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# Table of Contents

Value for Money: is Money Correlate to Education Quality? .......................................................... 1  
Nurkolis Siri Kastawi .......................................................................................................................... 1

Client Perception on Quality of Health Care Offered To In-Patients in Public and Faith Based Hospitals in  
Kiambu and Nairobi Counties, In Kenya: A Comparative Study ................................................... 7  
Dr. Margaret W. Nyongesa, PhD, Prof. Rosebela O. Onyango, PhD *, Prof. James H. Ombaka,  
PhD .................................................................................................................................................. 7

Ammonia Emissions at Broiler Farmings in Palangka Raya Central Kalimantan .............................. 16  
Paulini, Sudiarso, Budi Prasetya, Aminudin Afandhi ....................................................................... 16

The Role of Computed Tomography in Diagnosis of Unilateral Congenital Choanal Atresia in a  
Teenager: A Case Report ................................................................................................................... 23  
Danfulani Mohammed, Gele I. Haruna, Ma’aji M. Sadisu, Saidu A. Sule, Muhammad A.  
Musa ................................................................................................................................................... 23

Shoppal – Best Offers at Your Fingertips ......................................................................................... 27  
Vithana ............................................................................................................................................... 27

Contribution of bacteria to Artemia nutrition in conditions of degressive algal feeding ................. 34  
Huynh Thanh Toi, Nguyen Thị Hong Van ......................................................................................... 34

AssistME ........................................................................................................................................... 46  

Enhancing Irrigation Farming In Nigeria Using Software Technologies .......................................... 52  
Jibril Lawal, Abubakar Usman Mohammed, Mansur Muhammad, Musa Murtala Abubakar ....... 52

Art of Breathing ................................................................................................................................. 56  
Gopal Krishan .................................................................................................................................... 56

A Clinical Study of Heart Failure with Preserved Ejection Fraction in Patients at College of  
Medical Sciences, Teaching Hospital: A Tertiary centre from Central Nepal .................................. 58  
Panjiyar RK, Twayana RS, Laudari S, Gupta M, Dhungel S, Dubey L, Subramanyam G ...... 58

Review on Potential of Mobile Phone Usage in Agricultural Information Dissemination in Ethiopia 63  
Mulugeta Tegegn, Akalu Dafisa ....................................................................................................... 63

PODDANTA PULUWAN: Educational Game for Toddlers Based on Leap Motion Technology .... 76  
Fernando ......................................................................................................................................... 76

Effectiveness of Sofosbuvir in Treating Patients with Hepatitis C – Risks Vs Benefits Ratio ........... 83  
Abeera Tariq, Ayesha Khawar, Fatima Amin ..................................................................................... 83
Communication between Deaf-Dumb People and Normal People: Chat Assist
L. Jayatilake, C. Darshana, G. Indrajith, A. Madhuwantha and N. Ellepola

Fabiano Gibson Daud Thulu, Estiner Walusungu Katengeza, Malazi Mkandawire

Use of heat pump dehumidifiers on industrial drying of chili
Abeyrathna R.M.R.D., Amaratunga K.S.P.

Smart Cultivation Partner - Mobile Application (Android) Service to Increase Cultivation and Sales
Nirojan, V.N.Vithana

Siegel Harmonics – A Sound Like No Other
Hayden B. Siegel

Estimating Base Saturation Flow Rate for Selected Signalized Intersections in Khartoum State, Sudan
Galal A Ali, Yousif Mohamed Osman

The Impact of Rule of Law and Other Macro-Economic Variables on Performance of the Stock Markets
Haris Ali Khan, Dr. Danish Ahmed Siddiqui

A Study on Biosurfactant Production from Marine Bacteria
Sumaiya.M, Anchana Devi.C & Leela K.

Characteristics of Fuzzy Domination Number In Fuzzy Digraphs
G.Nirmala, M.Sheela

Image Compression Algorithm and JPEG Standard
Suman Kunwar

Overview of biogas production from different feedstocks
Edward Kwaku Armah, Emmanuel Kweinor Tetteh, Bright Boafo Boamah

The Status and Causes of Secondary School Students’ Dropouts: The Case of East Gojjam Administrative Zone, Ethiopia
Eshetu kibret, Alem Amsalu, Aschale Tadege, Gebeyaw Teshager, Molla Bekalu

Effective Utilization of Condenser Heat of a Refrigerator in a Heating Chamber
Anshul Sarin, Aatish Goel, Tushar Sharma, Abhishek Misra, Shivam Tyagi

Emulation tool for research purposes in smart grids

Determinants of brand loyalty: A case study of Asian Mobile Phone Users
Ossama Fazal, Sonia Kanwal
Teacher Performance Based on Stress and Organizational Commitment..............................................................................................192
Nur Laily, Dewi Urip Wahyuni..................................................................................................................................................................192

The Role of Corporate Social Responsibility in Mediating the Effects of Foreign Operation on Tax Aggressiveness...........................................................................................................................................................................200
Nurul Aini, Soegeng Sutejo, Basuki..........................................................................................................................................................200

Strengthening of Reinforced Concrete Building by Externally Bonded Carbon Fiber System..........................................................................................................................210
Ohnmar Zaw, Nang Su Le, Mya Thwin.........................................................................................................................................................210

Issues and Challenges of Post Landslide Management in Sri Lanka..............................................................................................................................215
Heshani Maheshika & Rev. Pinnawala Sangasumana.........................................................................................................................................................215

The role of PHA transformation in obtaining distinct bioproduts: insights into biorefinery and medical applications..................................................................................................................................................................................226
Leonardo Bastos Moraes, Maria Viviane Gomes Muller, Rosana de Cassia de Souza Schneider..................................................................................................................................................................................226

The Inaugural Caribbean Cancer Survivorship Conference 2016.........................................................................................................................231
Charmon Mohammed, Amanda Carrington, Carol-Anne Stephens, Karen Pierre........................................................................................................231

Prevelence, Assessment & Management of Hypovitaminosis-D In Randomly Selected Populations of Lahore .................................................................................................................................................................................236
Qurratulain Munawar, Ramsha Zafar, Mariam Zaka.........................................................................................................................................................236

Stories Learning by a Rational Agent Using CPM.................................................................................................................................................243
Sajid Hussain Raza...............................................................................................................................................................................................................243

Intelligent Floor Cleaning and Insect Killing Robot Machine System........................................................................................................247
M. Noor Alam, Sajid Hussain Raza........................................................................................................................................................................247

Efficacy of Ef-Chlor for Drinking Water Purification and Multipurpose Disinfection..........................................................................................250
Abhishek Bajpai, R.S. Goswami, Aayush Goswami, Shrikant Garde, Preeti Phadnis........................................................................................................250

Artificial models of iron hydrogenases for their potential use in the generation of molecular hydrogen: a mini-review................................................................................................................................................................................262
Maria de la Luz Pérez-Arredondo, Ricardo González-Barbosa, Juan Antonio Ramírez-Vázquez, Jóse J. N. Segoviano-Garfias.......................................................................................................................................................262

Manlian Ronald A. Simanjuntak, Cucun Sunarsih.........................................................................................................................................................269

Recommendation Analysis of Important Risk Factor in Construction Company "X" on Joint Operation Project with Foreign Company in Jakarta, Indonesia.........................................................................................................................................................................274
Krishna Mochtar, Manlian Ronald. A. Simanjuntak, Yulius Adhi Wibowo........................................................................................................274
Effect of Novel Insecticides against Helicoverpa armigera (HBN.) on Chickpea crop under Field Conditions. 

Muhammad Mushtaque Kumbhar, Syed Shahzad Ali, Khalid Hussain Dhiloo, Irum Kumbhar and Reema Veesar

Noise Mapping of the University of Agriculture Makurdi Nigeria

Amine, J.D.; Injor, O.M. Okosu, O.M. and Orok, S.A

Ethical Practices in C-Section Delivery and Prevalence of Post-Caesarian Complications in Pregnancy in Lahore

Maria Khaliq, Amber Abid, Dr. Mariam Zaka, Dr. Munazza Ryaz

E-Mart: Product Placement and Promotion System to Enhance Sales Promotion Effectiveness


Effect of Swine Manure with Terminalia catappa leaves Compost and NPK Fertilizer on Growth and Yield of Pepper (Capsicum chinense Jacq.) in Ibadan, Nigeria

A. Ogunsesin and E. A. Aiyelari

COMPLEX FORMATION EQUILIBRIA OF COPPER(II), METFORMIN AND D-(+)MANNOSE OR D-(+)
GLUCOSE IN METHANOL

Ana Abigail Márquez-Vargas, María de la Luz Pérez-Arredondo, Juan Antonio Ramírez Vázquez and José J. N. Segoviano-Garfias

Biochemical Methane Potential (BMP) of Miscanthus Fuscus for Anaerobic Digestion


Determinants of sustainability of exclosure establishment and management practices in Tigray Region, Ethiopia

Samson Shimelse, Tamrat Bekele, Sileshi Nemomissa

Secure Data Collaboration Services with Outsourced Revocation in Cloud Computing

Anshul Garg and Rachna Jain

Debtors Management and Financial Performance of Selected Microfinance Institutions at Nairobi City County In Kenya

Moranga Getii Kevin, Dr. Job Omagwa

Shareholder Activism Compulsory or Option in the Corporate World?

Moonmoon Malik

Effect of Socio-Cultural Practices on Girl-Child Performance in Kenya Certificate of Primary Education Examination in Navakholo Sub- County, Kenya

Caroleen Murunga Saya, Oriaro C, Murgor A

Prescribing Trends Affordability and Compliance to Osteoporosis Pharmacotherapy in Private and Public Sector Hospitals of Lahore

Arfa Hameed, Iqra Zafar, Dr. Bushra Ali, Dr. Munazza Riaz
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of Fruit and Vegetable Dealers Awareness about Lead Contamination at Bahri Locality, Khartoum North</td>
<td>509</td>
</tr>
<tr>
<td>Nagwa B. Elhag, Somiya Gutbi Salim Mohammed</td>
<td></td>
</tr>
<tr>
<td>Good Governance, Organizational Culture, and Performance of Higher Education in Indonesia: A Conceptual Framework</td>
<td>528</td>
</tr>
<tr>
<td>Melvie Paramitha, Dian Agustia, Noorlailie Soewarno</td>
<td></td>
</tr>
<tr>
<td>Analysing compressed AKP file with BMP and TIFF format by considering number of colors of the image</td>
<td>536</td>
</tr>
<tr>
<td>Apurv Kantilal Pandya, Prof. CK Kumbharana</td>
<td></td>
</tr>
<tr>
<td>The Importance of Feminist Ethnography in Modern Folklore Studies</td>
<td>541</td>
</tr>
<tr>
<td>Maria Gasouka</td>
<td></td>
</tr>
<tr>
<td>Exercise and Its Corresponding Effect on Cardiac Output</td>
<td>545</td>
</tr>
<tr>
<td>Adikali Kaba Sesay, Alpha Bassie Mansaray, Javed Soomro Ali</td>
<td></td>
</tr>
<tr>
<td>The Importance of Palliative Care in Patient Therapy</td>
<td>556</td>
</tr>
<tr>
<td>Angela R. Bova</td>
<td></td>
</tr>
<tr>
<td>ACMD – Aquatic Condition Monitoring Drone</td>
<td>559</td>
</tr>
<tr>
<td>M. R. Ahmed, R. Inthusan, M. N. Samhan, M. I. Roshan, S. G. S. Fernando</td>
<td></td>
</tr>
<tr>
<td>A Smart Travel Companion Application with Location Base Scheduling</td>
<td>564</td>
</tr>
<tr>
<td>Fodder Resources in Temperate Fruit Valley of Western Himalaya, India</td>
<td>571</td>
</tr>
<tr>
<td>Lokender Singh, Neelam Sharma, S. P. Joshi</td>
<td></td>
</tr>
<tr>
<td>Preliminary Study of Optimization Model of Local Government Infrastructure Asset Management to Improving the Sustainable Development Performance</td>
<td>588</td>
</tr>
<tr>
<td>Manlian Ronald. A. Simanjuntak, Rezi Munizar</td>
<td></td>
</tr>
<tr>
<td>Knowledge, Attitudes and Behavior regarding Antibiotics Use and Misuse among Adults in the Community of Lahore, Pakistan</td>
<td>598</td>
</tr>
<tr>
<td>Umaira Zaheer, Mayasara Iqbal and Fatima Amin</td>
<td></td>
</tr>
<tr>
<td>Comparison of Efficacy of Oral Drug Therapy With Interferon in Hepatits C</td>
<td>603</td>
</tr>
<tr>
<td>Areeba Pervaiz, Shumaila Zahoor, Saleha Sadeeqa</td>
<td></td>
</tr>
<tr>
<td>A Review on Solid Waste Management &amp; its Recycling</td>
<td>612</td>
</tr>
<tr>
<td>Prof. D. S. Salgude</td>
<td></td>
</tr>
<tr>
<td>Isolation and Identification of Soil Fungi from Kadegaon Tehsil, Sangli District, Maharashtra, India</td>
<td>616</td>
</tr>
<tr>
<td>Jadhav Shilpa Y, Shinde Pratiksha P</td>
<td></td>
</tr>
</tbody>
</table>

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Emotional Intelligence Among Undergraduate Nursing Students………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………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Evaluation of Biofilm Production in Acinetobacter baumannii with Reference to Imipenem Resistance...........................................................................................................................................732
    Chaudhary Anish, Routray Abhisek, Madhavan Radha........................................................................732

Response of Wheat to Salicylic Acid........................................................................................................738
    Ziasmin, Mohammad Mahbub Islam, Kamal Uddin Ahmed, Shahidul Islam, Suraya Parvin...........738

The Menace of Open Defecation and Diseases in The Nadowli-Kaleo District, Ghana.............................743
    Stephen Ameyaw, Felicia Safoa Odame.............................................................................................743

Smart Highway........................................................................................................................................750
    Nagen Kumar Sahoo.........................................................................................................................750

Achalasia Misdiagnosed As Pulmonary Tuberculosis; Case Report.......................................................753
    Danfulani Mohammed, Abubakar Musa, Ma’aji M. Sadisu, Saidu A. Sule, Muhammad A. Musa........753

Farm-level Adaptation Strategies to Climate Variability: Evidence from Smallholder Farmers in Offin River basin, Ghana....................................................................................................................756
    Mr. Mensah-Brako Bismark, Prof. Wilson Agyei Agyare, Prof Ebenezer Mensah.........................756

State of the Art Optimization Model Role of Construction Management in Improving Performance Construction Design and Design and Build in Project Building Area of Emergency Ambulans Buildings in Provincial Health DKI Jakarta...........................................................................................................765
    Manlian Ronald. A. Simanjuntak, Jujuk Kusumawati.................................................................765

ADOPTION OF AMMONIATED STRAW TECHNOLOGY BY FARMERS AT SUB-DISTRICT OF DONRI-DONRI, SOPPENG DISTRICT, INDONESIA............................................................................773
    Muhammad Rusdy, Sjamsuddin Garantjang, Muhammad Aminawar........................................773

Vibrational Analysis of Passive Suspension System for Solar Vehicle..................................................777
    May Mya Darli Cho, Htay Htay Win, Aung Ko Latt........................................................................777

Investigation of Stress Analysis of Power Train Units for Light-Weight Car.........................................800
    Hlwan Htet Htet San, Htay Htay Win, Myint Thein.......................................................................800

    Ni Ni Aung, Myat Myat Soe.............................................................................................................821

Design,Simulation and Performance on the Effect of Modification on Impeller Tip for Pump as Turbine ( PAT ) ........................................................................................................................................844
    Nan Kathy Lin, Myat Myat Soe, Aung Myat Thu...........................................................................844

Design and Analysis of Steering Gear and Intermediate Shaft for Manual Rack and Pinion Steering System..861
    Thin Zar Thein Hlaing, HtayHtay Win, Myint Thein.......................................................................861

The Long-Run Relationship between Stock Market and Macroeconomic Behavior in Postwar Economy of Sri Lanka.....................................................................................................................................883
    DHD Nadeesha................................................................................................................................883
Anti Money Laundering - Strategy and Way Forward........................................................................893
   Arunkumar Dharmapuri.................................................................................................................893

Removal of Lead (II) Ions From Aqueous Solutions Using a Low Cost Adsorbent Obtained from Centella Asiatica Leaves........................................................................................................899
   S.Nirmala, A.Pasupathy, T.Raja2 M.Raja......................................................................................899

Effect of Classical and Pop Music on Mood and Performance.......................................................905
   Mamoona Khan, Asir Ajmal.......................................................................................................905

Preparation and Evaluation of Floating Drug Delivery System for Gastric Retention.....................912
   B.Rama, C.Varun Reddy, A.Sneha, D.Niharika, G.Sravani, S.Divya Laxmi.................................912

Voices of six mothers of children with Developmental Disabilities: experiences with health care workers in Gaborone, Botswana.................................................................918
   Kefilwe P.J. Batsalelwang, Joseph Habulezi..............................................................................918
Value for Money: is Money Correlate to Education Quality?

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Abstract- This article aims to find out the relationship between the budget of education function and quality of education. The research approach is quantitative descriptive using statistical analysis with percentage and Pearson correlation. The data used are secondary data of education budget to describe the quality of the education quality measure with of teacher's competency test results, the rate of literacy, and rate of school participation. The results show that there is no positive and significant relationship between the budget of education function and quality of education.

Index Terms- education budget; quality of learning outcomes; teacher quality; the rate of literacy; and rate of school participation.

I. INTRODUCTION

The Government of Indonesia strictly stipulates the education budget through the Law of Republic of Indonesia No. 20 of 2003 on National Education System. It is stated in Article 49 (1) that education funds including educators' salaries and official education are allocated at least 20% of the State Budget (Anggaran Pendapatan dan Belanja Negara, APBN) in the education sector and at least 20% of the Regional Revenue and Expenditure Budget (Anggaran Pendapatan dan Belanja Daerah, APBD).

Until 2006, the central government has not been able to fulfill the mandate of the law of education system in educational financing. It can be seen that the allocation of education budget from State Budget that has not reached 20%. In that year the education budget reaches 17%, this is lower than Thailand and Malaysia which has reached 27% [1]. For the first time, the government can fulfill the mandate in 2009, when the education budget from State Budget reaches 20% [2].

Governance systems in Indonesia have shifted from centralized to decentralized, so educational management has also shifted from central government towards decentralization to local governments. Local government law mandates that primary and secondary education responsibilities are in district, city and provincial governments. The Act of the Republic of Indonesia No. 22 of 1999, updated Law No. 32 of 2004, and renewed again through Law No. 23 the year 2014. The latest regional government law is the distribution of educational affairs, namely basic education becomes the authority of the district or city government and secondary education becomes the responsibility of the provincial government.

The local governance law in Indonesia has changed the management of the national education system from centralized to decentralized. Decentralization of education management is intended to improve the quality of education services. Decentralization of education can improve the quality of education services, this can be proven in more than 50% of districts and cities in Indonesia that have improved educational outcomes[3].

It is inevitable that the amount of money for the education budget can affect the quality of education services. However, it is important to realize that too much of the education budget can harm the development other sectors. So the most important thing is how to use education budget efficiently and effectively.

Research in China shows that there is a significant influence between private expenditure on mathematics learning outcomes of primary school students but has no significant effect on Chinese learning outcomes [4]. In Japan, it shows that public expenditure on public education has the influence on student learning outcomes, while the family environment does not affect student learning outcomes [5]. Research conducted on secondary education students shows that a comprehensive program that provides financial, academic, and social support to students from low socioeconomic levels shows positive results on improving student performance in the first year, drop-out rates, and student learning outcomes at the last level [6]. In Indonesia, public spending has no positive effect on access to education in areas with high levels of corruption but has a positive and significant impact in areas with low corruption. Public spending also has no significant effect on school performance [7].

Thus this article aims to determine the relationship between education budget to the quality of education. The detail objectives are to know: (a) the relationship between the the budget of educational function to the student's learning outcomes, (b) the relationship between the budget of education function to teacher quality, (c) the relationship between the budget of educational function to the literacy rate, and (d) the relationship between the budget of educational function to school participation rate.

II. RESEARCH METHOD

The research was conducted in 2016 in Central Java Province consisting of 35 districts and municipalities. This research was quantitative descriptive approach using secondary data. Statistical analysis of percentage and Pearson correlation. The data of the regional budget of education function was obtained from the Ministry of Finance in 2016 for the period of nine years.
2007-2015. The budget of the educational function in this article includes salaries and benefits of teachers and education personnel. The quality of education was viewed from the results of the national exam of junior secondary school students in 2015, the results of teacher competency test in 2015, the rate of literacy in 2015, and the rate of school participation in 2015. Teacher quality data was obtained from teacher competency test results (Uji Kompetensi Guru, UKG) in 2015 based on Ministry of Education and Culture report. Student learning outcomes data obtained from the results of the national exam (Ujian Nasional, UN) of junior secondary school in 2015 from the Ministry of Education and Culture. Literacy rate and school participation rates were obtained from Bureau of Statistics of Central Java Province in 2015.

