the method used to collect research data in the form of library data that has been selected, sought, presented and analyzed. This research data source looks for library data whose substance requires philosophical and theoretical processing. Literature study here is a literature study without empirical tests (Muhadjir, 1998: 159). The data presented is data in the form of words that require processing to be concise and systematic (Muhadjir, 1998: 29).

3. RESULTS AND DISCUSSION

1. Life Education

Talking about the concept of lifelong education (Hali, 2013), there are two important figures who talk about it. **First**, is Yeaxlee, he explained that Britain needed to hold lifelong education. **Second**, Paul Lengrand. Lengrand through the UNESCO organization popularized the concept of lifelong education. **Third**, the figure who first laid the foundation for a lifetime education was John Amos Comenius.

According to Comenius the first stage of human life consists of the time the baby is in the mother's womb is one of the broadest educational environments (Boehlke, 2015). PAK has a scope that includes schools, churches and communities. The instructors consist of teachers at the school, church leaders / educators and the community. Christian religious educators in schools are influenced by teachers appointed by the government or private education foundations with appropriate educational backgrounds. Christian Religious Educators in the church are conducted by teaching staff prepared by the church. Christian Religious Education in the community is carried out by Christians who feel called and have the responsibility of faith to educate outside the realm of schools and churches. The meaning of complete education must be seen in all aspects of human life. Horace Bushnell as quoted by Boehlke, who argues that; religious education must be given from the mother's womb until the end of one's life, so that a child learns in such a way as to know what is good from an early age (Boehlke, 2015). Parents are the first instructors to children from the womb.

The role of parents in the family as representatives of God entrusted to educate and raise each child in the light of God's word, parents are responsible before God and members of the congregation for the spiritual growth of children about education and the future of children in the future. The important point is that God's function as a human educator is delegated to parents to educate children. The influence of the role of parents in being a good role model in a family will affect the behavior of their children (Wadi and Selfina, 2016). Children are a gift from God, so we must educate and give a good influence on our children (Clark, 1990)

Child education as early as possible starts from the mother's womb, this gives an understanding that the importance of parent / adult education in the function to educate. Adult education can be a parent education strategy for children. According to Ismail Andar (1996), by educating adults at the same time we educate young children. Educating adults means educating teachers in the family. According to Judaism, the family is the place where God's will is revealed to the child (Ismail Andar ,1996) , Even Boehlke (2015) said that the scope of Jewish religious education was not a sideline endeavor in one corner of life, but rather a core part of daily activities (Deuteronomy 6: 4-9). So, family work is a core institution in educating children. In line with this, Andar Ismail agrees with Lewis Joseph Sherrill. Sherrill writes menulis " *The most fundamental for education is this assumption : the elemental facts of family life constitute the channel through which the will of God should first be made known to a child, and be put into effect in his living. The family was a mould into which a growing revelation of the nature and will of God could be poured without undermining the family itself. On the contrary, the growing religion strengthened the family to a rare degree. In Hebrew Thougt the family was 'in the Lord' and 'he in it'*. Furthermore, Ismail Andar (1996) said that today the church believes that Christian education needs to start at the age group of children as early as possible. If it is believed by the church then the strategy is to start Christian education for parents because these parents will carry out Christian education in children. In connection with PAK Life for pregnant women, the role of prenatal education is very important to be seen as a form of educational communication between mother and fetus during the womb. Baby education in the womb is a tangible form of life education. Psalms 139: 16 says "Your eyes saw me as a child, and all of your days are written in your book before any of them are written. There is an Hebrew word: Golmî (English: formless thing, embryo which is translated by the Indonesian Bible Institute with the word "future child" (Bible Works 7: 2018). God started the education process when humans were still children. This begins with God valuing life because He understood and saw while humans were still children, and wrote in His book. This means that prenatal education is a priority scale from God and must be a priority scale for the lives of God's people too.

Education is an important process in the life of the human community. This means that the education process is an important element in human life, including Indonesian society. The education process is not just a process of maturity, or a process of socialization or cultural adjustment, but more than that the educational process examines the process of a human being into a real person who has a personality (individuation) so that individual potential can be utilized for the dignity of human dignity as human beings and community members (Tilaar, 2002).

Education according to the formulation of the RI Law. No. 2 of 1989 "education is a conscious effort to prepare students through guidance, teaching, and / or training activities for their role in the future (Hamalik, 2011). This formula explains 4 important things. **First,** that the government consciously and deliberately plans an educational process with a curriculum and targets to educate the nation's life. **Second**, prepare students to enter the educational process through the availability of infrastructure that supports students. **Third**, prepare teaching strategies through mentoring, teaching and or training activities through the provision of mentors, instructors and trainers in this case competent educators. **Fourth**, the preparation of students to take on the functions and roles in the future for the life of the nation and the State of Indonesia. Emphasizing the function and role of students to play a role in the future shows the preparation individually and its use for humans in the Indonesian context according to the law.

According to Bonner "the family is very instrumental in laying the foundations for their children's behavior. Attitudes, behaviors and habits, parents, are always seen, valued and imitated by their children who then consciously or unconsciously absorb it, then it becomes a habit for their children. The family is the oldest educational institution, informal, the first and foremost experienced by children and educational institutions that are natural parents are responsible for maintaining, caring for, protecting, and educating children to grow and develop properly. Family education functions:

1. As a first experience of childhood.
2. Guarantee the emotional life of children.
3. Instilling the foundation of moral education.
4. Providing basic social education.
5. Laying the foundations of religious education for children.

Educational efforts always aim within the scope of valuable and meaningful life in terms of something that is "ideal" or "maximum" in accordance with the ability of family members including children in the family. The purpose of education usually contains three aspects of human life in relation to life in the community, as Boner said and quoted by Metekohy (2015), namely aspects of personal, social and moral life.

Adeyemi and Adeyinka (2002), explains that education consists of two Latin words. The first is educating (educo, educare, educavi, educatum), the first verb conjugation, which means "to carry," "backward," "to guide," "to direct," "to educate". 'The second Latin word from which education originates is educere (educo, educere, eduxi, eductum), the third conjugate verb, meaning "to draw out," "to lead out," "to arouse," "to bring up," or "back of the child". From this last derivation, a more comprehensive definition of education emerges: education becomes a slow and skilled process for extracting the latent potential of understanding and dedication, in contradiction with indoctrination, which means "instilling a set of untested concepts in the child's mind."