III. RESULTS AND DISCUSSIONS

Before discussing the relationship between the education budget and the quality of education, it is important first to analyze the budget of education function in the district and city based on budget year. For nine (9) years, the average budget for education function within 35 regencies and cities in Central Java Province was 45%.

During the nine years, the average budget of the highest education function reached 57% in Klaten District, while the lowest 32% in Salatiga City. This can be seen in figure 1.

![Figure 1. Average Education Budget by District (2007-2015)](image1)

Based on the budget year, the highest average budget of educational function was 50% in 2013 and 2014, while the lowest was 39% occurred in 2007. This can be seen in Figure 2.

![Figure 2. Average Education Budget by Year (2007-2015)](image2)

Based on figures 1 and 2 it is recognized that the average budget for education functions in districts and municipalities was relatively high (45%) and it was the highest when compared with other budgets of development function in local government. The high education budget is expected to improve the quality of education. Based on the World Ecospac Forum report, countries with the best quality education in the world are always supported by high education budgets.

Based on evidence from countries with the 2017 human capital index that includes the world's top 10, all allocate education budgets between 5.1% to 8.6% of GDP, the highest educational budget is Denmark. Indonesia has also allocated a substantial education budget of 3.6% of GDP [8].

The average budgetary function of education from the Ministry of Finance is higher than that calculated by the World Bank [9] that the national education budget averages 28.3% including salaries, but excludes salaries of only 6.3%. As a sample in Wonosobo Regency which reached 37% if including salary and only 6.6% if not including salary. Other samples in Magelang City reached 30.6% if including salary and only 2.2% if not including salary.

Unfortunately, the high budget of education function in Indonesia has not been managed efficiently and effectively. Based on a review of education spending by the World Bank [2] shows that continuing to increase education spending is not perceived by improving the quality of education. Other evidence suggests [10] that the high increase of access in Indonesia is not accompanied by significant increase in learning outcomes. Recent international results show that between 2006-2012, the value of mathematics of Indonesian students aged 15 years has decreased, while the value of reading and natural science stagnant.

A. The Relationship of Education Budget with Student Learning Result

The correlation between districts and cities education budgets with student learning outcomes analyzed by Pearson Correlation. The result of the analysis shows that there is an inverse relationship of minus 0.176 between the educational budget and the outcomes of junior secondary school students. This can be seen in table 1.

<table>
<thead>
<tr>
<th>Average Education Budget (%)</th>
<th>Score National Exam JSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 1. The correlation between Education Budget and Student Result of Junior Secondary School Year 2015

Based on the correlation analysis means that the higher the education budget allocation, the lower the score on the national
Korupsi known that Klaten district was famous for corruption at the level of officials after the Head of Regent was caught by the Corruption Eradication Commission (Komisi Pemberantasan Korupsi, KPK).

Based on the results of the study [7] which states that public spending including education spending does not have a positive effect on educational access and education quality in areas with high corruption. Research results in 50 countries [11] also show that corruption in education has a negative relationship with educational outcomes. This means that the higher the level of corruption in education the worse the results of education.

Taking into account the relationship between education budgets at the district and municipal levels while the students' learning outcomes are low, is there any suspicion that the education budget in the regions was not present at the school level or specifically not present in the classroom? If the money did not come to the students, where the money was gone? It could be only up to teachers and educational personnel, in other words, the high educational budget is only enjoyed by teachers and educational personnel.

Research conducted by the World Bank [9] shows that regular expenditures on the education of district and municipal, now referred to as education operational expenditures are mostly used for teacher salaries and educational staff of 96%. Readers may imagine, for what kind of operational expenditure is only 4%? At most, it can only to pay electricity subscriptions and office stationery only. So how can teachers create innovative teaching aids and learning media if there was no money available? How can students be invited to practice in the learning process if their budgets are spent on teacher salaries and education personnel?

### B. The Relationship of Education Budget with Teacher Quality

Paying close attention to the amount of education operational expenditure for teachers and educational staff, then we will assume that the teachers are qualified. This assumption makes sense because when teachers have high salaries and benefits it will be motivated to improve their competence. Let us prove the assumption with the data in table 2.

<table>
<thead>
<tr>
<th>Average Education Budget (%)</th>
<th>Teacher Competency Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Education Budget (%)</td>
<td>1</td>
</tr>
<tr>
<td>Teacher Competency Test</td>
<td>-0.498231641</td>
</tr>
<tr>
<td>Teacher Competency Test</td>
<td>1</td>
</tr>
</tbody>
</table>

The result of correlation analysis between educational budget and teacher quality showed the negative result, it means that there is an inverse relationship, the higher the education budget the lower the quality of the teacher.

Then the question arises, what is the salary and allowance of teachers and educational staff for? Salary is intended to meet the needs of the life of teachers and educational personnel. But the teacher allowance also called professional allowance is meant to improve the professionalism of the teacher.

Has the professional allowance of teachers been used to improve their professionalism? The World Bank report [12] shows that teachers receiving professional allowances have not been changed in the quality of teaching. Could be a professional allowance is not intended to improve their professionalism, but precisely for the needs of consumptive life. This is a conjecture and should be proven by further research.

Certification received by the teacher has no impact on the quality of learning process and student learning outcomes. This is another research result in Indonesia that teacher certification does not significantly improve the quality of the learning process [13].

Recent research results [14] suggest that teacher professional allowances increase teacher satisfaction with respect to earnings, but do not lead to improved student outcomes. This also indicates that teacher professional allowance is not used to improve the professionalism of teachers.

The teachers who the certification allowance assume that the one-month allowance for such basic salary is their right so that it is used for consumptive needs is no problem. If that was what most teachers in Indonesia though, it indicates that teachers lack professional responsibility.

District and city governments have not prioritized the improvement of teacher professionalism, it is evident that not many local governments have clear rules and policies on continuous professional development-CPD (Pengembangan Keprofesian Berkelanjutan, PKB). Among the 35 districts and municipalities in Central Java Province, there are only 6 districts that have Regent Regulations on CPD namely Batang, Blora, Demak, Grobogan, Purbalingga, and Semarang. As of mid-2017 of 514 districts and cities, there are not yet 20 districts and cities that have had the rules of CPD [15].

Noting the attitudes of teachers who consider certification allowances as rights so that they can be fully utilized for consumptive needs, there are some districts that make rules for the use of teacher certification allowances. For example, Batang District [16], Demak District [17], Purbalingga District [18], and Blora District [19] make regent regulations regarding the use of teacher professional allowances to develop their professionalism. The regional head requires that the teacher use the professional allowance allocated between 4% -5% for the professionalism of the teacher. Among others are to finance further education, training, workshops, buying books, journal, buying a computer or laptop.

### C. The Relationship of Education Budget with Literacy Rate

The literacy rate is calculated by the formula of the population over 15 years to 55 years old who are able to functionally read divided by the number of people aged >15-55 years.

The greater the budget of educational function has greater opportunity to get the higher rate of literacy. Because the more
people can read, write, and count functionally then the level of literacy of a region will be higher. The assumptions need to be proven by looking at table 3.

Table 3. The correlation between Education Budget and Literacy Rate Year 2015

<table>
<thead>
<tr>
<th>Average Education Budget (%)</th>
<th>Literacy Rate (Age 15-55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.40508854</td>
</tr>
</tbody>
</table>

The correlation between educational budget and literacy rate shows minus 0.405 which means there is an inverse relationship. The data shows that the greater the education budget in the regions, the lower the level of literacy of people.

If so then high education budget is also not used for the benefit of improving the quality of education in communities aged between >15-55 years. This fact is inevitable because high education budgets are mostly allocated for teachers' salaries and education personnel. Finally, local governments are unable to complete illiteracy in each district and city.

D. The Relationship of Education Budget with School Participation Rate

A final analysis to see if high education budgets also provide opportunities for all citizens to enjoy primary and secondary education? Let's examine the 7-12 year school participation rates in table 4, school participation rates 13-15 years in table 5, and school participation of 16-18 years in table 6.

It should be pointed out that school participation is based on the school age range. The age of 7-12 years is for the primary school children [Sekolah Dasar, SD], the age of 13-15 years is the period of children in junior secondary school (Sekolah Menengah Pertama [SMP] or Madrasah Tsanawiyah [MTs]), and the age of 16-18 years is the period of children in senior high school (Sekolah Menengah Atas [SMA], Sekolah Menengah Kejuruan [SMK], or Madrasah Aliyah [MA]). The school participation formula for 7-12 years of age is the number of 7-12 years old school children divided by the number of people aged 7-12 years, the other age groups adjusted.

Table 4 shows the relationship between district and city education budgets to school participation rates of elementary school-age children, as follows.

Table 4. The Correlation between Education Budget and School Participation Rate for 7-12 Age

<table>
<thead>
<tr>
<th>Average Education Budget (%)</th>
<th>School Participation Rate (Age 7-12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.098500839</td>
</tr>
</tbody>
</table>

Based on the data in table 4 it is found that there is a positive relationship between district and city education budgets with 7-12 years school participation rate with a correlation value of 0.098. This correlation value includes very weak category because the determination rate is only 1%. This means that the education budget only affects 1% of the increase in school participation rate of elementary school age children.

What about the relationship between education budget and school participation rate of junior secondary school children? The results can be seen in table 5.

Table 5. The Correlation between Education Budget and School Participation Rate for 13-15 Age

<table>
<thead>
<tr>
<th>Average Education Budget (%)</th>
<th>School Participation Rate (Age 13-15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.090737417</td>
</tr>
</tbody>
</table>

Based on the Pearson correlation results in table 5, the relationship between educational budget and school enrollment rate of children aged 13-15 years shows a negative association of 0.090 or an inverse relationship between education budget and school participation rate of junior secondary school children. This suggests that the greater the education budget incurred by district and city governments, the school participation rate of 13-15 years actually declines.

Table 6 below will show the correlation between the education budget incurred by district and city governments to the participation rate of school children of senior high school age.

Table 6. The Correlation between Education Budget and School Participation Rate for 16-18 Age

<table>
<thead>
<tr>
<th>Average Education Budget (%)</th>
<th>School Participation Rate (Age 16-18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.033241425</td>
</tr>
</tbody>
</table>

Based on the results of Pearson correlation analysis in table 6 it is known that the relationship between the education budget issued by the district and municipal governments with school participation rate of 16-18 years showed a negative result of 0.033. This means that there is an inverse relationship between the two, namely the greater the education budget issued by the district and municipal governments, the school participation rate of children of high school age decreases.

This is in line with the findings of research conducted in Germany which states that there is a negative influence on the cost of education with the enrollment of students to school [20]. The study took the time frame of 2002-2008 to determine the effect of determining the cost of education on the possibility of student enrollment in educational institutions.

The results of the analysis of the budget of education function and the quality of education above support the signal that the use of educational resources has no effect on the effectiveness of
education [21]. External factors such as the level of financial resources do not determine whether a school is effective or not, on the contrary, the way schools use resources will determine whether the school is effective or not. Taking note of the recommendations of the OECD and ADB [22] that the increased budget for education in Indonesia should be used efficiently and effectively in order to have a positive impact on student learning outcomes or the quality of education in general.

IV. CONCLUSION

The budget of education function in each regency and city in Central Java Province was relatively high with the average for nine years reaches 45%. The high education budget is mostly used for teachers' salaries and education personnel. The high of the education budget has not been positively related to the quality of education in terms of student learning outcomes, teacher quality, literacy rate, and school participation rates. Thus it can be concluded that the budget of education function has not been used efficiently and effectively. With regard to teacher professional allowances that have not been used to improve the professionalism of teachers, the government and local governments need to make policies to allow certification allowances to be allocated to improve teacher competence.

District and city governments need to make a policy regarding the use of education budgets by determining the formula for the use of it. Budgets for non-personnel education operational expenditure should be determined in a reasonable percentage so that the learning process can be qualified. With this budget use formula, teachers' salaries will be limited, for example up to a maximum of 60% so that the other 40% can be used for investment spending and non-personnel operating expenditures.

APPENDIX

Anggaran Pendapatan dan Belanja Negara (APBN) means the revenues and expenditures of the Government of the Republic of Indonesia determined annually by virtue of the Act. Anggaran Pendapatan dan Belanja Daerah (APBD) means revenue and expenditure of Regency and City Government in Central Java Province which is determined every year based on the Regional Regulation. Komisi Pemberantasan Korupsi (KPK) is an independent commission established to prevent and combat corruption in Indonesia based on Law Number 30 Year 2002 on Eradication of Corruption. Pengembangan Keprofesian Berkelanjutan (PKB) is a government program to improve the professionalism of teachers and education personnel continuously and sustainably. Sekolah Dasar (SD) is the education given to students aged 7-12 years after they finish the right kindergarten education (Taman Kanak-Kanak, TK). Sekolah Menengah Pertama (SMP) is the education given to students aged 13-15 years after they complete elementary school (Sekolah Dasar, SD). The equivalent of junior high school is Madrasah Tsanawiyah (MTs) which is equal education junior secondary school which is under the responsibility of Ministry of Religion Affairs.

Sekolah Menengah Atas (SMA) is the education given to students aged 16-18 years after they finish junior secondary school (Sekolah Menengah Pertama, SMP). The equivalent of SMA is Vocational High School (Sekolah Menengah Kejuruan, SMK) that provides vocational education. The equivalent of SMA and SMK is the Aliyah Madrasah (MA) which is under the responsibility of the Ministry of Religious Affairs.

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www.ijsrp.org

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Client Perception on Quality of Health Care Offered To In-Patients in Public and Faith Based Hospitals in Kiambu and Nairobi Counties, In Kenya: A Comparative Study

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Abstract

Introduction

Quality is the ability to deliver services that satisfy the consumer’s needs whereas service quality is the ability to meet or exceed customer expectations, providing quality healthcare is an ethical obligation of all healthcare providers and receiving quality care is a right of all patients. Africa Countries including Kenya has witnessed general deterioration in health indicators due to rapid population growth, child nutrition problems, poverty, HIV/AIDS, acute respiratory infections, malaria, diarrhea, and poor quality health facilities and services. Nairobi city with high population and Kiambu a neighboring County, the Public and some Faith-based hospitals in these two counties experience shortage of drugs and medical supplies, unaffordable out-of-pocket costs for health services’ consumers, poor quality of care due to overcrowding of the patients, thus services provided are considered unsatisfactory.

Objective

To compare client perceptions on quality of health care offered to patients admitted into public and Faith-based hospitals in Nairobi and Kiambu Counties in Kenya.

Methods

A descriptive cross-sectional study of client perception on quality of health care offered to in-patients in public and faith based hospitals in Kiambu and Nairobi, Kenya was conducted. A sample of 384 patients, 238 from public hospitals and 146 from Faith-based hospitals, and 276 were female and 146 male. Comparative analysis of quality of health care in faith based hospitals with public hospitals by use of SERVQUAL dimensions to assess’ patient perception was carried out.

Results:

Faith-based hospitals overall mean was (4.23 on a scale of 1 to 5 & SD 0.347) showing positive opinions and public hospitals mean was 2.62 (on a scale of 1 to 5 & SD 0.760) indicating negative opinions among all five (Tangibility, Responsiveness, Reliability, Assurance and Empathy) dimensions. The overall T test was -24.688; there was a mean difference in the patient’s opinions of public and faith-based hospitals on perception of service quality. There was significance difference at p ≤ 0.05; T test and Chi-Square p value was .000 for all five dimensions.

Conclusion

Patients had positive perception on service quality in faith-based and negative perception on service quality in public hospitals. There is need for re-structuring health service in public hospitals, to put in empowerment strategies to provide patient centeredness which is continuous quality health care improvement process.

Index Terms- Client Perception, Quality of Health Care, Public and Faith Based Hospitals, Kiambu and Nairobi Counties, Kenya.

I. INTRODUCTION

Quality is the ability to deliver services that satisfy the consumer’s needs, providing quality healthcare is an ethical obligation of all healthcare providers (Zineldin, 2006) and receiving quality care is a right of all patients Pickering (1991). Service quality was defined by Pui-Mun et al. (2006) as the ability to meet or exceed customer expectations. Sub-Saharan Africa is ranked among the lower 50% in terms of service quality performance of health systems. Report indicates that, Kenya’s health gains of the 1980s and 90s have begun to reverse. According to the World Health Organization (WHO), the country recently witnessed a general deterioration in health indicators due to rapid population growth, child nutrition problems, poverty, HIV/AIDS, acute respiratory infections, malaria, diarrhea, poor quality health facilities and services (WHO, 2008). Recent systematic reviews have highlighted quality failings in both public and private care settings in developing countries (Berendes et al., 2011) and have added power to earlier calls to standardize and assure the quality offered by private providers (Patouillard et al., 2007). There is a lack of public trust and confidence in government hospitals in terms of quality services provided at their end due to insufficient infrastructure facilities, lack of responsiveness, low reliability, and absence of empathy, obsolescent equipments, and minimal medicines availability (Zahida, 2012). This challenge demands well developed performance health systems to efficiently and effectively address the problem WHO (2000). The current study therefore uses SERVQUAL instruments to assess...
the perception of patients on service quality in public and faith-based hospitals in Kenya.

II. SIGNIFICANCE OF THE STUDY

The findings of study would be relevant and valuable to stakeholders in health care sector including health system developers, policy makers and more importantly to hospital management team to understand areas of improvement. This research results would further help healthcare providers to understand customer’s preferences by identifying the service quality dimensions that contribute to patients satisfaction. The hospitals could use the instrument (questionnaires) of this study to collect data about their patients’ perceptions in order to make strategic decisions. Finally, the findings would direct intervention efforts to improve health care provision for better treatment outcome for patients.

III. METHODS

A descriptive cross-sectional study of client perception on quality of health care offered to in-patients in public and faith based hospitals in Kiambu and Nairobi was conducted. Study setting was based in Public and faith-based hospitals. This study targeted all the in-patients aged 18 years and above who attend health services in level four public and faith based hospitals in Kiambu and Nairobi counties in Kenya, Kothari (2008). The sample size of 384 in-patients was determined using Fisher’s formula. Sampling the study used stratified random sampling to select 384 in-patient from the target population. Proportionate stratification was used to select the sample size per hospital and strata subsets were then pooled to form a random sample (Greener, 2008). Sample size in each stratum was determined proportional to the stratum’s size. Systematic sampling was used to select patient to be interviewed at exit point. Questionnaire was developed for perception of patients on service offered by faith- based with public hospitals. The questionnaire contained structured or closed questions that required respondents exercise judgment on five-point Likert scale was used. Twenty six instruments were modified from SERVQUAL instruments to reflect the environment in which the study was undertaken (Brysland and Curry, 2001).

Descriptive statistics were derived and used to analyze (using SPSSS version 22.0) perception of patients on service quality by use of percentage, frequencies, mean and standard deviation. Inferential statistical analysis was undertaken to enhance further insights of the data on perception of patient on service quality. Formulated hypothesis was tested using; Chi-Square to test significant differences among the type of hospitals at P value 0.05 and T-test to test the difference in means between public with faith-based hospitals service quality, and this was an equivalent of independent sample T-Test.

Approval to undertake the research was sought and obtained from Maseno University Graduate School and Maseno University School of Public Health and Community Development; permission to conduct research in hospitals was obtained from National Council for Science and Technology, Kenya and from ethics committee of the study hospitals.

IV. RESULTS

Descriptive analysis of five dimensions containing 26 scale questions on perception of patients on service quality in public with faith-based. The results of the respondents in Table 1.1 reveal that overall perception of the patients on tangibility dimension was perceived with higher satisfaction physical facilities appealing 64.4%, cleanliness in the ward 63.7%, toilet clean 58.9%, hospital linen are clean 58.9% in faith-based hospitals as compared with public hospitals, among all factors on tangibility except the cost of services that was perceived low in both public and faith-based hospitals the satisfaction was 23.5% in public hospitals and 23.3% in faith-based hospitals. The tangibility factor that the patients perceived to be worse in public hospitals was cleanliness of the toilet that scored as low as 1.3% and hospital linens cleanliness score 44.5% strongly disagree. Generally the level of cleanliness in public hospitals was rated low among all the factors on tangibility dimension in public hospitals as shown in Table 1.1.

<table>
<thead>
<tr>
<th>Type of facility</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Faith</td>
<td>Physical facilities are visually appealing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>45</td>
<td>18.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faith based</td>
<td>0</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>Cleanliness in the ward/room is high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>88</td>
<td>37.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faith based</td>
<td>0</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>Toilet facilities are clean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>144</td>
<td>60.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faith based</td>
<td>0</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1.1: Tangibility
<table>
<thead>
<tr>
<th>Type of facility</th>
<th>Public</th>
<th>Faith based</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>17</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>% within Tangibility</td>
<td>100.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Disagree</td>
<td>121</td>
<td>0</td>
<td>121</td>
</tr>
<tr>
<td>% within Tangibility</td>
<td>100.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Undecided</td>
<td>74</td>
<td>10</td>
<td>84</td>
</tr>
<tr>
<td>% within Tangibility</td>
<td>88.1%</td>
<td>11.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Agree</td>
<td>22</td>
<td>90</td>
<td>112</td>
</tr>
<tr>
<td>% within Tangibility</td>
<td>19.6%</td>
<td>80.4%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>4</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>% within Tangibility</td>
<td>8.0%</td>
<td>92.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>238</td>
<td>146</td>
<td>384</td>
</tr>
<tr>
<td>% within Tangibility</td>
<td>62.0%</td>
<td>38.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

From Table 1.2 on tangibility 100% of patients in public facilities interviewed disagreed whereas 80.4% of those in faith-based facilities agreed. In public 100% strongly disagreed while in faith-based 92% strongly agreed among responded interviewed.

Under null hypothesis, there is independence (no relationship) in perception of patients by type of health facility under tangibility dimension. With Pearson Chi Square value of 0.000 less than the set p value 0.05 this results being statistically significant, we reject the null hypothesis and conclude that perception among patients in the two types of facilities within tangibility dimension is dependent. Patients from faith based hospitals as from the descriptive statistics show they have positive perceptions for the tangibility dimension whereas those from the public hospitals have negative confirmed as being statistically significant with the Chi-Square analysis.
The results of perception of patients on service quality as shown in Table 1.4 indicates that in public hospitals the dimension of tangibility, patients perceived low satisfaction that’s 7.9% strongly agree and 25.5% agree while in faith-based hospitals patient perceive high satisfaction with service quality on tangibility of 47.9% strongly agree and 35.7% agree. On the other hand dimension of responsiveness public hospital scored 5.8% strongly agree and 27.5% agree showing that the perception of patients was low on dimension of responsiveness on service quality. Whereas, patients from faith-based hospitals perceived high satisfaction with responsiveness scoring 43.2% strongly agree and 38.9% agree. This represents Patients perceptions regarding service quality on reliability in public hospitals are not up to satisfaction that’s 6.4% strongly agree and 36.3% agree respectively in the faith-based hospitals patient perceived services quality on assurance to be satisfactory with 40.4% strongly agreed and 53.6% that the dimension of assurance was perceived with higher satisfaction. Among the respondents interviewed they perceived low satisfaction with the dimension of empathy in public hospitals with rating 4.8% strongly agreed and 29.9% agree while in faith-based hospitals patients perceived higher satisfaction with the service quality dimension on empathy with rating as 49.6% strongly agree and 42.1% agree. Therefore, the results of the respondents in Table 1.4 reveal that overall perception of the patients on five dimensions of service quality they perceived higher satisfaction in faith-based hospitals as compared with public hospitals among all five dimensions.

Table 1.4: Perception of Patients on Service Quality in Public and Faith-Based Hospitals

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangibility Public Hospitals</td>
<td>32.4%</td>
<td>33.0%</td>
<td>1.3%</td>
<td>25.5%</td>
<td>7.9%</td>
<td>100%</td>
</tr>
<tr>
<td>Tangibility Faith Based Hospitals</td>
<td>3.3%</td>
<td>11.5%</td>
<td>1.6%</td>
<td>35.7%</td>
<td>47.9%</td>
<td>100%</td>
</tr>
<tr>
<td>Responsiveness Public Hospitals</td>
<td>23.5%</td>
<td>39.7%</td>
<td>3.4%</td>
<td>27.5%</td>
<td>5.8%</td>
<td>100%</td>
</tr>
<tr>
<td>Responsiveness Faith Based Hospitals</td>
<td>2.7%</td>
<td>10.8%</td>
<td>4.4%</td>
<td>38.9%</td>
<td>43.2%</td>
<td>100%</td>
</tr>
<tr>
<td>Reliability Public Hospitals</td>
<td>17.0%</td>
<td>37.8%</td>
<td>2.4%</td>
<td>36.3%</td>
<td>6.4%</td>
<td>100%</td>
</tr>
<tr>
<td>Reliability Faith Based Hospitals</td>
<td>0.0%</td>
<td>3.8%</td>
<td>2.2%</td>
<td>53.6%</td>
<td>40.4%</td>
<td>100%</td>
</tr>
<tr>
<td>Assurance Public Hospitals</td>
<td>21.1%</td>
<td>34.9%</td>
<td>1.8%</td>
<td>28.0%</td>
<td>14.3%</td>
<td>100%</td>
</tr>
<tr>
<td>Assurance Faith Based Hospitals</td>
<td>0.5%</td>
<td>6.8%</td>
<td>1.0%</td>
<td>42.1%</td>
<td>49.6%</td>
<td>100%</td>
</tr>
<tr>
<td>Empathy Public Hospitals</td>
<td>20.7%</td>
<td>41.1%</td>
<td>3.5%</td>
<td>29.9%</td>
<td>4.8%</td>
<td>100%</td>
</tr>
<tr>
<td>Empathy Faith Based Hospitals</td>
<td>0.0%</td>
<td>6.7%</td>
<td>1.5%</td>
<td>46.2%</td>
<td>45.5%</td>
<td>100%</td>
</tr>
</tbody>
</table>

In the Figure 1.1 on perception of patients on service quality in public and faith-based hospitals, across all five dimensions as shown in the Figure 1.1 shows that patients are overall satisfied from the services provided by faith-based hospitals as compared with service provided by public hospitals as shown in the Figure 1.1.
Perception of Patients on Service Quality in Public and Faith-Based Hospitals

The descriptive analysis of mean and standard deviation of the respondents in faith-based hospitals reveals that overall satisfaction of the patients (i.e., 4.23 on a scale of 1 to 5, where 1 = Strongly disagree and 5 = Strongly Agree) is approximately near to 4.0 which is closer to the opinion “Agree” that shows patients on overall are satisfied with the services provided by Faith-based hospitals. Among the Individual variables, all factors have a mean greater than 4 which indicate that patients have high opinion on all the five dimensions. The standard deviation in all cases is less than 1 this shows that there is less variation in the responses while in public hospitals descriptive analysis shows that the respondents in public hospitals reveals that overall satisfaction of the patients (i.e., 2.62 on a scale of 1 to 5, where 1 = Strongly disagree and 5 = Strongly Agree) is approximately near to 2.0 which is closer to the opinion “Disagree” that shows patients on overall are not satisfied with the services provided by Public hospitals. Among the Individual variables, all of them have a mean less than 3 which indicated that patients have low opinion on all the five dimensions. The standard deviation in all cases is closer to 1 that shows that there is great variation in the responses as shown in Table 1.5.

### Table 1.5: Descriptive Statistics of Mean

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Type of facility</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangibility:</td>
<td>Faith-based</td>
<td>146</td>
<td>3</td>
<td>5</td>
<td>4.14</td>
<td>0.504</td>
</tr>
<tr>
<td></td>
<td>hospitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public hospitals</td>
<td>238</td>
<td>1</td>
<td>5</td>
<td>2.43</td>
<td>0.778</td>
</tr>
<tr>
<td>Responsiveness:</td>
<td>Faith-based</td>
<td>146</td>
<td>3</td>
<td>5</td>
<td>4.09</td>
<td>0.379</td>
</tr>
<tr>
<td></td>
<td>hospitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public hospitals</td>
<td>238</td>
<td>1</td>
<td>5</td>
<td>2.52</td>
<td>0.815</td>
</tr>
<tr>
<td>Reliability:</td>
<td>Faith-based</td>
<td>146</td>
<td>3</td>
<td>5</td>
<td>4.31</td>
<td>0.448</td>
</tr>
<tr>
<td></td>
<td>hospitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public hospitals</td>
<td>238</td>
<td>1</td>
<td>5</td>
<td>2.77</td>
<td>0.909</td>
</tr>
<tr>
<td>Assurance:</td>
<td>Faith-based</td>
<td>146</td>
<td>3</td>
<td>5</td>
<td>4.33</td>
<td>0.480</td>
</tr>
<tr>
<td></td>
<td>hospitals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public hospitals</td>
<td>238</td>
<td>1</td>
<td>5</td>
<td>2.79</td>
<td>0.913</td>
</tr>
</tbody>
</table>
Empathy: Faith-based hospitals

<table>
<thead>
<tr>
<th></th>
<th>Public hospitals</th>
<th>Overall: Faith-based hospitals</th>
<th>Overall: Public hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>146</td>
<td>238</td>
<td>238</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>4.31</td>
<td>2.57</td>
<td>4.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.62</td>
</tr>
</tbody>
</table>

T test analysis for perception of patient on public and faith-based hospitals where one sample test. T test was used to test if there was a mean difference in the dimensions taking the neutral rating as the mean. The hypotheses for the dimensions were formulated as shown in Table 1.6 of One-Sample Test for Public Hospitals.

H1: The opinion of patients regarding tangibility is neutral (μ = 3)
H2: The opinion of patients regarding reliability is neutral (μ = 3)
H3: The opinion of patients regarding responsiveness is neutral (μ = 3)
H4: The opinion of patients regarding assurance is neutral (μ = 3)
H5: The opinion of patients regarding empathy is neutral (μ = 3).

From results in Table 1.6 all the dimensions are statistically significant at 0.05. The means of the patients have either dominated positive or negative perception about the factors within all the five dimensions. From the t value mean different at 95% confidence interval of the difference determined whether the patient agree or disagree depending on the values (positive or negative). As in the Table 1.6 faith-based hospitals had positive values whereas those from public hospitals had negative values. The results indicate that respondents from faith-based hospitals agreed with the dimensions whereas those from public hospitals disagreed.

Table 1.6: One-Sample Test for Public and Faith-based hospitals

<table>
<thead>
<tr>
<th></th>
<th>Public Faith-Based</th>
<th>Public Faith-Based</th>
<th>Public Faith-Based</th>
<th>Public Faith-Based</th>
<th>Public Faith-Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Value = 3</td>
<td>t</td>
<td>df</td>
<td>Sig. (2-tailed)</td>
<td>Mean Difference</td>
<td>95% Confidence Interval of the Difference</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Tangibility</td>
<td>11.20</td>
<td>27.26</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.56</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>9.036</td>
<td>34.74</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.47</td>
</tr>
<tr>
<td>Reliability</td>
<td>3.853</td>
<td>35.24</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.22</td>
</tr>
<tr>
<td>Assurance</td>
<td>3.465</td>
<td>33.57</td>
<td>0.001</td>
<td>0.000</td>
<td>-0.20</td>
</tr>
<tr>
<td>Empathy</td>
<td>-7.42</td>
<td>30.6</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.42</td>
</tr>
</tbody>
</table>

In the table 1.7 the summary of descriptive results shows that the mean score of public are less than 3.0 implying negative perception while the mean score in faith-based is more than 3 indicating positive perception
Table 1.7: Summary of Descriptive Statistic of Faith-Based & Public Hospitals

<table>
<thead>
<tr>
<th>Type of facility</th>
<th>Public</th>
<th>Faith-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>238</td>
<td>146</td>
</tr>
<tr>
<td>Mean</td>
<td>2.43</td>
<td>4.14</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.778</td>
<td>.504</td>
</tr>
<tr>
<td>Std. Error Mean</td>
<td>.050</td>
<td>.042</td>
</tr>
<tr>
<td>Responsiveness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>238</td>
<td>146</td>
</tr>
<tr>
<td>Mean</td>
<td>2.52</td>
<td>4.09</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.815</td>
<td>.379</td>
</tr>
<tr>
<td>Std. Error Mean</td>
<td>.053</td>
<td>.031</td>
</tr>
<tr>
<td>Reliability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>238</td>
<td>146</td>
</tr>
<tr>
<td>Mean</td>
<td>2.77</td>
<td>4.31</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.909</td>
<td>.448</td>
</tr>
<tr>
<td>Std. Error Mean</td>
<td>.059</td>
<td>.037</td>
</tr>
<tr>
<td>Assurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>238</td>
<td>146</td>
</tr>
<tr>
<td>Mean</td>
<td>2.79</td>
<td>4.33</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.913</td>
<td>.480</td>
</tr>
<tr>
<td>Std. Error Mean</td>
<td>.059</td>
<td>.040</td>
</tr>
<tr>
<td>Empathy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>238</td>
<td>146</td>
</tr>
<tr>
<td>Mean</td>
<td>2.57</td>
<td>4.31</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.891</td>
<td>.516</td>
</tr>
<tr>
<td>Std. Error Mean</td>
<td>.058</td>
<td>.043</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>238</td>
<td>146</td>
</tr>
<tr>
<td>Mean</td>
<td>2.62</td>
<td>4.23</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.760</td>
<td>.347</td>
</tr>
<tr>
<td>Std. Error Mean</td>
<td>.049</td>
<td>.029</td>
</tr>
</tbody>
</table>

The independent-samples t-test was used to compare the means between hospital types that is public and faith-based hospitals for each dimension and an overall for all the patients. The analysis depicting that all the hypotheses are rejected and there is significant difference in the opinion of patient’s perception on service quality in public and faith-based hospitals. That is the satisfaction factors differ on the basis of the hospitals type among all the five dimensions of service quality.

Table 1.8: Independent Samples Test for Public and faith-Based Hospitals

<table>
<thead>
<tr>
<th>Type of facility</th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>Tangibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>23.007</td>
<td>.000</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-26.008</td>
<td>380.870</td>
</tr>
<tr>
<td>Responsiveness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>68.384</td>
<td>.000</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-25.501</td>
<td>360.291</td>
</tr>
<tr>
<td>Reliability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>67.189</td>
<td>.000</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-22.035</td>
<td>367.683</td>
</tr>
</tbody>
</table>
V. CONCLUSION

The study revealed that faith-based hospitals patients had higher satisfaction perception on services quality as compared to public hospitals. Therefore, the study revealed that there is difference in patient perception of service quality between faith-based and public hospitals. The current study has provided evidence that patients in public hospitals are found dissatisfied with health service provided.

ACKNOWLEDGEMENTS

I would like to make a special mention of the individuals and institutions that have made this research possible. My gratitude goes to Maseno University for granting me the opportunity to undertake a PhD degree. I also acknowledge, with gratitude the financial and moral support I received from the Sisters of St. Joseph of Mombasa. My special thanks to my supervisors Prof. Rosebella Onyango and Prof. James H. Ombaka for time, intellectual discussions and guidance throughout the research. I greatly recognize and appreciate their humility, and wealth of knowledge that enabled me to gather from their critiques.

I wish to convey my sincere gratitude to Medical Superintendent of Kiambu, Mbagathi District hospitals, and the Hospital Administrators of Nazareth and Jamaa Mission hospitals and their teams for the permission to undertake the study in the institutions. I further acknowledge the contribution and enhanced knowledge received from friends during informal consultations especially Rev. Dr. H. Mativo. Last but not least, I thank all my respondents for sparing time to respond to my questionnaires.

God bless you all.

REFERENCES


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Correspondence Author – Sr. Margaret Wandera Nyongesa, MPH, PhD. P.O Box 77807-00622, Nairobi – Kenya, Tel: Mobile; 0722 561826/0772148062, E-mail: maggwande@gmail.com
Ammonia Emissions at Broiler Farmings in Palangka Raya Central Kalimantan

Paulini*, Sudiarso**, Budi Prasetya**, Aminudin Afandhi**

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Abstract - Ammonia (NH3) emissions from livestock sector are one of the large contributors of greenhouse gas. The objective of this research is to determine ammonia emissions at three broiler farmings in Palangka Raya, Central Kalimantan, emissions measurement was conducted at the top and bottom of the poultry house using NH3 sensor conducted in the morning, afternoon and evening. In addition, the measurement is also conducted to the climatic factor, i.e. air temperature, humidity and wind speed. An analysis of the sample of chicken manure is also conducted to determine N and crude protein contained in chicken manure and ration used by poultry farmers during the study. The result of this study reveals that a number of ammonia emissions of the three farming measured on the top of the poultry house is 20,55 ppm, 14,61 ppm and 15,85 ppm, while at the bottom is 18,81 ppm, 15,50 pm and 14,91 ppm. A lot of ammonium emissions of those three farming are influenced by the lack of waste management, crude protein in the ration is not well-digestible so the content of N in the chicken manure is still high and the factor of climatology and humidity surrounding.

Index Terms- Emissions, NH3, broiler

I. INTRODUCTION

The improvement of broiler farming in Central Kalimantan, especially in Palangka Raya is welcome in the last five years, this is proven by the increase of chicken meat fulfillment until 30% compared to the needs in 2011 (Department of agriculture and farm or Distanak 2015). However, chicken farm business is one of the factors participating to pollute the environment. Given that more or less 80% of the total of NH3 emissions in Europe and United States comes from stock waste (Corinair, 2007).

For that matter, to realize an efficient and environmentally-friendly business so the husbandry management, caging, and waste handling should be paid attention. The Ministry of Agriculture and Farm has realized the matter by issuing the Ministerial decree through the SK Mentan No. 237/1991 and SK Mentan No. 752/1994, and UU No. 32/2009 on Living environment asserting that the farm business with particular population needs to be completed with the effort of environmental management and monitoring and it should be in accordance with the regulation that poultry house is not allowed to be established around the density inhabit as it potentially causes environmental pollution. Broiler farm business with more than 15,000 chickens per cycle is located in one place, while the layers with more than 10,000 chickens are located in an overlay of location.

The largest annual contributor of NH3 emissions in the atmosphere comes from livestock sector (FAO, 2016). According to Todd et.al (2009), livestock ammonia emissions are influenced by the following factors; intake level of N, caging condition, facility of chicken manure storage, etc. The content of N in the ration is considered as the main NH3 contributor as the emissions increase with the enhancement of excretion N caused by the crude protein supply is getting high (Todd et.al., 2006).

The amount of manure produced by chicken in a day is pretty more; each chicken produces about 0.15 kg (Charles and Hariono, 1991). Fontenot et al., (1983) reports that the average production of fresh layers manure is 0.06 kg/day/chicken, and the content of the dry material is 26%, while the broilers produce manure by 0.1 kg/day/chicken and the content of its dry material is 2.5%. The pollution source of chicken farm business comes from the chicken manure containing nitrogen and sulfide, which at the time of manure accumulation or storage, the process of decomposition by the microorganism forming gas of ammonia, nitrate, and nitrite, as well as sulfide, happens. Those gasses which cause odor (Sevensson, 1990; Pauzenga, 1991). The high content of ammonia in the feces also reveals the possibility of less perfect digestion process or over protein in the cattle feed, so that not all nitrogen is absorbed as ammonia but issued as ammonia contained in the manure (Pauzenga, 1991).

This research aims to find out the concentration of ammonia of the manure sample and in the direct air using NH3 sensors (tehu, R. 2016) as well as measuring factors influencing such as air temperature, humidity, wind speed and direction, and acknowledging sanitation of livestock environment.

II. METHODOLOGY

1. Field Survey

NH3 emissions measurement was conducted at 3 different broiler farmings (2 broilers farmings and 1 layers farming). This research was carried out for a year. Table 1 indicates general condition of farming where the study is conducted.

Table 1. General boilerplate of the Location of NH3 Emissions Source
Observation | Farming
---|---
| Layers | Broilers | Broilers

| Location | Jalan Karanggan, Palangka Raya | Jalan Manduhura, Palangka Raya | Jalan Banteng, Palangka Raya |
| Size (ha) | 10 | 6 | 6 |
| Type of Cage | Slay System and Cage | Slat System | Slat System |
| Total Cage | 10 cages | 7 cages | 7 cages |
| The number of population | ± 20,000 chickens | ± 20,000 chickens/husbandry period | ± 20,000 chickens/husbandry period |
| A strain of cattle | Red Layers | Mb 202 P/Pt Japfa COMFEED INDONESIA | Mb 202 P/Pt Japfa COMFEED INDONESIA |
| Ration | Benfeed/PT JAPFA COMFEED INDONESIA | BR1 and BR2/PT CHAROEN POKPHANG INDONESIA | BR1 and BR2/PT CHAROEN POKPHANG INDONESIA |
| The Frequency of Feeding | 2 times a day | Adlibitum | Adlibitum |
| Production | 15,000-17,000 eggs/day | ± 19,000 chickens/husbandry period | ± 19,000 chickens/husbandry period |
| Mortality | 3-5% | 1-3% | 1-3% |

2. **Measurement with NH3 sensor**
Ammonia measurement was conducted at the top and the bottom of poultry housing using NH3 sensor (Teguh, R. 2016). This NH3 sensor will detect ammonia concentration from the surrounding air through giving an indication in the form of sensor lights. The lamp will continuously light, blue indicates that the concentration is very low and changing into the red if the ammonia concentration is high. NH3 sensors will be connected to the laptop or computer which has an application named Arduino-1.8.1.window, so the sensor will read the level of concentration in the surrounding air. This NH3 sensor is indicated in the following figure.

Figure 1. NH3 sensor, temperature, humidity and Speed Direction (Teguh, R. 2016)

Microclimate measurement as the backup data is also performed to Air temperature measurement using digital Electronic Thermo-hygrometersLS-2017 and NH3 sensor (Teguh, R. 2016). Air temperature measurement was performed in and out of
poultry housing on 1.5-meter height above the ground level. Daily air temperature average is calculated with equation (Tjasyono, 2004):

\[
T_{\text{daily average}} = \text{formula 1}
\]

Description:
\( T \) Daily average = average daily temperature
\( T_{7}, T_{13}, T_{18} = \) air temperature observation at 6 am, 1 pm, and 6 pm.