While some scholars define education as "the transmission of life by the living for life," others define it as "the acquisition of the art of utilizing knowledge". James Majasan defines education only as "the art of learning" and emphasizes its relevance to the development of indigenous education in Africa. For Carter, education is "the art of making every generation have an organized knowledge of the past." Oladele Taiwo in the preface to the book titled Agencies of Education, defines education as "the total effort of a community to improve economic, social and political standards of life." Other relevant definitions of education include that by Snelson who presents education as "a condition of human survival, the means by which one generation transmits wisdom, knowledge,

and experience that prepares the next generation for the task of life. Lane defines education. as "the transmission of wisdom, knowledge, experience and skills. "George Hegel offers a rather complicated definition. According to him, education is "the progressive perfection of man from a simple, irreligious, primitive mind, through the discipline of hard work and working hard for awareness and carrying out his freedom". This implies that education is a gradual development of the body and mind from infancy to adulthood. Related to Bloom's taxonomy, it implies the progressive development of the cognitive, affective and psychomotor (or field) domains of knowledge (Adeyemi and Adeyinka (2002)

Human education begins at the moment of conception (the meeting of sperm and egg) or what is called a pregnancy. Theoretically his parents (husband and wife) began to educate their children since they were still in the womb. The gradual development of the body and mind from infancy and even in the womb to adulthood is an important concern of Christian religious education (PAK) life in the family. parents (read family) have the basic right to determine the style of education of their children before they are adults. Wolterstroff called it the primary rights of parents. This relates to the manifestation of parental love for their children, and the State guarantees this (Wolterstroff, 2007).

Life education in the family in the Jewish concept at the time of Jesus was realized in schools and synagogues. School and synagogue are the fundamental beliefs of post-exilic Judaism until the time of Jesus Christ. The law is the highest good in life. Knowledge of the Law aims to produce godly and smart people. This means that the goals of life education in the Torah include living smartly in a knowledge and godly life. Torah education produces an intelligent and godly generation. Acquiring the knowledge of the Law is the same as obtaining life in the world and preparing for life in the world to come. Philo explained that the Torah was not just a written customary law, but the Jews regarded their law as divine. So it becomes imperative to be taught by teachers and educators, namely parents to instill Torah education (Schurer). Obviously, this education is primarily the task of parents or family as primary educators in Torah education. The goal is to produce a smart and godly generation in the family.

2. Christian Religious Education

Speaking of Christian Religious Education (PAK) the family will not be separated from the concept of Israel's family and household. The testimony of Albertz and Schimiit (2012) in the pre-exilic period, family and household played an important role in the formation of the national religion of ancient Israel. The religion of ancient Israel began with a family religion with an internal pattern of religious pluralism which gradually underwent a transformation into an official / national religion.

The concept of Christian Religious Education (PAK) Family, oriented to Christian parents who educate children based on Christian teachings. The family is the main place for PAK which is described as a "miniature church". Here the family is understood to be the shadow of the church in implementing PAK (Homrighausen and Enklaar, 2011). Eminyan with family theology explains that the family as a "domestic church" or household church; what he means is that the family has characteristics that are not different from the church in general. As a household church, the family is also called to take part in preaching gospel education both in the family and out (Maurice, 2001). This includes pre-natal family education. Talking about PAK related to the pre-natal period, was explained long beforehand by Momius A father of Christian education (Boehlke, 2015). Comenius uses the term "school of birth". Birth school is a learning experience for parents, especially the mother because it is she who carries the fetus in the womb. For Comenius, Christian husband and wife should not be parents, if they do not think spiritually about the event of pregnancy. This preparation is considered a kind of schooling, a learning experience that requires effort from the prospective parents.

Groome defines PAK as a joint political activity by pilgrims at a time that deliberately together pays attention to God's activities today in the story of the Christian faith community, and the Vision of the Kingdom of God, as seeds that have come between us (Groome, 2011) . Based on this definition, PAK can be said to be a joint activity of pilgrims who were deliberately presented to the Christian faith community in this life and vision of the kingdom of God to come. Therefore parents intentionally and planned to give PAK to their children in the family as a form of educational involvement and participation in God's activities for family life. The purpose of PAK in a family context is to provide value and meaning in life so that children can grow in the Christian faith. Every child grows in family life, the most effective source for the implementation of PAK is the family.

Groome (2011) said there are three dimensions or pressures that can be seen in Education ("leading out"), namely: 1. Starting point from where. 2. The present process. 3. The future in which direction. In this sense, education has dimensions of "already", "being realized", and "not yet fully completed". These three time dimensions should never be separated in practice, but can be distinguished for analytical purposes (Groome, 2011). These three time pressures can be seen in the word education as an ongoing process, an ongoing process and a movement towards a new future that is evident throughout educational practice in history. In educational activities we do not understand the past, present and future as separate times from each other in a linear sense. If time is then misunderstood as three separate periods, then educational activities tend to emphasize one and neglect the other two, thus damaging all educational activities. So PAK life covers the dimensions of living education in the past, present and future. The PAK life instructor is a family that becomes the PAK life teacher itself. The history of family life stories in the Bible, both the Old and New Testaments related to religious education, always refers to Jewish families. This is because the writing of the Bible relates to Jewish culture, the house (read: family) is the main place in teaching religious traditions and God's Word. Thus the family has an important place for the education of the life of faith. As written in Deuteronomy 6: 7; "You must teach it repeatedly to your children and talk about it when you sit in your house, when you are on a journey, when you lie down and when you wake up" (LAI: 2011). This means that parents' educational and teaching activities are not limited in any situation. Even parents during pregnancy have the responsibility to educate and teach the fetus in the home. So the house as a school of education and teaching. Activities of pregnant women and

husbands to educate and teach while lying husband and wife, when they wake up before doing other activities. This means that all parent education activities to the fetus are integrated with the life of the fetus in the womb.

Christian education explores the disciplinary practices that are used to form concepts of comprehensive and integrated Christian education, from which principles and guidelines can be drawn for the practice of Christian education. Christian educators should make a concerted effort to ensure that there is a biblical perspective which gives essential authority to the theory and practice of Christian education. In addition Christians must also combine perspectives from various other scientific disciplines. The foundations of Christian education discussed include the incorporation of biblical foundations, theological foundations, philosophical foundations, historical foundations, sociological foundations, psychological foundations and curriculum foundations (Pazmino, 2012). Pazmino (2012), gives space to not only speak PAK from the biblical side alone, but also from various other scientific disciplines. Based on this view, it can be said that Pazmino stepped forward to speak of PAK from other scientific studies that are also symmetrical with life. Therefore there needs to be an open attitude for discussion space on life-based education that touches all dimensions of life.