Humidity is measured using digital Electronic Thermo-hygrometers LS-207 and NH3 sensor (Teguh, R. 216). Daily average air humidity is counted by the equation:

\[
\text{Daily average RH} = \text{formula 2}
\]

Description:
\( \text{Daily average RH} = \) average daily humidity
\( R_{AH7}, R_{H13}, R_{H18} = \) air temperature observation at 6 am, 1 pm, and 6 pm.

Wind speed is measured using anemometer RS 232 BTU-Psychrometer, while the wind direction is measured using simple methods, i.e. assisted by smoke and compass.

3. Laboratory Analysis

Analysis data of ammonia concentration measurement is also conducted to the chicken manure, chicken manure uptake as a sample was conducted at several points, namely two points inside the poultry house and 2 points outside the poultry house (the bottom of the poultry). The sample was then put into a clean and dry container, every sample was stuck a label of date, time, uptake point and the sample taker's name, the next step was keeping the sample of chicken manure in the freezer temperature (-10°C), then being dried at the temperature of 120°C and then analyzed using proximate analysis method. The methods used to analyze gross of energy and free nitrogen are Bomb Calorimeter and Kjehdal. The cattle feed was also analyzed to find out the nutrient content within, type of analysis used is proximate, Bomb calorimeter and Kjehdal.

The data of ammonia concentration was then compared to the ambient air quality standard issued by the government as stipulated in the government regulation (PP) number 41/1999 (Legal Bureau, 1999). The data of NH3 content at broiler farming was then analyzed descriptively and then connected with the common condition of the farming location, climate condition (air temperature, humidity, wind speed and direction, and the height of anytime) during the sample uptake of air, and the husbandry management system applied at broiler farming and the nutrient content of the cattle feed and the manure.

III. RESULTS

NH3 emissions concentration measurement at broiler chicken farmings in Palangka Raya along this time has not been performed yet. Table 2 indicates the result of measurement of NH3 concentration.

<table>
<thead>
<tr>
<th>Emissions Source</th>
<th>NH3 (ppm)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Morning</td>
<td>Afternoon</td>
</tr>
<tr>
<td>Layers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom of Poultry House</td>
<td>12,00</td>
<td>31,52</td>
</tr>
<tr>
<td>Top of Poultry House</td>
<td>10,96</td>
<td>38,70</td>
</tr>
<tr>
<td>Total</td>
<td>22,96</td>
<td>70,22</td>
</tr>
<tr>
<td>Broilers**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom of Poultry House</td>
<td>12,23</td>
<td>14,79</td>
</tr>
<tr>
<td>Top of Poultry House</td>
<td>7,83</td>
<td>17,25</td>
</tr>
<tr>
<td>Total</td>
<td>20,06</td>
<td>32,04</td>
</tr>
</tbody>
</table>

Table 2. NH3 Concentration Data from the Chicken Farming in Palangka Raya
The result of measurement using NH3 sensor indicates that from those three farmings, the highest NH3 emissions is at the layer farming measured in the afternoon and at the bottom of the poultry house, in contrary, the lowest NH3 emissions is at the broiler farming ** measured at the top of the poultry house in the morning.

The highest NH3 emissions at layer farming of the measurement in the afternoon and at the bottom of the poultry house, while the lowest NH3 emissions are also measured at the bottom of poultry house in the morning. The highest NH3 emissions of broiler farming are measured at the top of poultry house in the morning, while the lowest is also at the bottom of poultry house but being measured in the morning. The highest NH3 emissions from the broiler farming *** is measured at the bottom of the poultry house in the evening, while the lowest NH3 emission is measured at the top of the poultry house in the afternoon.

The research result of NH3 emission on broiler farms in Palangka Raya compared to the threshold of NH3 of broiler chickens according to Rits the (2004) is between 20-102 ppm. For that matter, broiler chicken farms in Palangka Raya is already dangerous enough for livestock, in which the average concentration, when measured at the top of the layer's poultry house, is 18.51 ppm, while at broiler's is 15.50 and 14.91 ppm, otherwise the NH3 concentration at the bottom of the layer's poultry house is 20.55 ppm and 14.61 and 15.85 ppm on broiler's chicken farming.

### Table 3. NH3 and Nutrient Contained in the Chicken Manure, Nutrient Content of Ration

<table>
<thead>
<tr>
<th>Manure</th>
<th>KA</th>
<th>PK</th>
<th>N</th>
<th>SK</th>
<th>LK</th>
<th>Ca</th>
<th>P</th>
<th>Abu</th>
<th>GE</th>
<th>NH3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location I</td>
<td>8.09</td>
<td>19.64</td>
<td>3.14</td>
<td>21.17</td>
<td>1.60</td>
<td>3.78</td>
<td>1.72</td>
<td>-</td>
<td>2563.33</td>
<td>2.35</td>
</tr>
<tr>
<td>Location II</td>
<td>8.11</td>
<td>22.70</td>
<td>3.67</td>
<td>22.13</td>
<td>2.57</td>
<td>1.58</td>
<td>0.85</td>
<td>-</td>
<td>3301.36</td>
<td>1.83</td>
</tr>
<tr>
<td>Location III</td>
<td>8.56</td>
<td>19.43</td>
<td>3.11</td>
<td>26.83</td>
<td>1.96</td>
<td>1.72</td>
<td>1.07</td>
<td>-</td>
<td>3151.15</td>
<td>1.26</td>
</tr>
<tr>
<td>Rations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Layers</td>
<td>8.97</td>
<td>18.56</td>
<td>3.16</td>
<td>3.41</td>
<td>5.75</td>
<td>4.42</td>
<td>0.72</td>
<td>11.7</td>
<td>3894.03</td>
<td></td>
</tr>
<tr>
<td>Broilers</td>
<td>9.47</td>
<td>23.06</td>
<td>3.57</td>
<td>3.77</td>
<td>6.22</td>
<td>1.19</td>
<td>0.68</td>
<td>6.12</td>
<td>4189.83</td>
<td></td>
</tr>
</tbody>
</table>

Description: Location I: Broiler Farming at Jalan Karanggan  
Location II: Broiler Farming at Jalan Manduhara  
Location III: Broiler Farming at Jalan Banteng

The result of analysis from the Nutrition Laboratory of Faculty of Animal Husbandry, Brawijaya University (table 3) indicates that the protein contained in the layers manure is higher than that of ration amounting to 19.64% while in the ration is only 18.56%. While the nutrient content of ration of broiler chicken is higher (23.06%) than that of chicken manure (22.70 and 19.43%). The concentration of N in the layers manure is 31.62, while in the broilers manure is 36.96 and 31.42%, in contrary, the concentration of N in the ration of layers is 46.95% and 53.05% for broilers.
Table 4. The Data of Temperature, Humidity and Wind Speed

<table>
<thead>
<tr>
<th>Farming</th>
<th>Daily Mean Temperature (°C)</th>
<th>Daily Mean Humidity (%)</th>
<th>Wind Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Morning</td>
<td>Afternoon</td>
<td>Evening</td>
</tr>
<tr>
<td>Layers *</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom of Poultry House</td>
<td>30.65</td>
<td>78.53</td>
<td>6</td>
</tr>
<tr>
<td>Top of Poultry House</td>
<td>30.05</td>
<td>78.99</td>
<td></td>
</tr>
<tr>
<td>Broilers**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom of Poultry House</td>
<td>30.73</td>
<td>79.03</td>
<td>5</td>
</tr>
<tr>
<td>Top of Poultry House</td>
<td>30.40</td>
<td>80.07</td>
<td></td>
</tr>
<tr>
<td>Broilers***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom of Poultry House</td>
<td>30.07</td>
<td>78.56</td>
<td>6</td>
</tr>
<tr>
<td>Top of Poultry House</td>
<td>30.69</td>
<td>79.17</td>
<td></td>
</tr>
</tbody>
</table>

Description: * Layer Farming at Jalan Karanggan  
** Broiler Farming at Jalan Manduhara  
*** Broiler Farming at Jalan Banteng

The data of climatology includes air temperature, humidity and wind speed at the three farmings is presented in table 4, the highest mean temperature is at the layer farming located at Jalan Manduhara, i.e. 30.58°C, followed by broiler farming located at Jalan banteng by 30.38°C and the last is Layer farming at Jalan Karanggan by 30.25°C. The highest humidity of the Broiler farming located at Jalan Manduhura is 79.55%, followed by broiler farming located at Jalan Banteng by 78.86% and the last is layer farming at Jalan Karanggan by 78.76%. While the wind speed between those three farmings does not indicate a significant difference, the highest one is at the broiler farming located at Jalan Manduhara by 5.33 mph, broiler farming at Jalan Karanggan by 5.33 mph and layer farming at jalan Banteng by 4.66 mph.

IV. DISCUSSION

The high degree of NH3 emissions at Broiler Farmings in Palangka Raya presented in table 2 is influenced by several factors that is husbandry management, chicken manure management, management of cattle feed and climatology factors such as air temperature, humidity and wind speed.

The result of the study reveals that the highest NH3 emissions are at the layer farming (39.07%) compared to two broiler farming’s (30.13 and 30.78%). The high degree of NH3 emissions at the layer farming is due to the lack of husbandry management, there is no drainage in these three farmings, so that the wastewater used to wash poultry equipment or the spilled of chicken's drinking water is left to spill, as the result, the chicken manure is always wet. Humidity can influence a number of emissions gas resulted from the source of chicken manure emissions. The higher the humidity, the better for the microorganism to grow and develop and the much more the process of renovation which is happened. According to Ryak (1992), humidity plays a role in the metabolism of macroorganism which indirectly affects the oxygen supply. If the humidity is greater than 60%, the nutrients will be washed, the volume of air decreases, consequently macroorganism activity will decrease and will occur anaerobic fermentation that causes odor. According to Charles and Hariono (1991), the odor-producing compounds can be easily formed under the anaerobic conditions such as wet piles of chicken manure. Such compounds may be produced during the decomposition process of chicken manure.

NH3 emissions from the poultry housing can be lowered if the content of dry material of chicken manure is greater than or equal to 60%. According to Elwinger and Svensson (1996), reducing water spilled so that the manure remains dry will help reduce NH3 emissions.

Another factor that affects the high degree of NH3 emissions at layer farming is due to the waste management has not been well implemented. This farm lets the chicken manure piled between the sidelines or at the bottom of the cage. The manure is collected if only there is a buyer who will function it as fertilizer. In contrast, the two broiler farms collect the chicken manure twice during the husbandry period (40 days or 4-5 weeks). The first collection is performed at 25 days of age and at 40 days of age or at harvest. These three farms apply the same methods to manage the chicken manure, i.e. broiler and layer feces are collected and directly loaded into sacks and then piled on the sides or in front of the cage and waiting for the buyer to carry it. The buildup of chicken manure which is covered can reduce the emission of NH3. According to J.Webb et.al. (2004), the chicken manure been collected and then directly deposits on concrete made of steel or wooden planks and roofs can reduce NH3 emissions by 80%. Closure of a liquid chicken drop shelter is also very effective at reducing NH3 emissions by up to 80%, where the lid is circular and made of steel or concrete (Sommer et al, 1993) Closure of chicken poo shelters should not be too tight,
there must be ventilation to prevent the formation of methane (Rom, 1996). The next step is to reduce NH3 emissions from the source, with the management of a cost-effective, practical and widely-enforced source of emissions.

The content of N in chicken manure on three farms where the study was 3.14%, 3.67% and 3.11% (table 3), on the contrary, the results also showed that N content in laying chicken rations and broiler rations was 3.16% and 3.57%. It is obvious that the N contained in the ration can not be completely digested by the chicken because the N content in chicken manure is also still very high. In general, rations are needed by livestock to meet basic living needs and for production. According to Rots (2004), to increase the utilization of N in the ration, so the quantity and quality of protein must be precise so as to maximize production with low ration cost.

Ration supply with amino acid content or crude protein that suits the needs can decrease the amount of N secretion in feces and urine. Provision of essential amino acid can reduce the crude protein supply, certainly without affecting the level of livestock production. However, the reduction of crude protein in the ration should consider the price of synthetic amino acid and other ration materials, so that the livestock production remains optimal and NH3 emissions can be reduced (Clark et al., 2005).

Reduction of the crude protein content in the ration is an effective way to reduce the excretion of N in the urine of monogastric animals; the use of high fiber sources such as fermented carbohydrates can change the excretion of N from urine to feces and be able to reduce NH3 emissions (Payeur et al 2002). Adjustment of protein intake in the ration is required for the production rate and to reduce the excretion of N. Excess of the N-protein will be excreted in the form of urea (uric acid in poultry) (Cattle: Smiths et al. 1995; Pigs: Kay and Lee 1997; poultry: Elwinger and Svensson 1996), is a major source of NH3 emissions from livestock manure. Reducing protein intake will reduce NH3 emissions, then emissions will be reduced at all stages of manure management.

The mean temperature between the measurements above the ingredients and under the layer farm and two broiler farms is 30.35°C, 30.57°C and 30.38°C, otherwise, the NH3 emissions from the three farms are 58.59 ppm, 45.17 ppm, and 46.14 ppm. The data states that the higher the temperature, the lower the NH3 emissions. Soedomo (2001) states that air temperature directly affects the condition of atmospheric stability. In stable conditions, ie, during the air temperatures which is lower than the environment, air pollutant masses can not rise but remain in the atmosphere and accumulated, thereby increasing the concentration of pollutants. Conversely, when the air temperature is higher than the air temperature of the environment, then the air pollutant mass will rise and spread, so there is no deposition on the surface and will minimize the concentration of pollutants. According to Misselbrook et al. (2005) temperature and wind speed show a significant influence when the chicken manure drops to the ground.

This study reveals that temperature is proven influencing NH3 emissions, although other factors could also affect, such as livestock density, rainfall and chicken manure management (method of collecting chicken manure and its frequency). To reduce NH3 emissions, the best thing to do is always paying attention the management of livestock waste, chicken manure collection of productive layer farming should be done twice a week, so the buildup of chicken manure can be avoided. Making the waste shelters permanently and closed. Poultry farmers pay more attention to the nutritional needs of the chicken, especially their protein so that ammonia emissions can be reduced and cost of feeding can also be lowered.

V. CONCLUSIONS

This study concludes that the average NH3 emissions measured at the top of the poultry house from those three farms are 18.51; 15.50 and 14.91 ppm, in contrary, NH3 emission at the bottom of the poultry house is as follows, 20.33; 14.61 and 15.85 ppm. Factors influencing the high average of NH3 emissions in those three farms is humidity and wind speed, where the average daily temperature is at the top of the poultry house by 30.64°C, 30.79°C and 30.07°C and at the bottom of the poultry house by 30.05°C, 30.40°C and 30.69°C, while the average humidity at the top of cage is 78.53%, 79.03%, and 78.56%, while at the bottom of poultry house is 78.99%, 80.07%, and 79.17%. With each wind speeds is 5.33 mph, 5.33 mph, and 4.66 mph.

Another factor also influencing is the livestock waste management, i.e. chicken manure, at which for layer farming, it is done anytime, while the broiler farm collects it two times per husbandry period. In addition, the high protein content and N in rations that exceed the needs of chicken livestock also plays a role.

VI. ACKNOWLEDGMENTS

The writers want to say thank you to THE MINISTRY OF RESEARCH AND HIGHER EDUCATION for funding support for the implementation of this research (doctoral grant) and to Mr. H. Suluhuddin and Mr. Andi Bustan, the owner of the farm where the research was conducted.

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The Role of Computed Tomography in Diagnosis of Unilateral Congenital Choanal Atresia in a Teenager: A Case Report

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Abstract: Choanal atresia is a rare malformation in newborns and infants. It could be a life threatening condition in neonates. We present a 15 year old female with history of recurrent right sided nasal discharge since birth. With Computed Tomography (CT) and CT Choanography, she was diagnosed to have unilateral (right sided) membranous choanal atresia which was treated by simple puncture transnasally with post-op stenting.

Index Terms: choanal atresia, girl, computed tomography, choanography

I. INTRODUCTION

Choanal atresia is the developmental failure of the nasal cavity to communicate with the nasopharynx. It is a rare malformation that causes airway obstruction in newborns and infants. It has an incidence of 1 in 5000-8000 live births. Females are more affected than males with a M: F of 1:2 and it is frequently unilateral and right sided. The atresia could be bony, membranous or mixed. The clinical presentation depends on whether it is unilateral or bilateral. Bilateral atresia is a life threatening condition as neonates are obligate nasal breathers and is one of the leading causes of sudden infant death syndrome. Unilateral atresia may present late with recurrent one sided nasal blockage and rhinitis. The diagnosis is established by computed tomography (CT) and CT choanography. This case is reported because of its rarity and late presentation and to emphasize the need for inclusion of CT in evaluating patients with recurrent nasal blockage.

II. CASE REPORT

KS is a 15 year old female student who presented to the ear, nose and throat unit (ENT) of Usmanu Danfodiyo University Teaching Hospital Sokoto with complaints of persistent right nasal discharge since birth. There was history of recurrent right nasal discharge and headache. No cough and no fever. She was treated on several occasions in a secondary health center with no satisfactory result and decided to seek medical care in tertiary health center. There was no family history of choanal atresia.

On physical examination she was fully conscious, not in obvious respiratory distress, not pale, anicteric and acyanosed. Examination of the nasal cavities showed that the right nasal cavity was filled with thick tenacious mucoid discharge. Nasogastric tube size 8 could not be passed beyond 4cm. The left nasal cavity was patent. A provisional diagnosis of suspected choanal atresia was made and she was referred to radiology department for computed tomography (CT) of the nose and paranasal sinuses.

The non contrast CT images revealed an isodense septum in the posterior nasal passage on the right extending from the medial wall of the right maxillary antrum to the vomer. No bony component was demonstrated in it. An isodense collection with air-fluid level is demonstrated anterior to the septum in keeping with the tenacious mucoid discharge seen on physical examination. There was thickening of the vomer, medial deviation of the medial wall of the right maxillary antrum and associated narrowing of the choanal air space distance on the right side measuring about 2.5mm (Fig.1). The left nasal cavity was normal. There was mucosal thickening involving both maxillary antra (Fig. 2) with fluid collection on the left antrum (Fig 3). The remaining paranasal air sinuses were clear. Images of CT choanography acquired after instillation of non ionic contrast medium into the right nasal cavity showed abrupt termination of the contrast column in the posterior choanal area with failure of the contrast to pass into the nasopharynx (Figs.2 and 3). A diagnosis of unilateral membranous choanal atresia was made.

She had nasal toileting with subsequent repair of the atresia using simple puncture transnasally with post-op stenting. Her symptoms greatly improved with no re-stenosis on follow up visits.
FIGURE 1: Non contrast axial CT showing an isodense septum at the posterior nasal space on the right side due to atresia (curved arrow) with collection and air fluid level anteriorly. Note the thickening of the vomer, medial deviation of the posterior right maxillary antrum and narrowing of the right posterior nasal air space (straight arrow).

FIGURE 2: Axial CT choanogram showing termination of contrast column at the atretic site (arrow) with air-contrast level anteriorly. The filling defect is due to enlarge turbinate. Note the mucosal thickening in both maxillary antra (curved arrows).
III. DISCUSSION

Choanal atresia (CA) is a rare congenital disease of the nasal airway where no connection exists between the nasal cavity and the nasopharynx. It was first described by Johann Roderer in 1755\(^2\). It is commoner in female and unilateral atresias are more common than bilateral\(^4\) as seen in this patient. In more than 90% of cases of CA, the abnormality is partly or completely osseous. Pure membranous atresia is rare\(^4\). Isyaku et al reported a case of bilateral CA in Ibadan being membranous on the right side and bony on the left\(^5\). This case is unilateral (right sided) and of the rare membranous type.

The cause of choanal atresia is unknown; however classic theories of embryogenesis of posterior choanal atresia implicate persistence of either the nasobuccal membrane or failure of the buccopharyngeal membrane to recanalized\(^6\). Most cases of CA are isolated malformation, but association with other congenital deformities is not exceptional and has been reported in literature as in the ‘CHARGE’ syndrome (Colobomatous blindness, Heart diseases, Atresia of the choana, Retarted growth, Genital hyperplasia in males, Ear deformity)\(^2,6\). No other congenital anomalies were detected in the case here presented.

The clinical presentation of this condition depends on whether it is unilateral or bilateral. The bilateral complete type is incompatible with life as newborn human babies are obligatory nose breathers. However if it is incomplete the neonate presents with nasal obstruction and cyanosis soon after birth. Unilateral atresia may go unnoticed or patient may have recurrent one sided nasal blockage and rhinitis only to be diagnosed later in life\(^6\). Cases of adolescent and adult CA have been reported\(^4,6\). The index case is a unilateral CA diagnosed at adolescence.

Plain radiography is an imaging method for initial radiologic assessment of patient suspected to have CA. An NG tube with a radiopaque tip may be passed into the nasal cavity and advanced to the furthest it can go and then a radiograph (lateral) is taken. This can be done before choanography and computed tomography\(^7\). Conventional choanography has been the traditional method of diagnosis of choanal atresia. However CT is the current investigation of choice and when combined with choanography can differentiate stenosis from atresia. Axial scans are best for assessment of choanal atresia and may show a unilateral or bilateral posterior nasal narrowing with an obstruction. The airway is less than 3mm measured at the level of the pterygoid plates in axial plane. There may be presence of air-fluid level above the obstruction point. It may also show thickening of the vomer and medial bowing of posterior maxillary sinus\(^4,5,7\). Most of these features have been demonstrated in this case (Fig.1).

The differential diagnosis of this condition includes nasolacrimal duct mucocele, pyriform aperture stenosis, sinonasal mucoid impaction and nasal polyp. These are usually differentiated from CA based on its described imaging features\(^3,8\).

The treatment of membranous CA is by endoscopic perforation. Osseous atresia may require choanal reconstruction or transpalatine resection of thick vomer\(^6\). The success rate following endoscopic treatment was reported as 62- 100%\(^9\). This patient had unilateral membranous atresia and was treated successfully by endoscopic puncture with post-op stenting.

IV. CONCLUSION

Using Computed Tomography (CT) and CT Choanography, a 15 year old girl presented with history of recurrent right sided nasal discharge since birth was diagnosed to have unilateral (right sided) membranous choanal atresia. She was treated by simple puncture transnasally with post-op stenting.
REFERENCES

Shoppal – Best Offers at Your Fingertips


Sri Lanka Institute of Information Technology(Pvt) Ltd

Abstract- Technology expansion has numerously contributed to marketing. The researchers built “ShopPal” to provide hassle-free shopping experiences to users. This is a mobile application displaying advertisements of individual shopping areas, not shopping malls. It also consists of billboards in shops that would display promotions in the shopping place based on age category of majority present in the area at a given time. A stored procedure was used to find preferences of given age categories. It is used to provide suggestions when consumers select product choices, when registering. Customized offers based on location, tracked using Global Positioning System (GPS), are sent to users. Customer connects to billboard via Bluetooth. Clustering is used to identify age category of majority of gathered customers and promotions are displayed accordingly. The system would be greatly beneficial to consumers and shop owners. “ShopPal” is an ideal location-based offer advertising system that gives consumers a hassle-free shopping experience.

Index Terms- Offer Advertising, K-means Clustering, Stored Procedure, GPS

I. INTRODUCTION

Advertising has reached new heights at present and has even reached a point where offers and promotions are advertised not only based on the user preferences and interests but also on location. With this new trend, it is of importance to have a system that would not only support mobiles but also one that would give an alternate option of viewing the offer or promotion for the targeted audience. A variety of offer targeting systems, location based services, data mining applications and intelligent digital signage systems have been developed so far.

In this research, a location-based offer advertising system was developed with the use of a smart billboard for the same. “ShopPal” is a targeted advertising system that contains both a web and mobile application. A smart billboard is introduced along with the mobile application. This billboard is synced with the mobile application through Bluetooth and buying preferences of the majority of users will be taken into consideration when displaying the content on the public display. It will contain content related to the majority of the crowd at a given time. The technologies used in the system will be Global Positioning System (GPS) and Bluetooth. GPS is used to track the current location of the system and the latter is used to sync the billboard with the mobile application.

Shop owners registered with the system can use the web application to upload offers given by them and these will be checked and sent to mobile users by those handling the website. The shop owners also have the facility to view offer details of similar offers in the area. Mobile users can download the application and when registering with the system they will be given the chance to select categories they are interested in. This is suggested to the users using results obtained through data mining. These will be taken into consideration when displaying offers. The user route is tracked and if there are any shops with offers desired by the particular customer, it is indicated on the map. The offer notification will be purely based on the areas the application user is interested in. A billboard is used to display offers based on the age category of the majority. The majority is identified using clustering. This billboard will be synced with the mobile application through Bluetooth.

The objectives of building “ShopPal” include; a) to analyse the buying patterns of customers based on their age categories, b) To display the offer notification on mobile based on their preferences and location and c) To display offer notifications on a billboard based on the age categories of the majority of the mobile application users in the location.

The rest of the paper is organized as follows. Background covers the existing literature on this topic. Methodology section covers the method we used to develop the system. Results and Discussion includes the results of our system and finally conclusion includes limitations and future work.

II. BACKGROUND AND RELATED WORK

A. BACKGROUND

Considerable effort has been put into identifying the location of an individual. Mobile marketing on the other hand is still a new approach in the world of business. Offer advertising has turned over a new leaf with the development of technology and little previous work has been done towards identifying customer buying patterns and sending customized offer advertisements to consumers via mobile and also displaying offer advertisements on public digital displays. This section explains previous work done on offer advertising systems, location based services, data mining applications and those involved with digital displays.

B. RELATED WORK

A. Offer Advertising

Kraft in [9] creates and presents the details found on individual user profiles used in collaboration with the physical geographic location of a consumer. The invention solves the problem of advertising tailored so that it is suitable to both the user and their current location by including a customer’s profile and their current location into the advertising message. Also, the invention consists of location tracking along with a personal electronic calendaring system. Further, this message is made more
personalized with the use of a relative address/direction that start from the current customer's location. This could be in terms of driving directions, using the current physical position of the user as a start address. The location tracking component locates the current location of the customer. This information is used to advertise products or services which are in close proximity to the customer's current location.

Wanek, Ayub and Boyd in [17] has reviewed on methods and systems target advertisements using real-time information such as location-based, defined geolocation territory rights and weather-related information. The invention relates to those methods and systems improved to display advertisements or other promotional information to users via mobile devices. The paper includes a method for delivering a message to a mobile device that comprises of selecting one or more messages targeted based on location-based, advertiser GeoEstate rights and weather-related information relating to said mobile device's location.

Chen and Huang in [5] investigates a smart environment, “Intelligent Shopping-aid Sensing System (iS3)”, for online shopping support in the years to come by developing a context-aware automated service system. Sensors and radio frequency identification (RFID), are applied for recognizing, collecting, and delivering user context. Product details like locations, specifications, and characteristics can be gathered swiftly through the deployed RFID reader and display. Moreover, local mobile devices applications help real-time interactions between central system and end users. Prompting product promotions, inquiry and online marketing to shopping malls is expected to be done by the system. According to experimental results, the quality of recommendations with the proposed approach reaches 70% accuracy rate and traditional and non-clustering approaches are 56% and 46%, respectively [5]. This study decreases the long-term retailer operation costs, stimulates service innovation and experience economy and enhances corporate operational performance.

Faith in [7] shows a review which provides a computer-implemented process for determining offers for a geofenced geographic area. Once a mobile user crosses a geofence, merchants having a geofence identifier and is associated with the particular geofence are identified. Candidate offers associated with the merchants are identified and these identified offers are ranked according to ranking criteria and they are then transmitted to a mobile device. The ranked candidate offers are then stored on a mobile user device and presented to the user via an offers notification. The user may view and redeem an offer by selecting the notification. Additionally, in some representations, a non-temporary tangible computer-readable memory is given to store instructions for determining relevant offers for a geofenced geographic area. Further, in some others, a computer-implemented method is given for determining relevant offers for a geofenced geographic area. The method includes getting, via a processor, a detected crossing of a geofence, the geofence defining a perimeter around a geographic area that includes one or more retail stores related to one or more merchants and transmitting, via a network and from a mobile.

### B.B. Digital Signage Systems

Payne and David in [13] proposed BluScreen, an approach to advertise in public spaces that uses wireless-enabled devices to improve the public display advertisement selection. A multiagent system is used here to determine appropriate content. Interactions with BluScreen are passive and not initiated by the user. “BluScreen is a distributed advertising framework in which advertisements are selected efficiently to maximize their exposure to as wide an audience as possible.” [13]

Cardoso and José in [4] penned a research on a context-aware display. A context-aware display should deliver the right information at the right time. It was started by analyzing interaction alternatives form the perspective of the information they generate. The concept of digital footprint was used to refer to the digital traces generated by the interactions with the display. Presence identification is done with the use of a personal device with Bluetooth. Self-exposure footprint will get interests, preferences or activities of the people nearby. Another way would be to register the user so that their preferences can be taken. The use of Bluetooth allows the user to manage his presence himself. However, Bluetooth naming is less suited when it comes to private naming as it is visible to anyone and everyone.

Digital signage industry is now only second to the internet in terms of annual advertising revenue growth [15]. Tian et. al [15] proposed an Intelligent Advertising Framework. It introduces the integration of Anonymous Video Analytics (AVA) and Data Mining techniques to achieve targeted and interactive advertising. This reduces waste by advertising to potential customers rather than to the entire population. AVA is used to capture human faces and capture demographic information, and data mining algorithms are used to learn advertising models. AVA includes three steps; human face detection, demographics recognition and viewing event creation. Data mining is used to discover patterns of viewing behaviours of the audience. Audience targeting methods are of three types; seeing-based, to target once the display sees them, prediction-based, to predict future passes and context-based, to target depending on the device location, time and weather information. The targeted advertising process is also divided into learning advertising models, creating playlists and playing playlists. The advantage of the framework proposed is that the AVA component is privacy friendly.

Intelligent digital signage systems can adapt the displayed contents to the audience in real-time. Batagelj, Ravnik and Solina in [1] showed how digital signage is made much more effective by using computer vision technology. By using a video sensor, the system could be made intelligent. Intelligent systems can display targeted ads to customers actually present at a moment. It can give the right message to the right audience at the right time. The system consists of two parts; the detector that captures the frame and calculates how long a face is present in front of the camera and a web application that generates reports.

### B.C. Location – Based Systems

Singhal and Shukla in [14] penned on the implementation of location based services using GPS and web services in Android.
Location based services offer personalized services to mobile clients based on their current location. These services include consumer services including maps navigation, marketing/advertising, location based reminders and preferred location search [11,14]. The device location can be tracked by either a mobile phone service provider network or satellites. A mobile phone with GPS is integrated by Assisted-GPS which is the new technology used by smart phones. It reduces the memory and hardware required by mobiles to provide GPS services. The advantage of the former is that it does not carry additional costs. Application Programming Interface (API) is also given by Android to access Google Maps which facilitates the user to find required places on the map. However, the implementation of Location Based Services has its drawbacks in the areas of technology and infrastructure.

A similar research has been done by Rani et. al [11] on location based services in Android. “Location based services is an umbrella term used to describe the different technologies used to find the current location of a device” [11]. Location Manager and Location Provider are the two main elements of Location Based Services (LBS). Location Manager finds the current location, does movement tracking, used to set proximity alerts for locations that are specified and also to find all available location providers. A variety of applications can be developed in Android one such being finding the route between two locations. The application developed here is able to find the route between two locations. LBS are services that can be accessed using mobile devices via the mobile network. Context awareness is a feature of LBS. LBS uses technologies such as GPS, satellite network, cellular networks, Wi-Fi and other technologies to find the location of a mobile device. Varying accuracy, user movement and multitude of location sources can be stated as reasons for inaccuracy of location-tracking.

Bhatia and Hilal in [3] reviewed on a new approach for location based tracking. Here, a “Localize Intelligence Algorithm” is developed in the field of tracking location. Location Based Services are used in areas such as navigation, for sending advertisement and marketing information and for location tracking. Location tracking works with networks such as Global System Mobile Communication (GSM), General Packet Radio Service (GPRS) and Code Division Multiple Access (CDMA). The “Localize Intelligence Algorithm” is used to micro define an area and name based on the latitude and longitude differences. It increases the accuracy of position of the user. Here, the client receives signals and the coordinates from the satellites. A localized location engine is designed here. The results include the latitude and longitude coordinates for a prespecified user location and also shows all locations along with their names on a map.

Babu et. al [2] penned a review on an intelligent android mobile based real time ads tracking system. The expansion of wireless technologies has given the domain of mobile marketing a new platform. The paper introduces iMAS and location-based marketing. Location-based advertising helps improve sales and brand-awareness among the potential customers. iMAS uses location based services and Global Navigational Satellite Systems the ad poster store and navigate using the route that is displayed between their current location and the store. The GPRS facility of android mobile is used to connect to the remote iMAS server. “The iMAS system, implemented using intelligent decision-and context-centric middleware, provides an effective basis upon which personalization in service provision can be achieved in a commercial location-based marketing system.” [2]

B.D. Data Mining Applications

Ling and Li in [10] discussed Data Mining for Direct Marketing: Problems and Solutions. “Direct marketing is a process of identifying likely buyers of certain products and promoting the products accordingly” [10]. In direct marketing, knowledge is a description of probable buyers or responders, and this is useful in getting a better profit than mass marketing. The most obvious problem stated in the framework is the extremely imbalanced class distribution. Typically, only 1% of the examples are positive (responders or buyers), and the rest are negative [10]. The second problem is that even if there are sensible patterns to be found, the anticipated accuracy cannot be used as a suitable evaluation criterion for the data mining process.

Rygielski, Wang and Yen in [12] discussed a framework on Data mining techniques for customer relationship management. Data warehousing, data mining, and campaign management software techniques have made customer relationship management a new area where a firm can obtain a competitive edge over others. May different techniques exist among data mining software, and each of them have their own advantages and challenges for different types of applications. They discuss that Data mining techniques are the result of a long research and product development process. The root of data mining lies with first the storage of data on computers, and continues with improvements in data access. Today technology allows users to navigate through data in real time. Towards the end, it is mentioned that to choose a suitable technology for personalization or CRM, organizations should be aware of the trade-offs when considering differing data mining software applications. To make a choice among different options is not as critical as making a choice to use data mining technologies in a CRM initiative. “Data mining represents the link from the data stored over many years through various interactions with customers in diverse situations, and the knowledge necessary to be successful in relationship marketing concepts” [12]. Technologies vary in terms of effectiveness and ease of use. It is businesses and managers who decide how to exploit collected data. Basically, it is more of a policy issue than a technology issue.

Vinodhini and Chandrasekaran in [16] have come up with a framework which discusses Sentiment Analysis and Opinion Mining. “Sentiment analysis is a natural language processing technique for tracking moods of the public regarding a particular product or topic” [16]. It involves in building a system to study opinions about the products made in blog posts, comments, reviews or tweets. Sentiment analysis can be useful in several ways and along with that have several challenges too. The first is that the opinion could be either positive or negative. A second challenge would be that people do not always express opinions in similar ways. There are some main fields of research noticeable in Sentiment analysis: sentiment classification, feature based Sentiment classification and opinion summarization. The soaring of sentiment analysis dates back to late 1990’s, but it becomes a major emerging sub field of information management discipline.
only from 2000, especially from 2004 onwards [16]. It was stated at the end that from the performance achieved by these methods it is difficult to judge the best choice of classification method. The reason for this was that the method uses a variety of resources for training and different collections of documents for testing, various feature selection methods and different text granularity.

Chen et. al [6] penned a framework on the literature review of Data mining for the Internet of Things (IoT). In this paper, a systematic way to review data mining in knowledge view, technique view, and application view is given, including classifying, clustering, association analysis, time series analysis and outlier analysis. The latest application cases are also surveyed. More the devices connected to IoT, large volume of data should be analyzed and the latest algorithms should be modified to apply to big data. Data mining involves discovering novel, interesting, and potentially useful patterns from large data sets and applying algorithms to the extraction of hidden information. Many other terms are used for data mining such as knowledge discovery (mining) in databases (KDD), knowledge extraction, data/pattern analysis, data archeology, data dredging, and information harvesting. Any data mining process objective is to build an efficient predictive or descriptive model of a large amount of data that best fits or explains it and is also able to generalize to new data. On the basis of the definition of data mining and the definition of data mining functions, a typical data mining process includes the three steps: Data preparation: prepare the data for mining. Data mining: apply algorithms to the data to find the patterns and evaluate patterns of discovered knowledge and Data presentation: visualize the data and represent mined knowledge to the user. According to their framework, data mining functionalities include classification, clustering, association analysis, time series analysis, and outlier analysis. They also discuss new big data characteristics and analyze the challenges in data extracting, data mining algorithms, and data mining system area.

Koh and Tan in [8] have come up with a review which explains Data Mining Applications in Healthcare. In healthcare, data mining is becoming increasingly popular, if not increasingly essential. Data mining applications can aid all parties involved in the healthcare industry. The large amounts of data generated by healthcare transactions are too complex to be processed and analyzed by traditional methods. Data mining gives the methodology and technology to transform these data into useful information for decision making. It discusses data mining and its applications within healthcare in major areas such as the evaluation of treatment effectiveness, management of healthcare, customer relationship management, and the detection of fraud and abuse also giving an example of a healthcare data mining application involving the identification of risk factors associated with the onset of diabetes. Under health care data mining applications, it was stated that these applications can be grouped as the evaluation of treatment effectiveness; management of healthcare; customer relationship management; and detection of fraud and abuse. Healthcare data mining can be limited by the accessibility of data, due to raw inputs for data mining existing in different settings and systems, such as administration, clinics, laboratories and more.

B.E. Research Gap

In this section, the research group review some recently developed Offer Advertising systems along with location tracking [7,10,13] and also intelligent billboard systems [7,13,14]. Most of the Mobile Advertising systems contain GPS technology as it is easy to implement and some of the system have used iBeacon technology. Most of the billboard systems contain Bluetooth. Almost every research only covers the Mobile Advertising; not Mobile Advertising along with billboard systems. Some of the researches are not managing the customer relationship properly because they use Sentiment Analysis methods for data mining; therefore, gathering information on public mood may be somewhat inaccurate [16]. Hence the research project team will build a mobile app to display offer advertisements by gathering buying patterns of the user and display by tracking the location by using GPS along with the billboard system which will sync via Bluetooth.

In billboard system, the system will navigate the crowd and their buying patterns to display the offers and it will be added to the customer’s shopping experience. As the research’s main objective is the customer relationship management, to add that, the research team has come up with this Smart Billboard System due to some reasons; the user may not be able to use the mobile phone every time due to lack of signal, user may be driving the vehicle or absence of mobile data. Therefore, “ShopPal” will give the solution by coming up with the Smart billboard system. It could be stated by looking at all this that this research can identify as an all in one system, with the advantages of high efficiency and easiness because the team introduces mobile advertising with location tracking along with the smart billboard system. High accuracy can be achieved because to identify the buying patterns the team will be using Market Basket Algorithm, GPS for location-tracking and Bluetooth for syncing the mobile with the billboard. Also with the advantage of high portability the system is a mobile application, low cost for installation and for devices.

III. METHODOLOGY

The prototype methodology was used to achieve the project goals. Analysis, Designing and Implementation phases were executed concurrently and iterated until the project reached all the objectives. First prototype was built with the minimal number of features and the other features were added to each prototype produced. This chapter briefly discusses each and every software development phase followed by the group in developing ShopPal.

A. Planning

According to the identified requirements the gathering of information had to be carried out. Primary data sources of the system were obtained through a questionnaire whereas secondary data sources were obtained from research journals and articles.

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Based on statistical analysis results, it could be stated that majority prefers an Android mobile application along with the billboard as an alternative to the mobile application. It also could be stated that buying preferences, technological factors like the mobile and billboard and age are factors affecting the user’s shopping experience.

B. Design

The logical diagrams were converted to physical diagrams during this phase. Development strategies and the methods of implementing the decided strategy was discussed during this phase.

C. Implementation

Following are the tools that were originally decided to be used to build the system; Web Browser, Adobe Dreamweaver, Android Studio, MySQL, MySQL Community Server, Business Intelligent Studio, Visual Studio 2015, Arduino and Visual Studio 2012.

Due to several changes and complications, in the system in later phases, additional tools listed below were also used to develop the system.

- SQL server 2016
- NetBeans IDE 8.1

An Arduino Mega 2560 was used along with a HC-05 Bluetooth module and an LCD screen to display offers for demonstration purposes.

D. Testing

Testing phase was focused on checking the system and identifying the system errors thus fixing them to provide the system with a better quality, performance and accuracy.

IV. RESULTS AND DISCUSSION

A. Results

This section covers the results of our system and the new approaches found to address issues and further research in the context.
ISSN 2250-3153
32

offers in the area. Market Basket Analysis was proposed to find
core functionality wherein the shop owners could also view similar modules. The web application too was added a new purpose, a decision on using the Arduino board with a Bluetooth component. For demonstration certain complications, the parking slot availability service was replaced with a billboard component. For demonstration purposes, a decision on using the Arduino board with a Bluetooth component. Each component has been tested in isolation. After stabilizing all the modules each of them were integrated together and tested again until the complete system is error free.

The system started with the decision of having a mobile application that contains location-tracking and notifying the users on preferred offers. This was decided to be combined with a parking slot detection service that notifies the customer on parking slot availability along with the offer notification. Due to certain complications, the parking slot availability service was replaced with a billboard component. For demonstration purposes, a decision on using the Arduino board with a Bluetooth module was put forth. The web application too was added a new functionality wherein the shop owners could also view similar offers in the area. Market Basket Analysis was proposed to find common preferences of customers in different age categories but after research analysis, a stored procedure was used for the same. The main intent of the system is to notify the target customers on offer notifications based on their current location and also one that would detect users in a crowd, work out the buying preference of the majority of them and display the content on the public display. Therefore, using this system the users will be able to get offer notifications with no hassle.