3. Theological Basis Of Christian Religious Education (PAK) Life

Life in Israel's view is inseparable from the phase of life that starts from pregnancy to birth. Alberttz and Schmiit (2012) ,shows that the birth of a child played a central role in family religion in ancient Israel. Every phase from pregnancy to the birth of a baby has a religious dimension and even its own mythology. The ancient Israelites and surrounding people believed that gods who were believed to overcome female fertility, accepted their prayers and caused their pregnancy. During the pregnancy phase, the god is believed to make a child in her mother's womb. The confession of Israel's faith in God as the creator of man in the womb or the womb was born from that context and is written in the biblical texts as follows Mazmur 139: 13 "for You formed my waist, weaving me in my mother's womb". The psalmist with the expression of his faith narrates and describes the neighbor of God as his creator. God's creations are expressed with a credo / confession of faith that God formed the kidneys, even God is described as a weaver who weaves the psalmist in his mother's womb. So the mother's womb is the arena of God's creation in presenting the early life of humans. The Book of Jeremiah also alludes to the womb as a container for human formation. There is a theological expression about God knowing human beings as His creation in the womb even before coming out of the womb. This verse reveals the calling and sanctification and designation of Jeremiah as a prophet starting from the womb. So the womb is also the initial arena of vocation, sanctification and designation of humans as partners or partners of God. In other words, the content is a forum for the preparation and initial education of humans to be educated and prepared for human life to be used as a means of witnessing as God's design for humans. Jeremiah 1: 5 says "before I formed you in the womb of your mother, I knew you, and before you came out of the womb, I sanctified you, I have made you a prophet of the nations". We Job also talks about the human life that God created. Job 10: 8-11 "Your hands formed and made me, but then you turned away and wanted to destroy me? Remember that you made me from clay, but you want to make me dust the ground again? Have you not poured me out like milk and curdled me like cheese? You wear skin and flesh on me, and braid me with bones and veins. Based on the biblical texts above it can be said that God is the source of life that created humans from clay, God created humans in the womb, caring for mothers and fetuses during pregnancy, God is believed to be active as a midwife / guardian of the mother and child. God also determines life. This is the theological basis which is the basis of life education that starts from the womb during pregnancy.

An expert who researched pregnancy education is David Chamberlain in his book Babies Remember Birth, the results of his study stated that at the age of the fetus eight weeks in the womb, the sense of taste begins to appear on the tongue of the fetus. At the age of fourteen weeks in the womb the fetus can swallow, it can also distinguish sweet or bitter taste and at the age of twenty weeks in the womb, the fetus can taste and receive stimuli from outside such as listening, seeing and feeling. At twenty-two weeks old, the fetus can hear and is sensitive to touch. This is when we start doing fetal education while in the womb (Yahya, 2017). This research gives a logical reason that the education of life to the fetus (pre-natal life education) can be done and can be accounted for in terms of educational sciences including Christian Religious Education.

3. CONCLUSION

Based on the discussion on family-based prenatal life education based on Christian Religious Education (PAK), it can be concluded that:

1. Family as a basis for the scope of Prenatal education based on Family PAK.
2. Christian religious education can be given early in life in the womb and has a biblical theological basis.
3. That prenatal education of life to the fetus can be carried out and can be accounted for in terms of educational sciences including Christian Religious Education.

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CSMA/CD with Priority Queue

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ABSTRACT

CSMA/CD suffers from drawbacks like packet starvation and wastage of bandwidth due to unutilised periods of the channel. Its performance can be enhanced greatly by modifying the protocol after taking all these factors into consideration.

The proposed protocol makes use of a network queue in addition with a priority counter to overcome the problems of the existing MAC protocol. It ensures that whenever there is congestion and high probability of collision and therefore also wastage of bandwidth, another alternative protocol is initiated. This increases its efficiency and also provides the regular protocol as a back-up option in case of queue failure. It also provides a mechanism for real-time audio and video transmission assuming that this feature is not required often.

INDEX TERMS

CSMA/CD, Ethernet, network congestion, packet starvation

1. INTRODUCTION

Ethernet currently employs the CSMA/CD protocol also known as the IEEE Standard 802.3 for media access resolution in the data link layer. CSMA/CD or carrier sense multiple access with collision detection adds on to the CSMA algorithm to define the procedure in case there is a collision.

CSMA was based on the idea that if the channel can be sensed before it is tried to accessed, the number of collisions could be drastically reduced. However, it takes a while for the nodes to receive the bits already being transmitted by another node as a result of propagation delay. This implies that a node might determine the channel is idle and start transmitting before it learns that the channel was already in use. This leads to a collision. CSMA/CD determines how the stations should proceed in this eventuality.

In CSMA/CD, the transmission and collision detection is a continuous and simultaneous process that means that the node transmits and receives using two different ports. Through one port, it transmits while through the other it monitors the channel. If the transmission is completed the process is terminated. If a collision is detected, the process is still terminated and the collision procedure is initiated for another attempt at transmission [1].

The node that detects a collision sends out a short jamming signal usually 48 bits long to let the other nodes know about it and inform them that all the frames involved have either been destroyed or modified so that they can be discarded. The nodes involved in a collision then have to wait a random amount of time before they can try to transmit again, the waiting time period is decided using the binary exponential back-off algorithm (BEB) and referred to as the back-off time, T_b. If the frame to be transmitted has already suffered K collisions then the node will pick a value R from among $\{0,1,2..2^K-1\}$ randomly and wait $R.T_{FR}$, where T_{FR} is average transmission time for a frame before incrementing the counter K and trying again. Eventually, it will pick a value of R small enough to start transmitting before all the other nodes who want to transmit. Now, if there were no restrictions it could mean that the value of R becomes unreasonably large so we limit the value of R at 1023 i.e at the most a data frame would have to wait $1023.T_{FR}$ time. There is also a possibility that the node tries to access the channel but is deterred every time by a collision. This only increases the possibility of a collision in a congested network . To overcome this the highest value that K can take is limited to 15, allowing a total of 16 retransmissions[2]. K_{max} is set at 15. If the value of K exceeds this it is automatically reset to 0 before it enters the process again.

This protocol is efficient when there is low to medium network traffic. However, when the network is busy it creates problems.

2. RESEARCH PROBLEM

The probability that a particular node manages to get access to the channel depends on its waiting period.

The first time a node tries to transmit the value of the counter 'n' is set to zero. In the scenario that it finds the channel to be busy it increments the counter to 1 and picks a value of R from among {0,1} to decide its waiting time. This implies that the first time a node tries to transmit after encountering a collision it has a 50% chance of success. The second time it will have to choose a value of R from among a larger set {0,1,2,3} which will decrease its chance of success to 25%. This value will go on decreasing with increase in the value of K or the number of attempted transmissions for a frame.

This leads to the conclusion that a node with a fresh frame to send has a higher chance of acquiring the channel than a node that has been waiting longer.

Also, some node that has just sent its frame and now has a new frame to send out can access the channel more easily than a node which has been waiting its allotted time because the transmission probability for a new frame if it senses the channel to be idle is 100%. It can do this again and again and unfairly hold the network. This is often referred to as ethernet capture.

It causes other nodes to timeout by manipulating the network. Thus preventing other nodes from transmitting. It is especially common when a node is transmitting high volume data such as video packets [3].

Also, since the entire process is randomised there is a possibility that even though many nodes have data to send they are all waiting. This leaves the channel unoccupied and wastes resources while also increasing the probability of collision [3].

CSMA/CD protocol does not provide a provision for real time audio and video transmissions. This is a major drawback because many up-coming technologies and applications require this feature.

I have modified the CSMA/CD protocol considering all these factors and proposed an alternative to increase its efficiency in case of heavy traffic and provide accommodation for real-time audio and video transmissions.

3. MODIFIED PROTOCOL FOR HEAVY TRAFFIC

3.1 Determining Network Congestion using Priority Counter

The problem of packet starvation and ethernet capture will only arise when there is heavy traffic or congestion on the network. To solve this it is essential to determine whether the channel is congested or not.