During the development period, the team had to face some technical and logical challenges. Following are some of the major challenges faced by the research group.

- Database used for data mining had to be accurate in order to get an accurate mining result.
- Lack of signal when syncing the billboard with the mobile application.
- The use of an Android version that supported the Google API.
- Complications in demonstrating the billboard component.

To avoid the listed problems, the team had to seek for support from other individuals and related tutorials and books. The accuracy of the system depends on the strength of Bluetooth connectivity and also the signal strength and mobile data present at the time.

V. CONCLUSION

“ShopPal – Best Offers at Your Fingertips” will be a better solution that will provide its users a hassle-free shopping experience with the combined effort of a mobile application, web application, desktop application and a billboard component. The four components integrated into a single system provides its users an error-free, accurate offer advertising service. The system will undoubtedly be greatly beneficial to both consumers and shop owners and “ShopPal” can be considered an ideal location-based offer advertising system that would give consumers a hassle-free shopping experience.

There are some limitations to be highlighted in “ShopPal”.
- The mobile user should use android OS and use GPS technology to use the services.
- An internet connection is required to use the services. Since the application fetches data from the database over the Internet, an internet connection is crucial.
- Both the web site and the mobile application will be constrained by the capacity of the database. Since the database is shared between both application it may be forced to queue incoming requests and therefor increase the time it takes to fetch data.
- Since the project team uses Bluetooth to sync the billboard, there may be lack of signal.
- Since the application makes use of GPS technology, it would be not suitable for shopping malls that extend over multiple floors because GPS would not be able to track the same.

Figure 5 Data Mining Result

Figure 2 depicts the interface that allows the shop owners to view offer details of all shops around his location. Figure 3 shows the mobile interface that shows the user offers based on his location and preferences. The offer details according to the age category of the majority is displayed on a billboard and this is depicted in Figure 4. The data mining results are shown in Figure 5. It displays the top five user preferences according to specified age categories.

The shop owner adds an offer detail to the system via the web application. He can view related offers in the area through the use of the interface given in Figure 2. A desktop application is used by the cashier to enter details that are required to update the mining model. The mobile user when downloading the app, will have to state his preferences. The preferences are suggested to the user with the use of the result of a stored procedure as depicted in Figure 5. The mobile app will track the user location and depending on his desired preferences, if there are offers available, will display it to the user. This is done as depicted in Figure 3. The billboard will read the age category of the majority of users connected, and taking the majority into consideration, will display offer details related to the majority as depicted in Figure 4. The offer details will contain the name of offer, offer description, and image of particular product. For demonstration purposes, an LCD screen connected to the Arduino was used and shows the offer title.

B. Discussion

ShopPal contains functioning components as a mobile application, web application, desktop application and a billboard component. Each component has been tested in isolation. After stabilizing all the modules each of them were integrated together and tested again until the complete system is error free.

The system started with the decision of having a mobile application that contains location-tracking and notifying the users on preferred offers. This was decided to be combined with a parking slot detection service that notifies the customer on parking slot availability along with the offer notification. Due to certain complications, the parking slot availability service was replaced with a billboard component. For demonstration purposes, a decision on using the Arduino board with a Bluetooth module was put forth. The web application too was added a new functionality wherein the shop owners could also view similar offers in the area. Market Basket Analysis was proposed to find common preferences of customers in different age categories but after research analysis, a stored procedure was used for the same.
VI. FUTURE WORK

➢ The mobile application could convey the availability of parking slots along with notifying the user on particular offers. 
➢ The gender attribute could be considered along with the age when predicting promotions for the billboard.
➢ The system could introduce a way to track offers available in shopping malls that span multiple floors.

ACKNOWLEDGMENT

The research team take this opportunity to sincerely acknowledge all who have provided guidance and assistance throughout the project. First and foremost, we would like to thank Dr. Yasas Jayaweera, the Academic Head of SLIIT Computing (Pvt) LTD, and Ms. Gayana Fernando, Senior lecturer and lecturer in-charge of the module for providing us with the opportunity to conduct the Research Project. Deserving of special mention is Ms. Nipunika Vithana, the group’s project supervisor, for providing the guidance and feedback to carry out this research and steering us in the right direction. We would also like to thank Ms. Nideshika Ellepola for providing help and guidance. We also thank the non-academic staff who have provided support. Finally, we would like to acknowledge with gratitude, the great amount of support and advice given by our family members and would extend our gratitude to all colleagues at Sri Lanka Institute of Information Technology who have been supportive at all times.

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Contribution of bacteria to *Artemia* nutrition in conditions of degressive algal feeding

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**Abstract.** *Artemia* were reared, under zero water exchange, on four different microalgae feeding regimes: standard ad libitum feeding (SF1), half of SF1 (SF1/2), one third of SF1 (SF1/3), and a quarter of SF1 (SF1/4). In additional treatments, for each of these feeding regimes nitrogen waste from *Artemia* in the cultures was converted into bacterial biomass by addition of carbohydrate to produce carbon/nitrogen (C/N) ratio 10. The objective was to investigate what the contribution of bacteria to the *Artemia* diet was at different degressive algae feeding rations. After 15 days of culture period, the results of survival and biomass production (WW g/L) indicated that stimulating bacterial growth increased survival and biomass production of *Artemia* in all feeding rations when compared to the corresponding control treatments with algae only. Particularly, manipulating the C/N ratio in the SF1/3 treatment induced the improvement of *Artemia* biomass production equal to that obtained in the treatment where *Artemia* were offered solely algae at SF1 ration. Moreover, the results of fatty acid assimilation and especially 15N accumulation in *Artemia* indicated that *Artemia* utilized relatively more bacteria for the treatments with the lowest algae supply. These findings open perspectives for using bacteria to substitute or supplement microalgae in *Artemia* biomass production.

**Index term:** *Artemia*, biomass production, C/N ratio,

I. **INTRODUCTION**

Among live food organisms, *Artemia* nauplii are extensively used for the larval stages of fish and crustaceans, because they satisfy the nutritional requirements, are convenient to use and are readily available as dry cysts (Sorgeloos *et al*., 2001). Moreover, the protein content of on-grown *Artemia* is around 50% (Anh *et al*., 2009a); therefore it can be a candidate to replace fish meal in aquafeed ingredients, and adult *Artemia* is a good food to enhance maturation of marine shrimp (Gelabert *et al*., 2003).

*Artemia* can be cultured with selected algae (Fábregas *et al*., 1996; Thinh *et al*., 1999), but it is costly to offer *Artemia* only microalgae under tank culture systems (Lavens and Sorgeloos, 1991). Thanks to its particular biological characteristics, it can also be cultured with low nutrient diets from cheap agriculture by-products, which reduces the production costs, e.g. rice bran, soybean meal (Anh *et al*., 2009b), animal wastes (Baert *et al*., 1997), aquaculture wastes (Marinho-Soriano *et al*., 2010), yeasts (Coutteau *et al*., 1990), and inert diets (such as wheat flour, fishmeal, egg-yolk, homogenized liver and rice powder) (Dobbeleir *et al*., 1980).

As is the case with *Artemia* culture, foods are also the major component of aquaculture production costs in general, with food conversion efficiency of aquatic animals in the range 1-3 (Naylor *et al*., 2000). The unutilized nitrogen and phosphorus of food remain as waste in the water (Piedrahita, 2003).

Along with the present drive to commercialized aquaculture, research efforts have focused to increase production per culture volume, to reduce production costs and to reduce nitrogen discharge from aquaculture to the environment. This can be accomplished by, amongst others, retaining more nitrogen from the food in the culture animal via the stimulation of the production of natural protein-rich food sources using the heterotrophic bacteria/biofloc technique. Bacteria, which range in size between 0.6-3 µm, can be used as food for *Artemia* (Yasuda and Taga, 1980; Douillet, 1987; Intriglio and Jones, 1993; Gorospe *et al*., 1996). To enhance bacterial growth, it is recommended to maintain the carbon/nitrogen (C/N) ratio at 10 in the culture system (Avnimelech, 1999). Therefore, carbohydrate is added to the system (Burford *et al*., 2004; Avnimelech, 2007; Crab *et al*., 2007; Schneider *et al*., 2007; Nootong *et al*., 2011). Bacteria aggregate with other particles such as colloids, organic polymers, and microalgae and diverse mixtures of bacteria produce flocs (De Schryver *et al*., 2008), with a size generally between 0.1 to a few mm (Avnimelech, 2011). The consumption of bioflocs by fish or shrimp has demonstrated many benefits such as significantly reduced production costs and improved water quality (Avnimelech, 1999; Burford *et al*., 2004; Hari *et al*., 2004, 2006; Crab *et al*., 2009; Nootong *et al*., 2011).
In previous study (Toi et al., 2013) the result demonstrated that bacteria grown while manipulating the C/N ratio at 10, partially compensated for nutrition of Artemia under limited algae supply. However, this study applied a low algal feeding regime which was fixed at random at ⅛ of a reference regime, and didn’t point out from which level of reduction of algal supply onwards Artemia takes advantage of the bacteria supply. Therefore, in the present study we investigated what the contribution of bacteria to the Artemia diet is at different degressive algae feeding rations.

II. MATERIALS AND METHODS

Experimental design

Artemia were reared on four different microalgae Tetraselmis sp. rations under laboratory conditions during 15 days (Table 1). The nitrogen generated from Artemia waste in the cultures was converted to bacterial cells by manipulating the C/N ratio at 10 (Avnimelech, 1999). Based on the algae feeding regimes (Table 1), the nitrogen content in the algae supplied per day was used to calculate the concentration of dissolved organic nitrogen in the culture medium, assuming that the daily nitrogen concentration was approximately 50% of the feed nitrogen flux (Avnimelech, 1999). Therefore, using these nitrogen concentrations, sucrose was added once per day to produce C/N ratio 10. To assess the utilization of heterotrophic bacteria by Artemia, 15N NaNO3 was daily used as a tracer at 0.1% of total organic nitrogen in the culture medium to label the bacteria (Burford et al., 2004; Avnimelech and Kochba, 2009). Each of four feeding regimes was conducted with three replications.

Table 1: Experimental set up; Artemia was reared during 15 days on Tetraselmis sp. with four different feeding rations, and sucrose was used as carbon source to produce C/N ratio 10. No application is denoted by dash (-).

<table>
<thead>
<tr>
<th>Treatment code</th>
<th>Algae ration</th>
<th>Carbohydrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF1 (control 1)</td>
<td>standard feeding</td>
<td>-</td>
</tr>
<tr>
<td>SF1+S10</td>
<td>standard feeding</td>
<td>sucrose</td>
</tr>
<tr>
<td>SF1/2 (control 2)</td>
<td>half of standard feeding</td>
<td>-</td>
</tr>
<tr>
<td>SF1/2+S10</td>
<td>half of standard feeding</td>
<td>sucrose</td>
</tr>
<tr>
<td>SF1/3 (control 3)</td>
<td>one third of standard feeding</td>
<td>-</td>
</tr>
<tr>
<td>SF1/3+S10</td>
<td>one third of standard feeding</td>
<td>sucrose</td>
</tr>
<tr>
<td>SF1/4 (control 4)</td>
<td>one fourth of standard feeding</td>
<td>-</td>
</tr>
<tr>
<td>SF1/4+S10</td>
<td>one fourth of standard feeding</td>
<td>sucrose</td>
</tr>
</tbody>
</table>

Artemia hatching and culture procedures

Dried Artemia franciscana Kellogg 1906 cysts, originating from Great Salt Lake, Utah (EG type; INVE Aquaculture NV, Belgium), were hydrated in tap water for 1 h, and then the cysts shells were removed by decapsulation as described by Sorgeloos et al. (1977) and Marques et al. (2006a). Decapsulated cysts were rinsed thoroughly in FIOSW to get rid of all residual bleach. Cysts were incubated in a 1 L conical glass tube containing 800 mL FIOSW at 33 g/L salinity at 28 °C for 24 h under standardized hatching conditions (Sorgeloos et al., 1986). Artemia instar I nauplii were inoculated into 1 L conical glass tubes containing 800 mL FIOSW of 33 g/L salinity at a density of 2 nauplii/mL (Naegel, 1999).

Water pH (range 7.0-8.5) was daily adjusted by adding NaHCO3 at 0.05 g/L, and tubes were provided with aeration to ensure continuous supply of oxygen in the cultures. The experiment was carried out using white neon light illumination with photoperiod 12/12. All the tubes were kept at a temperature of 28.0 ± 0.5 °C by partial submersion in a temperature-controlled water bath.

Uneaten food and wastes from Artemia were daily removed by siphoning before feeding, while aeration was briefly interrupted.

Food preparation

A marine Tetraselmis sp. concentrate (Instant Algae 3600; Reed Mariculture Inc., USA) was used. The microalgae concentrate contains intact cells that are non-viable. The latter was verified by the absence of a pH change over a period of 6 h with continuous illumination (± 41 µE/m2s) at an algae concentrate density of 1 g/L. As algae were metabolically non-active it is available at www.ijsrp.org.
assumed that the nitrate assimilation in the experiments was done by the bacteria. The microalgae concentrate was diluted in 0.2 µm filtered Instant Ocean artificial seawater (FIOSW) at 33 g/L salinity. The concentration of algae in the solution was measured by a Bürker counting chamber. The algal solution was stored at 4 °C for subsequent use and the number of cells, administered once daily in the morning, was increased per day according to the age of *Artemia* (Table 2).

Table 2: Feeding schedule for *Artemia* fed on microalgae (adapted from Naegel, 1999).

<table>
<thead>
<tr>
<th>Day</th>
<th>Tetraselmis (106 cells/animal/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>0.14</td>
</tr>
<tr>
<td>3</td>
<td>0.18</td>
</tr>
<tr>
<td>4</td>
<td>0.25</td>
</tr>
<tr>
<td>5</td>
<td>0.38</td>
</tr>
<tr>
<td>6</td>
<td>0.50</td>
</tr>
<tr>
<td>7</td>
<td>0.75</td>
</tr>
<tr>
<td>8</td>
<td>0.88</td>
</tr>
<tr>
<td>9</td>
<td>0.90</td>
</tr>
<tr>
<td>10-14</td>
<td>0.90</td>
</tr>
</tbody>
</table>

**Data collection and sample analysis**

**Pre-sampling treatment**

At the end day of the experiment *Artemia* were harvested and transferred to 1 L beakers containing 500 mL of FIOW and 20 µm cellulose particles (Sigma) at a concentration three times the algae cell density in the ST feeding regime, for gut evacuation. During the evacuation period, aeration was provided continuously to ensure homogeneous distribution of the cellulose in the water. *Artemia* were checked regularly for the ingestion status under a binocular microscope. Sampling for analysis was done when the digestive tract of the *Artemia* were filled completely with cellulose.

**Growth of *Artemia***

Thirty animals from each replicate were randomly collected and fixed with Lugol’s solution. The individual length of *Artemia* was determined (from the front of the head to the end of the telson) using a dissecting microscope with a drawing mirror (Marques et al., 2004b), and by conversion to real length using the software *Artemia* 1.0® (courtesy of Marnix Van Damme).

**Survival and total biomass production**

*Artemia* were harvested at DAH15 and rinsed several times in de-mineralized water (DEMI-water) on a sieve to remove un-eaten food and waste; then *Artemia* was placed on tissue paper to remove all excess water.

Survival in each replicate was calculated according to the following equation:

\[
\text{Survival} \% = \left( \frac{\text{final number of *Artemia*}}{\text{initial number of *Artemia*}} \right) \times 100
\]

Total biomass production (TBP) in wet weight (g/L) in each tube was determined by weighing the total production (including the *Artemia* sampled for length measurement) and the average per treatment was calculated.

**After obtaining survival and TBP data, sampling for 15N accumulation and fatty acid analysis in *Artemia* was done.**

**Nitrogen accumulation in *Artemia***

Ten cellulose-treated *Artemia* individuals from each tube were sampled randomly at DAH15 for 15N analysis. After sampling, *Artemia* were first immersed in a benzocaine solution (Sigma, 0.1%) for 10 s, transferred to a benzalkonium chloride solution (Sigma, 0.1%) for another 10 s to kill attached bacteria on their exoskeleton (Chládková et al., 2004), and then washed in DEMI-water to remove salt. Each sample was then put into a pre-weighed tin capsule cup (5 x 8 mm), oven-dried at 70 °C for a day (De Troch et al., 2007), and then cooled down in a desiccator. The dry weight of the samples was determined using a digital precision balance (precision 0.1 mg), and the level of 15N excess in *Artemia* was determined using an elemental analyzer (ANCA-SL, PDZ
Europa, UK) coupled to a continuous flow isotope-ratio mass spectrometer (CF-IRMS) (20-20, SerCon, UK) at the Department of Applied Analytical and Physical Chemistry, Ghent University, Belgium.

Nitrogen derived from heterotrophic bacteria in Artemia was calculated according to the formula as described by Fry (2006): the nitrogen stable isotope contents in Artemia are expressed as δ values in parts per thousand (‰).

\[ \delta^{15}N \text{‰} = \left[ \frac{R_{\text{sample}} - R_{\text{std}}}{R_{\text{std}}} \right] \times 1000 \]

where \( R = \text{ratio 15N/14N} \), \( R_{\text{std}} = 0.0036765 \), the internationally recognized standard for atmospheric N2.

Fatty acids composition of Artemia and feed sources

After weighing the biomass and after taking animals for 15N, Artemia from each culture vial were frozen at \(-20^\circ\text{C}\) for fatty acid analysis. Fatty acid methyl esters (FAME) of Artemia were prepared by transesterification for gas chromatography and identified by a gas chromatograph (GC), via a procedure modified from Lepage and Roy (1984) and Coutteau and Sorgeloos (1995). Briefly, 0.2 g of Artemia biomass was weighed on the bottom of a 35 mL glass tube with a teflon® lined screw cap. Total lipids were extracted from Artemia with a solvent mixture including 100 μL of internal standard solution containing 4.78255 mg/mL 20:2n-6 or 14.39986 mg 22:2n-6 fatty acid dissolved in iso-octane, 5 mL of methanol/toluene (3:2 v/v) solution and 5 mL of freshly prepared acetylchloride/methanol (1:20 v/v) solution. The air in the tube was flushed out by nitrogen gas and the tube was then closed tightly. The product in the tube was mixed by shaking and the reaction was left to take place for 1 h at 100 °C in a boiling bath with shaking every 10 min. Then the sample was allowed to cool down and 5 mL of hexane and 5 mL of distilled water were added to the tube. The sample was extracted by centrifugation (± 2,000 x g; 5 min) with hexane and transferred into another glass tube. The combined hexane phase was dried by vacuum filtering in a 50 mL pre-weighed pear-shaped flask over a 4 cm diameter P3 filter, filled for one third with anhydrous sodium sulfate powder. The tube and the filter were rinsed several times with hexane (± 5 mL) until the flask was filled up. The solvent was evaporated on a rotary evaporator at 35 °C, flushed to dryness with nitrogen gas, and the pear-shaped flask was weighed again. The dried FAME was finally dissolved in 0.5 mL iso-octane and transferred into a 2 mL glass vial with teflon® lined screw cap. The vial was flushed with nitrogen and the sample was stored at \(-30^\circ\text{C}\) until injection. For the actual GC analysis, 0.25 μL of the iso-octane dilution was injected, containing ± 2 mg FAME/mL. The individual FAME-amounts were calculated using the known amount of the internal standard as a reference.

Quantitative determination was done by a Chrompack CP9001 gas chromatograph equipped with a CP9010 liquid autosampler and a temperature-programmable on-column injector. Injections were performed on-column into a 50 m long polar capillary column, BPX70 (forte-series, SGE Australia), with a diameter of 0.32 mm and a layer thickness of 0.25 μm. The BPX70 was connected to a 2.5 m long methyl deactivated pre-column. The carrier gas was hydrogen, at a pressure of 100 kPa using a flame ionization detector (FID). The oven was programmed to rise from the initial temperature of 85 °C to 150 °C at a rate of 30 °C/min, from 150 °C to 152 °C at 0.1 °C/min, from 152 °C to 172 °C at 0.65 °C/min, from 172 °C to 187 °C at 25 °C/min and set to stay at 187 °C for 7 min. The injector was heated from 85 °C to 190 °C at 5 °C/sec and was set to stay at 190 °C for 30 min.

Analog to digital (A/D) conversion of the FID signal and subsequent data capture to a computer was done with an Agilent 35900E A/D converter. Peak identification was based on GLC-68 series standard reference mixtures, complemented by individual standards (both from Nu-Chek-Prep, Inc., USA). Integration and calculations were done on a Microsoft -Windows© -based computer using Agilent GC Chemstation Rev. B.02.01 (build 244), complemented by two custom designed Microsoft Excel© macros.