Suppose it is, there will be many nodes with data frames to send out and they will all be competing against each other to access the channel. This contention will mean that most of them will collide again and again and with every collision the value of their collision counter K will increase. Until it eventually exceeds 15 and is reset to 0. Instead of this, we can have another counter P that decides the priority of the frame by incrementing it after every 5 transmission attempts. I have chosen 5 here because the minimum value of the counter can be 0 and maximum can be 15. So we will increment the P counter when K becomes 5, 10 or 15 and again when it becomes 5. This is necessary to ensure that a node which has re-entered the algorithm is given the highest priority.

Ethernet can only have a maximum of 16 nodes on a single shared media channel and each node can have at most one frame ready for transmission into the channel. Assuming that 6 nodes competing for the channel is considered heavy traffic, when more than 6 nodes have priority counter P >=2. We assume can that the channel is congested and activate the alternative protocol for heavy traffic.

3.2 Priority Queue

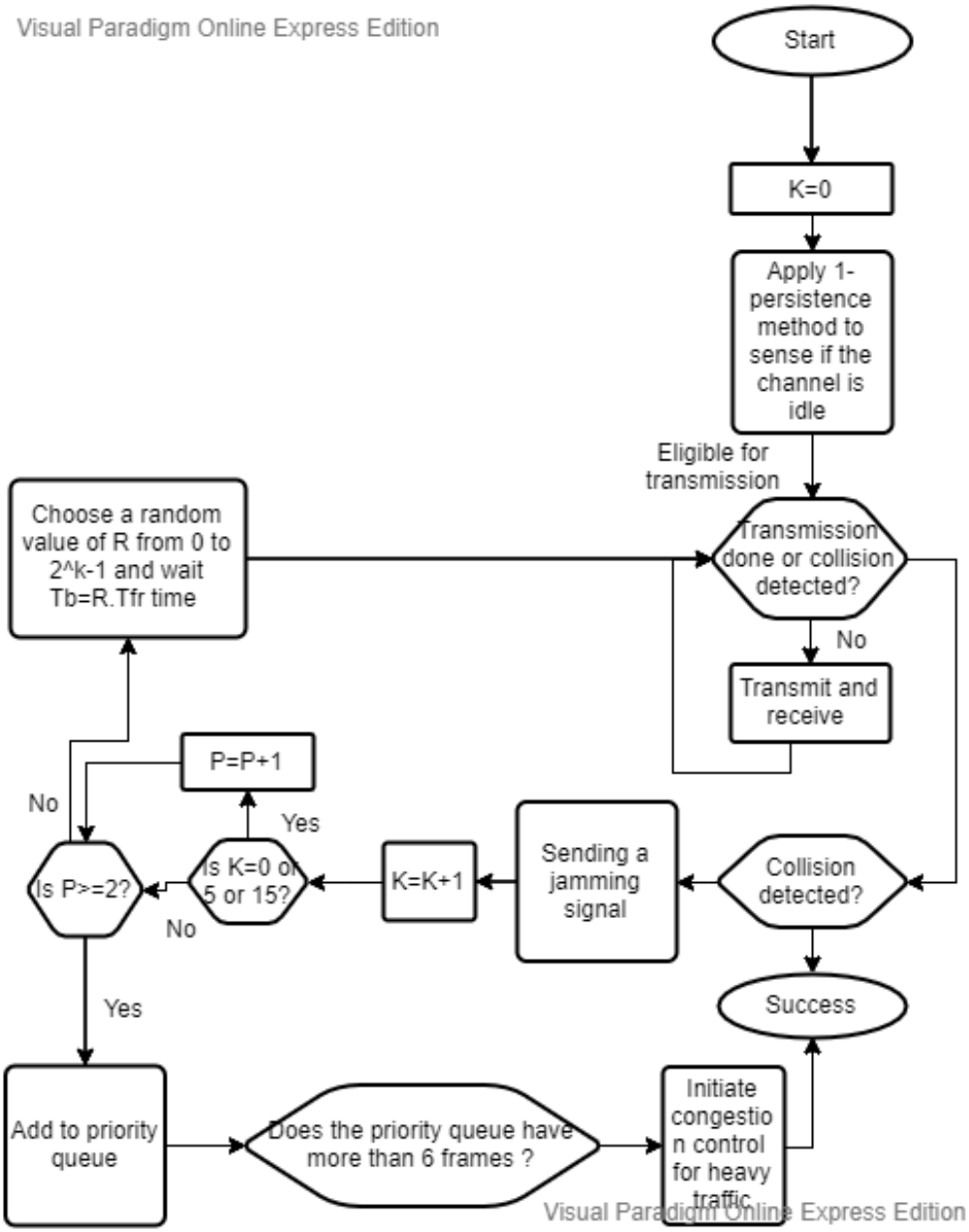
As the P value for a node exceeds the decided value which in this case is 5, it will be added to the priority queue. The frame will be assigned a position in the queue according to the number of transmissions it has already attempted. The node with a higher value of P will be before a node with a lower value of P. In case two nodes have the same value of P then they will follow the First Come First Serve algorithm to decide priority implying that the node whose P value exceeded 2 first will get priority. Again choosing the value of P as 2 for employing the following procedure is just conjecture at this point. Further analysis can be done to determine the optimal value at which Priority Counter, P should be incremented and the minimum value of P at which a frame is qualified to enter into the priority queue.

If there are more than 6 nodes in the priority queue the protocol for congested network is automatically activated and the priority queue sends a jamming signal to let all the nodes in the network know that it is about to start transmitting.

In essence, the priority queue is just a node with a transmitter and a queue with network responsibility. It will go on transmitting until the queue is empty. After which it will send another jamming signal to notify all the nodes to assume normal behaviour and revert back to the original CSMA/CD protocol being followed earlier.

The use of the priority queue will reduce network traffic.

Refer to the following link for a clearer view of the algorithm: https://diagrams.visual-paradigm.com/#proj=0&type=Flowchart



4. ACCOMMODATION FOR REAL-TIME TRAFFIC

4.1 Flags for Real-Time Data Transmission

Each node will have a flag whose value can be either 1 or 0. When it is 0, the protocol will behave normally. When it is 1, the procedure for real-time transmission will be initiated. It will freeze the state of the transmission counter, the priority counter and the priority queue. The node which wants to send real-time data will set it's flag to 1 and then set out a jamming signal to ensure that all the other nodes have set their flag to 1 as well.

When all the flags are 1, the channel will be utilised by the first node which initiated the procedure for transmission of real time video or audio data.

This is necessary because it requires continuous streaming of data which is otherwise not possible with the existing protocol since that would require monopolising the network entirely by one node.

At the same time, there has to be a restriction on how long a node can hold the network. This will be long but not so long that it blocks all the other nodes from using the channel.

4.2 Collision Resolution during real-time transmission

When one node has just finished transmitting real-time data the other node cannot be immediately allowed to hold the network, it will be unfair to all the other nodes which have ready data to send out. As a result, we place a limit on how many times a node can utilise this feature and also how long it has to wait before making another valid request, this is done using a time out feature. Every node after will have to wait a minimum amount of time after it just made a real-time transmission. Every node will also have to wait after the channel has just been used for a real-time transmission. That is, in either case a time out will be started and the channel becomes available for real-time transmission.

Now, there can still be more than one node which wants to acquire the channel for this, in this case again there will be a collision which will be resolved using the standard Binary Exponential Back-off algorithm. This is done keeping in mind that the assumption that not many nodes will want to transmit real-time data at the same time which will decrease the probability of a collision enough to ensure that this does not create a problem.

5. DRAWBACK OF THE PROPOSED MODIFICATIONS

The solution proposed above is a combination of a centralised and decentralised method. This has improved its efficiency and allowed for real-time transmission at the same time compromising it's maintainability and dependability. This is a result of including a centralised feature which can practically bring down the entire system by acting as the single point of failure.

To minimise the damage this might cause to the network I have provided a provision for back-up. All the nodes will listen in to the channel and if they detect its idle for longer than a certain period of time they will assume that the priority queue has gone down and will use the standard CSMA/CD protocol in case of both heavy or medium to low traffic. This will ensure that even in the eventuality that the priority queue mechanism fails, the nodes can still transmit data across the channel.

6. ANALYSIS

It's been inspired from the idea of a network queue proposed in [3]. However, certain appropriate modifications have been made to it to enable real-time transmission along with the introduction of the priority concept to make the process more fair. This method also ensures that a node is not locked out or is made to wait inevitably because the longer it tries for transmission the higher priority it is assigned.

The idea proposed gives a solution to ethernet capture and packet starvation, thus making the system more fair and increasing its overall efficiency.

7. RELATED RESEARCH

7.1 Network Queue

CSMA/CD is modified to include a network queue with a send variable as given in [3].

The queue constantly listens to the channel and when it senses activity it listens for interruption or completion. The queue becomes active when it senses a collision in the network or a 48 bit jam signal. The queue basically sends out a frame that collects the MAC address of every node involved in the collision. When this frame comes back, the network queue places all these MAC addresses in its queue and network queue takeover begins[3].

Each node has a variable which is changed to true when it is its turn to transmit according to the MAC addresses in the queue. This behaviour continues until there are no more addresses in the queue[3].

When it is finished it sends out a broadcast signal changing all the nodes' variables to true so that the network can function normally.

7.2 The Packet Starvation Effect(PSE)

PSE causes some packets to experience extremely long delays and some to starve out due to 16 collisions. According to [4] stimulation shows that the effect usually becomes significant at an offered load of about 60% and 70% and gets only worse as the load increases even further. The reason for packet starvation is that when two packets compete for access over the other is approximately proportional to the ratio of their maximum backoff values. When two packets become ready at approximately the same time, the two controllers will both wait until they see that the network is free and then attempt to resend, colliding with each other. When this happens they back off a random amount of time based on the number of collisions that the packet has already suffered. The probability that an older packet selects a smaller back-off value than a newer packet with fewer collisions is less than the ratio of the newer packet's maximum backoff divided by the older packet's maximum backoff. Because this value increases exponentially, unless a packet comes ready when no other host is ready to send, it will usually either get access to the

bus very quickly or it will experience 16 collisions and starve out. Under high load, there is usually another packet to send and so long delays and packet starvation occurs to a significant percentage of packets [5].

8. SUMMARY

CSMA/CD with Priority Queue is a hybrid protocol because it is a cross between two of the three multiple access protocols, random access and controlled access protocols. It aims to use the channel resources to their maximum capacity by initiating a separate algorithm in cases where the efficiency of the regular CSMA/CD protocol fails such as during congestion. To make this possible in the simplest of ways it makes use of a priority queue which starts transmitting when the channel has been idle for too long or when there is congestion. Since, it is a priority queue it has to assign each node a priority in a fair manner this is done using the already existing collision counter, K to introduce another counter called the priority counter, P. When the P value is high enough the frame will make it to the queue, which will be activated when the required minimum number of frames are already waiting in the priority queue. The application of the protocol in a stimulated environment can allow us to find the most optimum values at which to increment the priority counter, initiate the queue and also when a node is qualified to be added to the priority queue.

It also allows the nodes to transmit real-time data assuming that not many nodes will require to use this feature at the same time. This is done by using a time out feature and flags which indicates that a node wants to request the channel for a real-time transmission. The flags when set to true suspend the procedure otherwise going on and allocate all the resources solely to the node that made the request while ensuring that enough time has passed since the last time the request was made.

However, it is only of use when only a few nodes want to transmit real-time data. Otherwise it fails. This will require further research to overcome the faults of the proposed idea.

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Analytical Study and Prediction of Consumer Price Index for Rwanda Using Data Mining Techniques

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Abstract- Several works using different tools with various algorithms and models, worked on forecast of agricultural areas include crop yield. However, their findings still need improvement for more accurate performance. Precisely predicting the change of CPI is significant to many aspects of economics, some examples include fiscal policy, financial markets and productivity. In this study, we are conducting an analytical study to discover which factor is most affecting changes of Consumer Price Index for Rwanda and make prediction of CPI for 2019 to 2025. The dataset is extracted from online platform of World Bank on world economy, especially for Rwanda (1990 - 2018).
M5Rules algorithm is used with MAE and MAPE performance metrics to test the model performance on dataset; the model built by M5Rules with MAPE is found the best model to fit our dataset. The results indicated that IVI is the best factor that influencing the CPI for this long period studied from 1990 – 2025.

Index Terms- Analytical, Consumer Price Index, Time series, Prediction.

I. Introduction

The era of Big Data has accelerated the use of data mining (Galit, S. et al., 2018). The amount of data in the world, in our lives, seems to go on and on increasing and there' s no end in sight (Ian H. W. and Frank, E., 2005). The analysis of data has formed a cornerstone of scientific discovery in many domains (Kamath, C., 2009).

Galit, S. et al., 2018, continue saying that, a common task in data mining is to examine data where the classification is unknown or will occur in the future, with the goal of predicting what that classification is or will be. Kamath, C., 2009, also said, the original or " raw" data which are provided for data mining often need extensive processing before they can be input to a pattern recognition algorithm.

To date, various economic indicators of interest can predicted for specific sectors of economy include Consumer Price Index (CPI), Exchange rate, Import value, etc. (Godwin, A. et al. 2017). CPI number measures changes in the general level of prices of a group of commodities; Precisely predicting the change of CPI is significant to many aspects of economics, some examples include fiscal policy, financial markets and productivity. Also, building a stable and accurate model to forecast the CPI will have great significance for the public, policy makers and research scholars (Nyoni, T., 2019).

In this study, we are conducting an analytical study to discover which factor is most affecting changes of Consumer Price Index for Rwanda and make prediction of CPI for 2019 to 2025. The dataset is extracted from online platform of World Bank on world economy, especially for Rwanda (1990 - 2018).

The Consumer Price Index (CPI) is a measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food, and medical care. CPI is widely used as an economic indicator. It is the most widely used measure of inflation and, by alternative, of the effectiveness of the government' s economic policy.