Relative survival increase and relative total biomass production increase

The relative survival increase (RSI) and relative total biomass production (TBP) increase (RTBPI) were calculated to assess the effect of carbohydrate addition to the Artemia culture according to the following formula:

\[ \text{RSI or RTBPI (\%) = \frac{(survival or TBP of treatmenti – survival or TBP of controli)}{survival or TBP of controli}} \times 100 \]

Where i=1-4

Statistical analysis

The data of biomass production, fatty acid levels and the values of 15N nitrogen were checked for normal distribution and homogeneity of variance by p-p plots and Levene’s test of Statistica 7.0 software for windows. If one of these assumptions could not be satisfied, data were transformed, prior to two-way analysis of variance (ANOVA), which was used to test the effect of

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feeding regime and carbohydrate addition, and the interaction between these factors, on the survival, individual length and biomass production of *Artemia*. This was followed by Tukey’s honestly significant difference (HSD) test, employed at 0.05 probability level. A non-parametric, Kruskal-Wallis, test was used when the transformation could not be applied. One-way ANOVA was performed for fatty acid levels and 15N accumulation in the *Artemia* tissue.

III. RESULT

*Artemia* performance

Feeding regime and carbon addition both had a significant effect (*p* < 0.05) on *Artemia* survival and biomass production. Feeding regime also had a significant effect on growth (*p* < 0.05). Interaction between both variables was only significant for growth (Table 3).

Table 3: Probability levels of two-way analysis of variance (with feeding regime and carbon addition as independent factors) on survival, individual length (IL) and total biomass production (TBP) of *Artemia*. Asterisk (*) indicates significance (*p* < 0.05).

<table>
<thead>
<tr>
<th>Source</th>
<th>Survival p-value</th>
<th>IL p-value</th>
<th>TBP p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeding regime (FR)</td>
<td>0.008*</td>
<td>0.000*</td>
<td>0.000*</td>
</tr>
<tr>
<td>Carbon addition</td>
<td>0.000*</td>
<td>0.582</td>
<td>0.000*</td>
</tr>
<tr>
<td>FR x carbon addition</td>
<td>0.814</td>
<td>0.001*</td>
<td>0.491</td>
</tr>
</tbody>
</table>

Survival of solely microalgae-fed *Artemia* didn’t strictly decrease in the order of the reduction of algae supply. When comparing to the SF1 regime, the survival of *Artemia* fed the SF1/2 regime increased, but decreased for the SF1/3 and SF1/4 regimes. In comparison to the non-treated respective controls, the addition of carbohydrate improved survival of *Artemia* in all feeding regimes, and the increase was significant (*p* < 0.05) for SF1/3, as illustrated as well by the high RSI values, 182%, for this treatment. When comparing the four feeding regimes, the best survival was shown by SF1/2+S10, SF1+S10 and SF1/3+S10, while the poorest survival was shown by SF1/4 (Table 4).

The availability of microalgae as monodiet in the culture medium affected the growth of *Artemia*: with the exception of SF1/3, the individual length gradually but non-significantly decreased when the feeding regime was gradually reduced from SF1 to SF1/4. With addition of carbohydrate, a higher individual length of *Artemia* was shown in both SF1 and SF1/2 treatments as compared to their matching control treatment, but a lower body length in case of SF1/3 and SF1/4. In the case of SF1/3 this decrease was significant (*p* < 0.05).

As a combination of growth and survival, also the TBP of *Artemia* was related to the density of algae in the culture medium. TBP gradually reduced from the SF1 to the SF1/4 regime of solely algae fed *Artemia*, and the reduction was significant in the lowest feeding treatment (SF1/4) as compared to SF1 (*p* < 0.05). The addition of carbohydrate to the *Artemia* cultures improved biomass production in all feeding regimes as compared to its corresponding control treatments, but the increase was not significant (*p* > 0.05). Moreover, the RTBPI gradually increased from around 60% for SF1 to nearly 150% for SF1/4, as compared to the matching control treatments. When comparing the four feeding regimes, the best TBP was shown by SF1+S10 and SF1/2+S10, while the poorest TBP was exhibited by SF1/4. The addition of sucrose to SF1/2 and SF1/3 feeding regimes increased the TBP of those treatments to a level equal or exceeding that obtained in the SF1 control.

Table 4: Final survival (%), individual length IL (mm) and biomass production TBP in wet weight (g/L) of *Artemia* fed on different algal paste rations and with stimulation of bacterial growth by carbohydrate addition. The values are mean ± standard deviation (n = 3). RSI = relative survival increase (%) of carbohydrate treatments as compared to respective controls; RTBPI = relative total biomass production increase (%) of carbohydrate treatments as compared to respective controls. Different superscript letters in the same column denote significant differences (*p* < 0.05). For abbreviation of the treatments, see Table 1.

<table>
<thead>
<tr>
<th>Treatment code</th>
<th>Survival (%)</th>
<th>IL (mm)</th>
<th>TBP (g/L)</th>
<th>RSI (%)</th>
<th>RTBPI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF1 (control 1)</td>
<td>36.4 ± 12.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.0 ± 1.6&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.8 ± 0.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SF1+S10</td>
<td>62.4 ± 25.8&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>7.9 ± 1.7&lt;sup&gt;c&lt;/sup&gt;</td>
<td>4.6 ± 1.7&lt;sup&gt;d&lt;/sup&gt;</td>
<td>84.3 ± 63.0&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>60.2 ± 35.1&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>SF1/2 (control 2)</td>
<td>41.1 ± 13.4&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>6.7 ± 1.1&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>2.1 ± 0.2&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SF1/2+S10</td>
<td>75.9 ± 5.3&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.9 ± 1.1&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>3.5 ± 0.7&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>54.8 ± 10.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>71.8 ± 32.7&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>SF1/3 (control 3)</td>
<td>22.7 ± 4.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.2 ± 1.4&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>1.2 ± 0.3&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SF1/3+S10</td>
<td>61.1 ± 11.6&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>5.9 ± 1.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.7 ± 0.3&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>181.6 ± 53.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>118.9 ± 25.6&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>SF1/4 (control 4)</td>
<td>14.4 ± 8.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.4 ± 1.3&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>0.6 ± 0.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Fatty acids composition of feed and *Artemia*

Dietary fatty acids composition

Results of fatty acid analysis showed that the microalgae concentrate, Tetraselmis sp., was abundant with polyunsaturated fatty acids (PUFA) (57.1 mg/g DW), but contained low levels of monounsaturated fatty acids (MUFA) (19.7 mg/g DW); particularly, both 16:1n-7 and 18:1n-7 were present in equal amounts at 3.2 mg/g DW. In contrast to the algal concentrate, bacteria contained high levels of MUFA (37.7 mg/g DW). Particularly the 16:1n-7 and 18:1n-7 levels in bacteria were respectively 5 and 2 times higher than in the microalgae concentrate. Bacteria contained minor PUFA contents, which was 21 times lower than the PUFA contents in the microalgae concentrate. Additionally, 18:3n-3 in bacteria was 10 times lower than in the microalgae concentrate, and 20:5n-3 was below detection level (Table 5.5).

Fatty acids composition of *Artemia*

The MUFA levels (mg/g DW) of *Artemia* fed solely microalgae were gradually reduced as the algal ration was reduced from the SF1 to the SF1/4 regime, resulting in a value for the SF1/4 regime significantly lower than in SF1 (p < 0.05). The levels of 16:1n-7 were lower in the control treatments with reduced algal ration than in SF1, but the decrease was non-significant (p > 0.05). The addition of carbohydrate increased MUFA levels in all feeding regimes as compared to the respective control treatments, and in case of SF1/3 and SF1/4 this increase was significant (p < 0.05) (Table 5). For 16:1n-7 this increase was always significant; for total MUFA and 18:1n-7 it was significant for the lowest feeding regimes SF1/3 and SF1/4 (p < 0.05). In the latter two feeding regimes 18:1n-7 levels increased after carbohydrate addition to levels higher than in SF1 and SF1/2.

The PUFA content (mg/g DW) in *Artemia* fed solely algae non-significantly decreased from SF1 to the other algal feeding rations. The addition of carbohydrate into the *Artemia* cultures non-significantly reduced PUFA levels as compared to the respective control treatments (p > 0.05). When comparing the four feeding regimes, significant difference was only found between SF1/3+S10 (19.7 mg/g DW) and the SF1 control (27.5 mg/g DW) (p < 0.05). Moreover, 18:3n-3 levels of PUFA in *Artemia* fed solely algae was lower in the feeding rations SF1/2, SF 1/3 and SF1/4 as compared to SF1. This fatty acid was non-significantly reduced when carbohydrate was added (except for SF1/2 where the level was constant) (p > 0.05). The addition of carbohydrate non-significantly reduced 20:5n-3 levels in the lowest feeding regimes (SF 1/3 and SF1/4).
Table 5: Fatty acids composition (mg/g DW) of Tetraselmis sp. concentrate, bacteria biomass (grown on sucrose) and *Artemia* biomass. Fatty acids, discussed in the text, are highlighted in grey. The values are mean ± standard deviation (n = 3). Different superscript letters in the same column denote significant differences (p < 0.05). MUFA: monounsaturated fatty acids; PUFA: polyunsaturated fatty acids; total FA: total fatty acids. Value below detection limits is denoted by dash (−). For abbreviation of the treatments, see Table 1.

<table>
<thead>
<tr>
<th>Fatty acids</th>
<th><em>Tetraselmis</em> sp.</th>
<th>Bacteria</th>
<th>SF1</th>
<th>SF1+S10</th>
<th>SF1/2</th>
<th>SF1/2+S10</th>
<th>SF1/3</th>
<th>SF1/3+S10</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:0</td>
<td>1.1 ± 0.1</td>
<td>1.9</td>
<td>0.7 ± 0.1</td>
<td>0.8 ± 0.1</td>
<td>0.5 ± 0.1</td>
<td>0.7 ± 0.1</td>
<td>0.4 ± 0.2</td>
<td>0.8 ± 0.2</td>
</tr>
<tr>
<td>14:1n-5</td>
<td>0.2 ± 0.0</td>
<td>1.5</td>
<td>0.4 ± 0.1</td>
<td>0.7 ± 0.2</td>
<td>0.2 ± 0.1a</td>
<td>0.5 ± 0.1b</td>
<td>0.2 ± 0.1a</td>
<td>0.6 ± 0.2ab</td>
</tr>
<tr>
<td>15:0</td>
<td>0.1 ± 0.0</td>
<td>0.1</td>
<td>0.3 ± 0.0</td>
<td>0.3 ± 0.0</td>
<td>0.2 ± 0.0</td>
<td>0.3 ± 0.0</td>
<td>0.2 ± 0.1</td>
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Nitrogen derived from heterotrophic bacteria

The natural 15N abundance in *Artemia* was as low as 10‰ (Fig. 1). The excess of 15N in *Artemia* was inversely proportional with the availability of microalgae in the culture, resulting in values significantly higher for the lowest feeding regimes as compared to the standard regime SF1 (p < 0.05).

![Figure 1: 15N nitrogen accumulation in Artemia. The values are mean ± standard deviation (n = 3). Indices a, b, c, and d are indicating homogenous subsets (p < 0.05). For abbreviation of the treatments, see Table 1.](image)

### IV. DISCUSSION

The survival of *Artemia* fed solely on algae concentrate at the standard feeding ration in the current study was less than 50%, which is lower than survival of *Artemia* in a previous study by Fábregas *et al.* (1996) where *Artemia* were fed live Tetraselmis during 19 days. Loss of nutritional quality may have occurred during centrifugation, harvesting, transportation and/or storage of the algae (McCausland *et al.*, 1999). According to Albentosa *et al.* (1997) the process of algae preservation may affect the cell wall, hence reducing their digestibility.

This study demonstrated that stimulating bacterial growth by adding carbohydrate at C/N ratio 10 increased the survival of *Artemia* in all feeding rations. This is a confirmation of our previous finding (Toi *et al.*, 2013) where manipulation of C/N ratio 10 also improved *Artemia* survival. *Artemia* fed the SF1/3 or SF1/4 regime together with sucrose addition had more or less 3-fold increase of survival (RSI values) as compared to the SF1 or SF1/2 regimes. However, the manipulation of C/N ratio 10 only improved body length of *Artemia* in SF1 and SF1/2 ration, while the body length of *Artemia* in SF1/3 and SF1/4 was reduced by sucrose addition. This finding is not entirely similar to our previous study where C/N ratio 10 addition improved body length of *Artemia* at any feeding regime. The poor growth of *Artemia* in sucrose added SF1/3 and SF1/4 treatments as compared to the corresponding control treatments may relate to the relatively high survival combined with lower food availability, due to reduced algal concentration. The nutritional supplement from the bacteria may not have been enough to compensate for the lack of nutrients from algae when compared to the matching control treatment. Moreover, the higher survival in sucrose supplemented treatments led to higher total biomass production in all sucrose added treatments as compared to the corresponding control treatments, with the most prominent (and often significant) effect at the lowest algal feeding regimes SF 1/3 and SF 1/4.

The fatty acid (FA) composition in *Artemia* biomass responds to the FA composition in its diets (Zhukova *et al.*, 1998). The differences in fatty acid composition between algae and bacteria allows to use certain (groups of) fatty acids as biomarkers (Chamberlain *et al.*, 2005) when assessing the ingestion and utilization of bacteria by *Artemia* in combination with different algae rations (Intriago and Jones, 1993). The MUFA levels in *Artemia* in our study indicate that this group of fatty acids increases when stimulating bacterial growth in the culture medium, in agreement with previous findings (Toi *et al.*, 2013). This confirms that bacteria contribute nutrients to the *Artemia* tissue. Particularly the levels of both 16:1n-7 and 18:1n-7, the main MUFA components of bacteria (Table 5), were higher in all carbohydrate supplemented treatments. These fatty acids were also found at high levels in previous studies where co-feeding of bacteria and microalgae was offered to *Artemia* (Intriago and Jones, 1993; Brown *et al.*, 1996; Toi *et al.*, 2013). In comparison to previous study (Toi *et al.*, 2013), there was a similar trend of MUFA accumulation in *Artemia*, with a considerable increase of MUFA accumulation in *Artemia* when sucrose was administrated at low microalgae supply, and a moderate
MUFA increase when sucrose was administrated with microalgae fed ad libitum. Moreover, the stimulation of bacteria by sucrose addition didn’t really influence PUFA accumulation in Artemia. This finding is in agreement with our previous study.

The 15N used to tag heterotrophic bacteria was found to accumulate in the Artemia tissue. This result confirms that Artemia can ingest and digest heterotrophic bacteria. Moreover, the level of 15N in Artemia receiving a low algal feeding regime was higher than in a high feeding regime, which is in agreement with our previous study (Toi et al., 2013) and which confirms that Artemia mostly utilized algaee when algaee are applied in optimal density. When comparing results of 15N versus MUFA accumulation in Artemia, there was dramatically gain of 15N in Artemia with degressive algal rations from SF1+S10 to SF1/4+S10. While the gain of MUFA in Artemia did not increase dramatically from SF1+S10 to SF1/4+S10.

In conclusion, the contribution of bacteria to the Artemia diet is clearly illustrated by this study. This bacterial contribution starts becoming substantial when the nutrients provided by microalgae are reduced to sufficiently low levels (33% and lower in this study). In these feeding conditions the TBP resulting from carbohydrate supplementation may achieve levels equal to those obtained in Artemia receiving a standard, exclusively algal based, feeding regime.

ACKNOWLEDGEMENTS

This study was funded by 322 project, the Ministry of Education & Training. The authors would like to thank Em. Prof. Dr. Patrick Sorgeloos, Prof. Dr. Peter Bossier and Prof. Dr. Gilbert Van Stappen for their special helps.

Reference


AssistME

Sri Lanka Institute of Information Technology
(SLIIT)

Abstract- There are many applications that are capable of making personal daily tasks convenient, but there is no application which includes the features of an intelligent alarm, Item tracker, Navigation, Health reminder. The application explained in the paper is an integration of all the features mentioned. The goal of this research is to play the role of an assistant, so called a Virtual Assistant capable to perform on its intelligence to make the daily chores convenient. “AssistME” application will be built on the technology of Bluetooth and Global Positioning System which enables the application to track the presence of Radio Frequency Identification (RFID) tags attached to the personal belongings of the user.

Index Terms- IOT, Health Monitor, Personal Assistance, Alarm, Item tracker, Health informatics, data Integration, Weather API.

I. INTRODUCTION

The majority of the people spend a hectic and a busy life. This affects a person’s health physically and mentally that results them in oversleeping and being less punctual. This leads to a rush most of the mornings, because they are running late they tend to leave behind items. People rely on applications to make their daily tasks convenient. Most of the applications do not support notifying the user when the application is not open which actually drop down the application’s importance.

AssistME was created to assist employed people, students or any other person who needs to be punctual in their daily tasks. A person who is late will be always in a rush, because they are behind the schedule. The alarm component will assist the user to ignore the hassle and to keep up with their schedule. As mentioned above most of the people who fall behind their schedule will spend their day in a rush which increases the probability of forgetting things. This directs to the second component of the AssistME application, which is an item-tracking component. If a person forgets one of his personal belongings, he/she can find the misplaced item(s) by simply launching the AssistME application.

The application also remind the user of certain items according to the factors such as weather. Additionally AssistME has a step counting component which will monitor the user’s health and suggest the user with health advice and remind about the medicine dosage and consultation days. This component is included in the application because the targeted users will mostly spend their day outside, actively.

The research was intended to achieve the following objectives:
1) Identify the factors that will determine the wake up time of the user is based on his/her schedule, weather and traffic information.
2) Integrate with Google Maps API to determine the best path to a destination based on weather, traffic and transportation mode.
3) Remind and alert the user about a particular item that is left behind by indicating the location.
4) Attaching RFID tags to the items.
5) Develop an algorithm to determine the step count of the user so that the user can get constant accurate reminders about health issues. (Get medicine on time, step count, graph for the users health metrics).

II. BACKGROUND

The literature review was conducted by the AssistME research team under 5 main categories that are directed towards our project. There were many research papers that could be related to our research components which are the Alarm System, Item tracking System, Navigation, Health System along with Artificial Intelligence and Internet of Things that comprise the above four. Following researches were some among the research papers that were found out which could have a major impact on our innovation.

Alarm System
Early Bird Alarm Clock application consists of more additional features than a normal alarm clock. The alarm s will be generated according to the user’s pre-entered schedule. The ringtones are shuffled and randomly played different tones so the users are not familiar to a specific tone. QR codes and voice recognition is used to stop the alarm to make the user wake up to switch it off [1].

www.ijsrp.org
McGee et al. discusses about a portable device that generates an alarm with the help of a location detector. The user can preset the alarm for multiple tasks and through GPS it will generate the alarm for the relevant task and indicates that it has been performed [2].

**Item Tracking System**

**RFID tracker and locator** uses Global Positioning System (GPS) to locate the RFID tags. The RFID interface is able to read an RFID tag on a RFID item and identify it uniquely. It is also capable of storing the GPS location. A Near Field Communications (NFC) communicator is used to read a RFID tag. [3]

**Personal item monitor using radio frequency** Research done by Robert C. Boman and Brian Hanson defines a system that consists of a monitor with a transmitter and a receiver which enables the user to monitor the location of personal items. RFID tags are attached to the items, so when the signals are transmitted from the tag it checks for the presence of the item. [4]

**iBeacons** uses Bluetooth Low Energy (BLE) to communicate with any smart device within a range. It will broadcast BLE waves periodically, rather than keeping a constant connection with the device it’s communicating with. Upon broadcasting, the receivers will know of the exact location of the beacon which is much more accurate than Global Positioning System (GPS). It can be used to broadcast any kind of information. iBeacons can be used in stores and in many other areas. [5]

**Navigation and IOT**

**Google Maps** Application provides real-time traffic updates, navigation and details about places that enhances the real-time traffic updates for the user and the system to come up with an accurate estimated time of Arrival (ETA). They even contribute to update users without an internet connection. [6]

**Future Internet: The Internet of Things** Research paper conducted by Lu Tan and Neng Wang describes a concept that could be foreseeable and discoverable in near future which would change people’s life utterly. This concept expands the communication form of human-human to human-thing and thing-thing where interrelated electronic devices can transfer data without any human interactions. [7]

**Health Reminder System**

Google Fit and SHealth Applications provides features to keep up the body healthy. This enables the users to capture and store their health metrics and monitor them from anywhere. Displays the real-time exercises which motivates the users. [8][9]

**Step counting algorithm** Research paper discusses about a two phase algorithm implemented on the android platform. This algorithm has defined to overcome the restrictions that the users face and how to overcome them. [10]

**Artificial Intelligence**

Jibo is an intelligent home assistant that can remember people as they interact with it. This is capable to recognize people by their face and greet, ask a question or joke as they pass by. Jibo can take photos/videos, send/read messages, remind, make phone calls, place orders and connect with the home’s devices. [11]

**Cortana and Siri** are Personal Digital Assistants (PDAs) that will learn about the user as the user interact with it. These PDAs are capable of storing reminders based on both time and location and are also capable of managing the user’s calendars. Cortana and Siri can open any app in the system and can also fetch information about facts, places, people and other information. [12][13].

### III. METHODOLOGY

**A. Planning**

AssistME research team was formed, selected the project and defined the requirements of the system along with the scope and the boundaries. Created the Schedule (Gantt chart), Cost plan for the project, Work Breakdown Structure, followed with a literature review and identified similar applications and researches conducted.