In this research we are examining Import value index (IVI), Official Exchange Rate (ER), and Food Production Indices (FPI) indicators to find the relationship of each one vis-à-vis the Consumer price Index (CPI); then from those relationships we can set rules that govern the changes of Consumer Price Index and we shall predict the future value of Consumer Price Index for Rwanda (2019 – 2025).

II. LITERATURES

Godwin, A. et al. 2017, in this research study, the Artificial Intelligence (AI) approach was applied by combining neural networks and fuzzy logic to develop a neuron fuzzy model so as to improve prediction accuracy of CPI. The first step was to prepare the data; the data collected were transformed into matrix vector having one row and many columns. MATLAB software was used for simulating the experiments in the process of designing and testing neuro fuzzy model. Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) were used as error metrics.

For a period of 15 years from January 2000 to January 2014, they used seven input variables and one output to forecast the US future CPI using subtractive clustering method for generating FIS then as shown, the prediction errors are small in RMSE (0.44886) and MAPE (0.233839).

Omprakash, Y. et al. 2019, In this report researchers have attempted monthly inflation of consumer price index (CPI) for India by using conventional time series forecasting based machine learning algorithms on the basis of monthly data between January 2013 to April 2018, focusing to employ four methods: Linear

Regression, Ridge Regression, Lasso Regression, XGboost Regression, and Random Forest Regression with RMSE, MSE and MAE performance accuracy for forecasting of inflation of CPI.
The results of this study show the relative values of RMSE, MSE and MAE for all learned models and all specifications of each model for all forecast horizons. It gives the relative values of RMSE (0.871341), MSE (4.608483) and values of MAE (1.924700) error rates for XGboost Regression model which is the most performing method.

Nyoni, T., 2019, In this study, CPI was used as an indicator of inflation in Germany as they seek to model and forecast CPI using ARIMA models, one of the methods that are commonly used for forecasting time series data is the Autoregressive Integrated Moving Average (ARIMA).

The researchers confirmed that a model with a lower Akaike Information Criterion (AIC) value is better than the one with a higher AIC value. Theil' s U must lie between 0 and 1, of which the closer it is to 0, the better the forecast method, the study will only consider the AIC as the criteria for choosing the best model for forecasting inflation.

From the results, this study indicates that the accuracy of forecast, as given the most performing model is ARIMA (1, 1, 1) model which is satisfactory since it falls within the 95% confidence interval. The results of the study indicate that a 1% increase in the previous period CPI will lead to approximately 0.9% increase in the current period CPI.

Habimana, N. et al. 2016, the aim of their project was to model and forecast the future value of CPI which will be of great significant to policy makers, investors and also to the Central Bank in setting consequently monetary policies. Two approaches such as, Moving Average (MA) and Autoregressive (AR), have been used in modeling univariate time series data. The series was not stationary, that why researchers combined the two models to form ARIMA class to assure the stationary series. To assess the accuracy of the model, Mean Absolute Error (MAE), Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE).

After experiment, the results shown that the ARIMA (4,1,6) model was the one with the smallest forecasting error for RMSE (0.776), MAE (0.5742) and MPE (0.06138) comparing to the rest of other models despite their smallest value of BIC, AIC and AICs.

III. METHODOLOGY

Methodology of this research, is explaining the way from row data to the expected results by achieving research objectives. The methodology of this study is following the flowchart below:

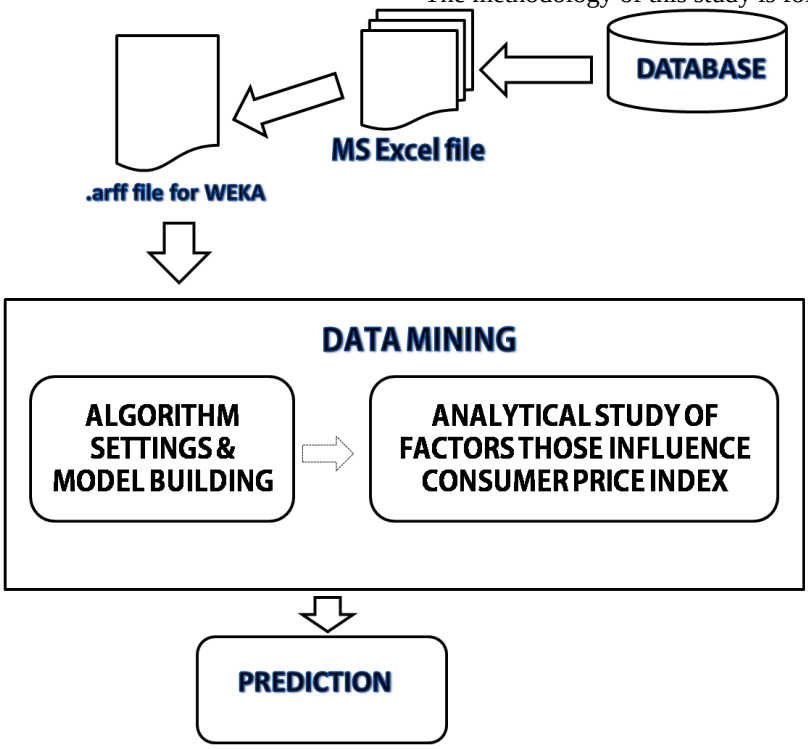

Figure 1 - Study framework

3. 1 Data Preprocessing

Data used within this research is obtained from www.data.worldbank.org, a World Bank online data platform; we focused on Rwanda between 1990 and 2018; downloaded data is about Import value index, Official Exchange Rate, and Food Production Indices in Microsoft Excel file (.xls) format, we had converted this into Attribute-Relation File Format (.arff) file which can be supported by WEKA tool. This data pre-processing phase it ended by getting a dataset to be used for next step where this dataset will processed.

3. 2 Data analysis

From the phase above, we are heading with data analysis phase; under this phase, we are using WEKA 3.8.3 tool to classify, to model and mine the dataset. This tool has different packages including Time series forecasting which is best for predicting the future values for Consumer Price Index.

Time series forecaster feature of WEKA 3.8.3 has two panels named " Basic configuration" and " Advanced configuration" these contain other features to set up algorithms' parameters and build models to test, model and analyze our dataset. In this study, we select M5Rules algorithm to be used for building models on our dataset; Bui, X-N et al., 2019, said that this algorithm uses a tree learner over the training samples to train a pruned tree. Then, the elite leaf is made into a rule, and the tree is discarded and this action can be mentioned as the exclusive difference between M5Rules and regular process that creates a single rule.

By default, classification algorithm performance is measured by Mean Absolute Error (MAE), and Root Mean Squared Error (RMSE) metrics. Instead, we considered MAE in our experiments, as it is a common method to evaluate the performance of prediction approaches and gives the same weight to all individual differences, then to strength our results we add Mean Absolute Percentage Error (MAPE) which is a statistical metric of how accurate a forecast system is; this is measured as the average absolute percent error of actual values minus forecasted values divided by actual values. This is the most common measure used to forecast error. The two metrics are computed through the following formulas;

$$MAE = \frac{1}{n}\sum_{i=1}^{n} | x_i - x | \qquad (1)$$

Where;
n: The number of errors
∑: Summation symbol
$|x_i - x|$: Absolute errors

$$MAPE = \frac{\sum \frac{| A - F |}{A} \times 100}{N} \qquad (2)$$

Where;
A: Actual
N: Number of observations
F: Forecast
| |: Stands for absolute value

Above metrics are expressing forecasting error rate in percentage, lower values indicate that the forecasted values are good predictions and the higher they increase in percentage indicates that forecaster is doing worse predictions.

While implementing our research experiment, we start by loading dataset file into WEKA 3.8.3 tool, we select M5Rules algorithm to train our dataset; Time stamp is set as " year" , Periodicity as " detect automatically" , Number of time units to forecast as 7 and Perform evaluation check box is "checked" to evaluate the algorithm performance level. Thereafter, we test our target algorithm with MAE and MAPE accuracy metrics, by associating IVI, ER and FPI indicators, one by one, to CPI to find one that is more influencing the changes of CPI for Rwanda with consideration of 1990 to 2018.

IV. RESULTS

During our data analysis phase, as stated above, we trained with M5Rules algorithm with MAE and MAPE to measure its accuracy; during this phase, five experiments, named CPI – IVI, CPI – ER, CPI – FPI, CPI – IVI – ER – FPI and CPI, were conducted TO determine which indicator can influence the changes of CPI within a given period.

When interpreting our data, we divided the long-studied period of 1990-2018 under two sub period based on our country history which impacted enough the country economy. We have a period between 1990 and 2003, remarked by political instability, Liberation war, Genocide against Tutsi in 1994, and economically in general, and another period of 2004 to 2018, a period of political stability, prosperous economy and good trading climate.

When consulting the domain experts, they told us that, normally, IVI is the current value of imports converted to US$ and expressed as a percentage of the average for the base period (2000).

This figure below is drawn from our dataset, we present the curve of CPI and IVI, shows the increase on a rate of 76.74% for CPI and a fall of -11.86% on IVI between 1990 and 2003. For next fifteen years, they grew on a rate of 89.03% and 59.35% for IVI and CPI respectively.

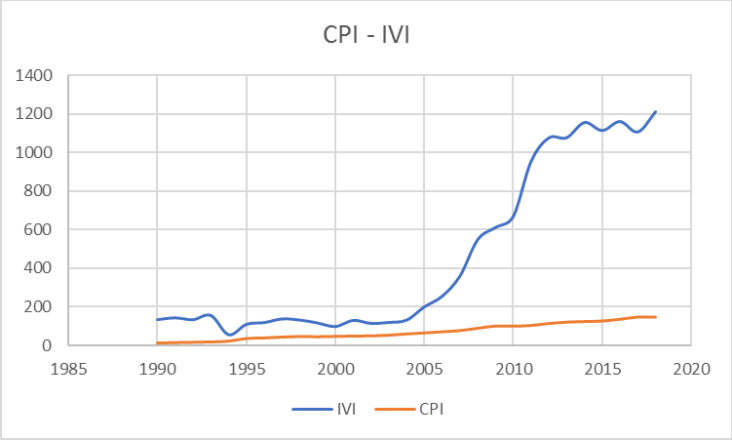

Figure 2 - CPI - IVI Graph

The consulted experts, continue by telling us that, Food Production Index (FPI), covers food crops that are considered edible and that contain nutrients, coffee and tea are exluded because they have no edible nutritive value.

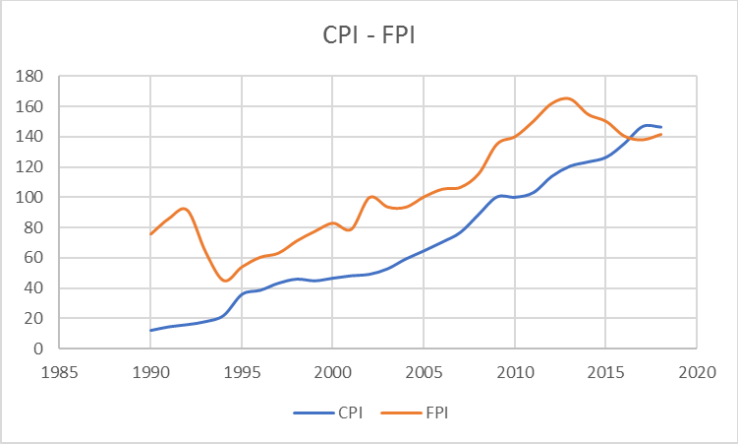

Figure 3 - CPI - FPI Graph

With observation of our data, we present the relationship of CPI – FPI as shown in figure above; as stated before the value of CPI still the same, here we are evaluating the FPI curve. Between 1990 and 2003, it was growing with 84.43% rate and from 2004 to 2018, it was on 32.94%. This increase is affecting strongly positive the CPI within thirteen previous years and increase with weak trend in next sixteen years, 2004 – 2018.

The Exchange rate (ER), as another studied indicator in this study, is the value of local currency for the purpose of conversion to another one, usually US$.

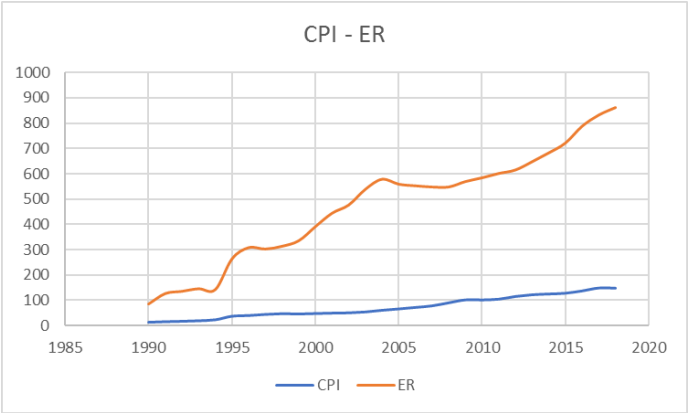

Figure 4 - CPI - ER Graph

As shown in Figures 2 and 3, the selected indicators IVI and FPI are presented; ER is growing with 18.98% rate under 1990-2003 period and 33.87% in next fifteen years, from 2004 to 2018. This scatter plot describes weak positive trend between Exchange rate and CPI, The value of CPI increases slightly as the value of exchange rate increases.

With the experts definitions, we can confirm that this fall of Imported Value Index is due to Rwanda economic problems from the fall of Coffee at the international market in the late 1980s, this cause the economy to fall down and the ability of importing goods and services was delimited; This was more interrupted by country insecurity, where by beginning of October 1990, marks the start of Liberation war, Genocide against Tutsi in 1994, the refugees around anyway, which lead to the people displacement and with this is understandable that they could not import while being disturbed.

In overview analysis, the whole selected indicators, are affected by the country instability between 1990 and 2003, while in new period of 2004 ahead will be an improvement of economics of the country in all corners. This is observed in increase of IVI from 121.47% to 133.08%, for ER was increased from 93.75% to 93.84%, from 537.65% to 577.44% for FPI and 52.92% to 59.41% for CPI, all respectively they increased from 2003 to 2004.

From these experiments' results, we find that the experiment CPI – IVI is the best from other experiments of CPI with each one of the associated indicators that gives the smallest values of MAE and MAPE with 2.3822% error rate for MAE and 2.7574% error rate for MAPE.

Table 1 - M5Rules experiments results

Algorithm	Experiments	Indicators	METRICS (% Error rate)	
			MAE	MAPE
M5Rules	CPI - IVI	IVI	**2.3822**	**2.7574**
		CPI	**19.236**	**4.0785**
	CPI - ER	ER	51.2196	20.3994
		CPI	24.9164	4.4222
	CPI - FPI	FPI	3.7616	3.1518
		CPI	31.8334	5.856
	CPI	CPI	**19.236**	**4.0785**
	CPI, IVI, ER, FPI	IVI	**2.375**	**2.7405**
		ER	42.5221	12.7721
		FPI	4.6221	4.1237
		CPI	24.4166	4.1817

Also, as indicated in the table above, values for MAE and MAPE of CPI in two experiments, CPI – IVI and CPI alone are similar, with 19.236% and 4.0785% errors respectively and within experiment that combines all indicators, values of IVI are respectively, 2.375%, 2.7405% errors for MAE and MAPE. This satisfies the first objective of this study and leads us to conclude that from 1990 to 2018, Consumer Price Index (CPI) for Rwanda is influenced by Imported Value Index (IVI).

Another task of this research is to predict the value of CPI for Rwanda in next seven years, means from 2019 to 2025; this is achieved by training our dataset with selected attributes, CPI associated with IVI using M5Rules algorithm with MAPE accuracy metric.

Table 2 - Predicted CPI Values, 2019 – 2025

Year	CPI - IVI	CPI	IVI
2019	866.1812	866.1812	148.1189
2020	870.1085	870.1085	153.3716
2021	877.7696	877.7696	158.6387
2022	895.6512	895.6512	163.8913
2023	921.311	921.311	169.144
2024	951.4668	951.4668	174.3967
2025	981.7728	981.7728	179.6638

From the table above, we present predicted CPI values for Rwanda within seven years ahead, from 2019 to 2025. These results confirm the accuracy of our model built using M5Rules with MAPE accuracy measure and verify the relationship of IVI indicator to CPI change, this last one is observed via the equality of predictions from CPI – IVI and CPI experiments for all years, from 2019 to 2025.

The IVI is changing with CPI but on the same growth rate level; IVI value will grow with 17.55% rate and 11.77% of CPI – IVI experiment.

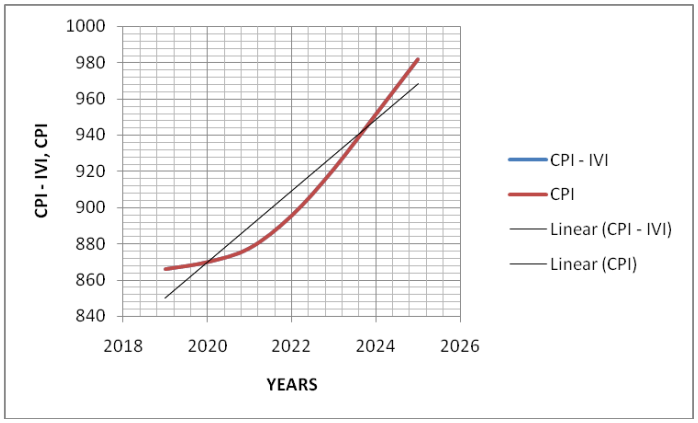

Figure 5 - Predictions from CPI-IVI and CPI Experiments

With data mining observation, from figure above, we see that CPI – IVI and CPI curves and tending line are mixed because their values are equals for all predicted years. Also the results in Table 2, indicate that will be an augmentation of 5.2527 for respective years 2019 – 20, 2022-23, 2023-24 and an addition of 5.2571 for 2020-21, 2024-25 and 5.2526 for 2023 for IVI values.

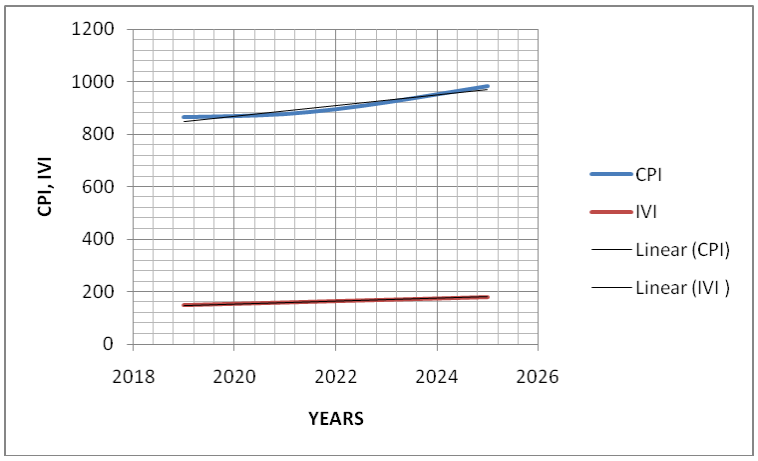

Figure 6 - CPI, IVI Predictions

The value of Rwandan Import Value Index is at low base which is increasing with time; this is justified by the results from Table 2, and this will continue to increase from 2019 to 2025 with 148.11% and 179.66% respectively.

V. CONCLUSION

In this analytical research conducted with aim of examining changes of Consumer Price Index for Rwanda between 1990 and 2018, by relating the CPI with IVI, FPI and ER as factors those can influence this Consumer Price Index. Dataset was built with data obtained from www.data.worldbank.org, a World Bank online data platform; we focused on Rwanda between 1990 and 2018; downloaded data is about Import value index, Official Exchange Rate, and Food Production Indices in Microsoft Excel file (.xls) format, we had converted this into Attribute-Relation File Format (.arff) file which can be supported by WEKA tool.
M5Rules algorithm is used with MAE and MAPE performance metrics to test the model performance on dataset; the model built by M5Rules with MAPE is found the best model to fit our dataset. The results indicated that IVI is the best factor that influencing the CPI for this long period studied from 1990 – 2025. The values for MAE and MAPE of CPI in two experiments, CPI – IVI and CPI alone are similar, with 19.236% and 4.0785% errors respectively

and within experiment that combines all indicators, values of IVI are respectively, 2.375%, 2.7405% errors for MAE and MAPE.

The studied indicators in this study have been at the maximum value in 1213.95% in 2018; 146.62% in 2017; 165.22% in 2013 and 861.09% for IVI, CPI, ER and FPI respectively. This results to the increase of demand for country in different sectors like construction, education, technology, and others.

By concluding, we say that countries are having different ways to earn some income and then the consumption depends to the level of income and interest rate. Among the following values, IVI, FPI and ER; the import value index affects positively the consumer price index as their increase.

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