**B. Requirement gathering and Analysis**

AssistME research team chose the Android smart phone users as the population to gather the opinions of the questionnaire created. The sample size was nearly sixty (60) android smart phone users. We selected quota from the non-probability sampling method where the questionnaire was sent out to students as well as employees and others.

Then we created a questionnaire to collect the opinions of the users about the Android application that we will be creating. Most of the questions were based on the factors that would determine the punctuality of people in general such as weather, traffic, mode of transportation, time management and absent minded.

The overall analysis of data gathering was helpful to narrow down the requirements under each component. It was suggested that an intelligent alarm can be a handy tool, but the accuracy of it is a critical factor since variables like weather and traffic seems to affect daily schedules for most. Therefore we are to expect users with hectic schedules and use of public transportation modes which limits using of alternative routes to avoid traffic. It was recognized that keys, wallets, umbrellas are among the items that are essential but forgettable. This is helpful to understand what kind of items the RFID tags should be installed into, the number of RFID tags a single user requires and also to
implement the installation method. The application must offer better accuracy, good performance and interesting personalization options to the users in order to persuade users to leave the methods in place for these tasks and use the proposed application. The results are positive enough to anticipate acceptance to the application even among many competitors such as Siri, Cortana, TrackR etc. already in use.

C. Design
The four components of the application which is an intelligent alarm with a navigation system, item tracking component and a step counting component which will be managed upon the user’s schedule. The application will run as a background process so the user will never have any trouble in finding the items as the application will notify without having it open.

Fig. 1. System Architecture

Fig. 1. describes the overview of the AssistME android application. The user is able to provide health updates and schedules to the application and the use is able to set an alarm, navigate to destination, receive health tips and find items from the application. From the Health System, health tips are provided upon receiving health updates. The Navigation System will receive the schedules of the user and navigate the user to the appropriate location. Item Tracking System will return an item’s location when an attempt is made to find an item. The user can be alerted about items through alarms. Specific items will also be reminded according to the weather condition. The Alarm System will set the alarm according to the schedule, weather information and traffic updates. The weather information will be retrieved through internet.

D. Implementation
The four components of the “Assist ME” application was implemented using Android Studio SDK. The application supports the Smart phones with Bluetooth 4.0 and Android Version 4.0 Ice Cream Sandwich and above.

Apart from all the built-in functions in the Android Studio SDK the alarm component required external API’s. Google Maps API and the Google Place API was used to get traffic information and the duration to the destinations and the nearest train stations. To retrieve the weather details and the status Open Weather API and to retrieve the train schedules Sri Lanka Railways Website was used. Data and libraries from the ST1726H chip’s datasheet was used to make the tags compatible with the application. The method of calculating BMR is retrieved by doing some research on the internet.

E. Testing
Each component was tested individually and another testing process took place after the integration. Then the final testing was done assuming the application is delivered to the user. All these were performed with the guidance of test specifications designed according to the test plan.

IV. RESULTS & DISCUSSION
This section explains about the results obtained from the AssistME application. It includes the major interfaces and important code segments.

From the tests that were performed it was clear that the accuracy rate of the functions are above 85%. Almost all the outputs gained from the test results are dependable enough to determine that the users can rely on the application when they start using it.
Fig. 2. shows the initial interface of the AssistME application. This interface is only visible in the first time a user launches the application. This interface allows the user to choose the items that they carry, provide the destination, provide the time that they need to be present at the destination and the transportation method of their choosing. The above mentioned information will be collected for each day. Initial alarms will be made with the data gathered from the system.

Fig. 3. shows the Add alarm interface that allows the user to give a title to the alarm, choose a ringtone, the destination, transportation method and time that they need to be present at the destination. This interface is for the user to create an alarm to their liking, apart from the alarm which is made from the initial interface.

Fig. 4. explains a small code segment which is used when influencing the alarm with the weather condition.
Fig. 5. shows the Add item interface. In this interface, the user can pair an iTag with the AssistME application which they can attach to the items that they need to keep track of. The user can toggle the tracking state of each tag and can search for tags to pair with the search floating action button.

Fig. 6. describes a code segment regarding the thread which is used to scan the iTags.

Fig. 7. shows the Health interface of the AssistME application. It displays the step count of the user and calculates the BMR according to the health information captured from the user and their step count.

V. CONCLUSION

The main goal of this research was to develop an application that can perform as a virtual assistant who is capable to work on its own intelligence. All the objectives were achieved through the implementation of algorithms according to the components functionality. The components were designed with necessary assumptions to produce a reliable and accurate output to the user in order to enhance the quality of the application.

Assist ME application was built on assumptions such as the user will have a simple knowledge in English as well as the smart phone. The GPS component in the phone must function as designed and all the information and the notifications can only be received through their own account. In addition the processing power and the internet connectivity of the smart phone will affect the speed of the application to perform its tasks.

The current application includes all the essential features as the proposed concept. Additional features like connecting the Alarm component to Google Transit which is supported by some
countries might help the users to get more accurate results regarding the public transportation. A person with an interest of continuing this research to the next level can enhance this by enabling a vocal representation to answer the questions as a normal Virtual Personal Assistant.

ACKNOWLEDGEMENT

We dedicate our special thanks to Sri Lanka Institute of Information Technology for the opportunity to conduct a research on information technology and implementation and our lecture in charge Ms. Gayana Fernando and Dr. Yasas Jayaweera for the tremendous support.

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Enhancing Irrigation Farming In Nigeria Using Software Technologies

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Abstract - The rapid increase in population in Nigeria has brought the need for a massive increase in agricultural produce to cater for the population. In view of this, traditional farming only during the annual rainy season cannot suffice to cultivate enough farm produce for the nation. Therefore, irrigation farming that allows farmers to plant crops throughout the year is now embraced across the country. However, lack of knowledge about the crops that can grow best in a particular land and the exact amount of water and fertilizer needed in the farm is leading to poor output. This study proposes intelligent irrigation software system to improve irrigation farming in Nigeria by acquiring and sharing information about crops requirements (soil, quantity of water and fertilizer) with farmers. With the use of Global Positioning System (GPS) and expert agricultural information, data is captured by the software, analyzed and shared with the selected farmers. The final output is generated and sent to the Farmer via Short Message Service (SMS) describing the accurate farmland size, suitable crops to plant, as well as the agrochemicals needed in the farmland.

Index Terms - Agricultural Information System, Irrigation farming, AFAN, GPS,

I. INTRODUCTION

It wouldn’t be an exaggeration to say that nearly every farmer that is in to irrigation farming for over 10 years in Nigeria now has a mobile phone. A trial being conducted by the AFAN is showing that the mobile has great potential for more than phoning home. About 90% of the country’s food is produced by small-scale farmers cultivating tiny plots of land [1]. Irrigation Agriculture in Nigeria is plagued with problems of poor access to information, inputs and low productivity [8]. Farmers face unpredictable weather brought on by climate change, sometimes the rainy season comes late; at other times, it ends early, and sometimes the rains come late and hard causing floods. At other times, rains don’t come at all, causing drought. With these weather changes, it is difficult for farmers to plan which crops to grow, when to prepare land, when to plant, and how to plan other farming tasks. Worst hit are those from the North who have to respond to serious weather changes, making it difficult for them to farm during dry season, which runs from October to May. The weather during this period is much hotter and drier [7].

Agricultural irrigation in Zamfara State is plagued with problems of poor access to information, inputs and low productivity. Most farmers in state fail to have much knowledge about the nature of their farmlands, the accurate size of their farmlands this drawback leads to either under or over application of agrochemicals and fertilizer, which leads to poor yield and the farmers mostly run their farming at lost and end of becoming discourage in the entire system. Computer technology analyses the data and sends a short message about irrigation for the crop by mobile phone. For example, it tells you how long to run a drip irrigation system for a vineyard, the computer system applies a crop factor for low, medium or high watering over a season and calculates dripper run times, based on the individual irrigation system’s output. A short message is automatically sent to a mobile phone by SMS each morning. For evaporation text message advice, cumulative evaporation readings for the past week are collected and sent by mobile phone. As it develops, more farmers will save money in water monitoring and irrigation costs, by making appropriate budget. The advancement in the technologies has enabled the use of state-of-art technology at a reasonably low cost [11]. The objectives of this study are to:

1) To help farmers to have access to basic information about their farm requirements and weather condition in the farm.
2) Enable farmers to make appropriate planning with regards type of crop to plant, required fertilizer and quantity of water needed daily.
3) Update and share the information regularly with the selected farmers.

For this reason, the proposed study aimed at providing solution to the problems by developing real time Intelligent Irrigation Software System (IISS).

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II. RELATED WORKS
The National Economic Council recently reported that Nigeria spends 2.8 billion American dollars annually on food importation [8]. In fact the situation is getting worst as the global food crisis is reaching alarming rate and has become a great concern. Recently, World Bank inaugurates 1.2 billion American dollar ‘fast –truck facility to boost its support for global agriculture and food to overcome global food crisis [8]. We should note that the first goal of the eight Millennium Development Goals, eradicating extreme hunger and poverty has been traced to agriculture. This first goal calls for halving hunger and poverty by 2015 taking 1990 as the base line [5].

The GPRS feature of mobile phone is used for proving solution to irrigation control problem. Sufficient amount of water can be given to the fields. The system sends messages using GSM [3]. The scheme has a 47m long concrete weir constructed on Oshin River to impound water for irrigating about 100hectares of farmland at the inception. Additional weir was constructed in 2001 down the main weir together with the improvement made by increasing the height of the former weir. Throughout the world, irrigation schedules are based on farmer’s experience and changes according to weather fluctuation which can be handled by smart irrigation system. This approach requires PCs (Client/Server) along with additional devices like modems, buffers, etc. for internet connectivity and software support for TCP/IP protocols and control system interaction [4]. The target however is to be able to cultivate about 1000ha. This is one of the reasons for the additional weir constructed in 2002 [9]. With over 70 per cent of rural people in agriculture their access to productive resources and employment is critical. According to IFPRI report 2002, more productive agriculture is vital, for productive gain in agriculture would boost the income of rural people both on and off the farm and to the extent that gains in agriculture productivity leads to lower food prices. Despite this, many rural people do not have the tool they need, to be more productive farmers [6]. For instance they need access to credit and savings institutions, fertilizer, as well as high yield seedlings.

III. METHODOLOGY
Global Positioning System devices, and also Digital Cameras were used in mapping the farm and the data was recorded and uploaded to the computer. This study achieved by examining the trends of irrigation system component parts and its interactions [10]. The goal of farmland mapping is to enable better performance so that it can lead greater profits and serve its constituents more effectively [2]. The finite step by step of solving a problem is term to be algorithm, several algorithms were used to solve the problem, among which include: The algorithm for transforming the waypoints in to the longitude and latitude to distance. Using the ‘Haversine’ formula to calculate the great-circle distance between two points (the shortest distance over the earth’s surface – giving an ‘as-the-crow-flies’ distance between the points ignoring any hills they fly over). Algorithm for converting the waypoints as input determines the distance and the hectares of the farmland. Also, the algorithm that accepts hectares of the farmland determines the required inputs and agro chemicals needed. Lastly, algorithm for sending sms to the farmer is obtained.

Algorithm 1. Identifying the size of farmland using GPS

Procedure ComputeFarmland_Size( N, longitute1, longitude2, latitude1, latitude2, elevation1, elevation2; var reportfile);
{
counter ← 0;
Const1 ← 6378137, Const2 ← 6356752.314;
Open file(reportfile);
While (counter<= N and N<>0 ) do
{

β ← Radiuspt2*SIN(Θ2*PI()/180);
α ← Radius pt1*SIN(Θ1*PI()/180);
Hectare ← (Distance↑2)/1000;
Distance ← ((digital1↑2 +  YCoordinate↑2)½ YCoordinate ← 2*PI *(((XY1 + XY2)/2))/360) *(Latitude 1 - Latitude 2);
XCoordinate ← ((XY1 + XY2)↑2 + (α - β) ↑2) ↑½;
XY1 ← Radiuspt1*COS(Θ1*PI()/180);
XY1 ← Radiuspt2*COS(Θ2*PI()/180);
Radius pt2 ← (1/((COS(Θ2*PI()/180)) ↑2)+(SIN(Θ2*PI()/180))) ↑2/Const1↑2 + (Elevation1 + Elevation2) /2;
Radius pt1←((COS(Θ1*PI()/180)) ↑2/Const1↑2 +(SIN(Θ1*PI()/180)) ↑2/Const2↑2) ↑½ + (Elevation1 + Elevation2)/2;
θ2 ← (ATAN((Const2↑2)/((Const1↑2)+(SIN(Θ1*PI()/180))↑2/Const2↑2)) ↑½ + (Elevation1 + Elevation2)/2;
θ1 ← (ATAN((Const2↑2)/((Const1↑2)+(SIN(Θ1*PI()/180))↑2/Const2↑2)) ↑½ + (Elevation1 + Elevation2)/2;
Write (reportfile, Hectare);
Counter ←counter +1
}

End
The algorithm is used to compute the size of each farmland. It takes total farmlands(N), longitude1, longitude2, latitude1, latitude2, elevation1, elevation2 as input parameter and return hectare as output parameter, and the hectares are stored in a report file.

**Algorithm 2. Calculating the quantity of agro chemicals**

```plaintext
PROCEDURE AGROINPUT(Crop; Reportfile)
  Open file(Reportfile);
  Extract:(Reportfile, hectare)
  for all hectare h ∈ farmland do
    if crop ← true then
      NPK ← getNPK(crop);
      UREA ← getUREA(crop);
      Trigger agrochemicals(crop);
    End if
  End for
}
```

This algorithm receives type of crop and reportfile and read the hectares from the report file and make computations base on the hectare size and the type of crop.

**IV. RESULTS**

The result indicate the actual inputs required from the sample of farmlands selected and mapped because the actual size of each farmland was computed. This has helped to eliminate the issue of low input or over applying inputs.

**Table 1: Comprehensive Analysis of the Farmland**

<table>
<thead>
<tr>
<th>FARM LAND</th>
<th>Elevation1</th>
<th>Elevation2</th>
<th>Longitude1</th>
<th>Longitude2</th>
<th>Latitude 1</th>
<th>Latitude 2</th>
<th>HECTARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>297</td>
<td>299</td>
<td>12.38219</td>
<td>12.38234</td>
<td>005.58067</td>
<td>005.58065</td>
<td>1.52</td>
</tr>
<tr>
<td>2</td>
<td>292</td>
<td>297</td>
<td>12.38219</td>
<td>12.38214</td>
<td>005.58008</td>
<td>005.58115</td>
<td>1.37</td>
</tr>
<tr>
<td>3</td>
<td>299</td>
<td>299</td>
<td>12.38185</td>
<td>2.38190</td>
<td>005.58237</td>
<td>005.58210</td>
<td>1.9</td>
</tr>
<tr>
<td>4</td>
<td>398</td>
<td>397</td>
<td>12.38161</td>
<td>12.38139</td>
<td>005.58315</td>
<td>005.58343</td>
<td>1.77</td>
</tr>
<tr>
<td>5</td>
<td>298</td>
<td>299</td>
<td>12.38109</td>
<td>12.38017</td>
<td>005.58417</td>
<td>005.58388</td>
<td>1.09</td>
</tr>
<tr>
<td>6</td>
<td>298</td>
<td>299</td>
<td>12.38109</td>
<td>12.38017</td>
<td>005.58417</td>
<td>005.58388</td>
<td>1.21</td>
</tr>
<tr>
<td>7</td>
<td>364</td>
<td>366</td>
<td>12.38250</td>
<td>12.38340</td>
<td>005.58664</td>
<td>005.58694</td>
<td>1.18</td>
</tr>
</tbody>
</table>

**Table 2: The Required Farmland Input and Agrochemicals**

<table>
<thead>
<tr>
<th>FARM LAND</th>
<th>CROP</th>
<th>HEATCRE</th>
<th>NPK 20:10:10 (Kg)</th>
<th>UREA 46% (Kg)</th>
<th>NPK 15:15:15 (Kg)</th>
<th>SSP 18% (Kg)</th>
<th>SEED (Kg)</th>
<th>Pesticide (g)</th>
<th>Habicide (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MAIZE</td>
<td>1.52</td>
<td>456</td>
<td>304</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>RICE UPLAND</td>
<td>1.37</td>
<td>274</td>
<td>548</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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V. CONCLUSION

The system of irrigation is fading simply due to inadequate knowledge from the required agencies to the farmers, leading to a lot of drawback. But with the new system where a farmer can make adequate plan for the farming due to this technology, a lot of people will adhere to the system to go back to irrigation.

ACKNOWLEDGMENT

We would like to acknowledge the support from Federal University Gusau in undertaking the research, under the TETFUND Institutional Base Research (IBR), scheme batch 1 with reference number TETFUND/DESS/UNIGUSAU/RP/VOL.1.

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Art of Breathing

Gopal Krishan

Abstract- Breathing is simple inhaling and exhaling of air, which we all are doing 24 hours continuously. It is a process which goes on unconsciously. PEOPLE DON’T KNOW WHETHER THEY ARE BREATHING PROPERLY OR NOT. No one is breathing consciously. Our saints, sadhus & preachers practised this and got the knowledge of proper breathing, so they enhanced their ages and lived for hundreds of years.

I. INTRODUCTION

Breathing is neither PRANAYAMA NOR YOGA; it is simply taking air inside the body and throwing it out. All can survive without food for many days, but no creature on this earth can survive for more than few minutes without (air) breathing.

Air plays a vital role in our body. Air is the life line, when a person is declared dead; the only thing not present in the body is flow of air, rest all the organs remain there.

Our body runs because of two major systems: one is nervous system and second is digestive system. Whenever any person falls sick, he/she tries to get well by having medicine (allopathic, homeopathic, Ayurveda or by naturopathy) by doing this, he only improves through his digestive system but not through his nervous system.

80 % of diseases are because of the Nervous system, which can be improved by proper breathing.

Breathing starts the moment we take birth. As everyone knows, when a child is born the first thing doctor does is- he pats on the back of the new-born child, so that child cries and opens his lungs to breathe in.

Breathing is done by respiratory system which allows us to take in vital oxygen and expel carbon dioxide.

Lungs are responsible for transferring oxygen into the bloodstream where it goes to our cells; they also remove carbon dioxide which we exhale.

Breathing is simple inhaling & exhaling of air though it seems very simple but it is very complex process. We should have rhythm in our breathing. Improper inhaling & exhaling of air is the root cause of most of the diseases. When we inhale through our nose our nasal system purifies the air our lungs are like balloons, when they expand they pull more air into body and when they compress, they expel carbon dioxide (a waste gas).

If we inhale more and exhale less, carbon dioxide will remain in the body which means waste gases will remain in the body, which is the root cause of all diseases. Also when we inhale through mouth we get impure air & toxic materials which can again make us fall sick.

Improper inhaling occurs because of the following reasons:

1. Improper sitting (when we don’t sit straight our diaphragm gets pressed and we start breathing through our abdomen our lungs don’t get proper air)

2. Improper walking, (when we don’t walk properly again the lungs don’t get proper air)

3. Improper sleeping (when we sleep with pillows under our head, our spine gets bended and is not straight. So the breathing gets blocked and lungs don’t get space to expand and contract)

It is a common fact that our respiratory system works day and night as compared to our digestive system because of our wrong postures (sitting, standing, sleeping & eating). Our digestive system works more than our respiratory system that means we breathe through our abdomen not through lungs most of the time and that is the root cause of all the diseases. When we breathe using our stomach, air goes into our abdomen and our lungs do not get proper oxygen.

Air gets all polluted because it gets mixed with all the waste and toxic material which is near our intestines. All the toxic air goes to different organs and reduces the efficiency of the organs which is the main cause off all the diseases.

When we exhale improperly, carbon dioxide remains inside our body which produces gases and reduces the efficiency of our system. It’s as simple to understand if silencer of any vehicle is blocked the efficiency of vehicle reduces and if it is choked the vehicle gets stopped. same is our body mechanism if we don’t exhale properly our system gets Blocked, efficiency of our organs reduces and we get sick. We should have proper rhythm in breathing and we should breathe consciously.

SO BREATHING PLAYS A VITAL ROLE IN OUR LIFE AND PROPER BREATHING IMPROVES OUR LIFE LINE OR WE CAN SAY INCREASES OUR PRAN URJA

PROPER BREATHING

Breathe through your nose

While inhaling, your lungs should expand so that air should go into your lungs not stomach

Always keep your back bone straight while sitting, walking or sleeping

Rhythm in breathing

Conscious Breathing

OTHER GENERAL INSTRUCTIONS

REGULAR MORNING WALK & EXERCISE

Eat proper, healthy seasonal food fruits at proper time.

Drink plenty of water.

Regular morning walk and physical exercise.

Proper breathing practices ensure the optimum exchange of Oxygen and Carbon Dioxide in the blood thus providing the right amount of Oxygen needed for nourishing all our body cells, organs and above all – the brain. Proper breathing benefits not only our physical self but also our
mental and emotional well-being, reduces stress and promotes peace of mind.

Fortunately for us, we can learn proper breathing through awareness and training under the guidance of an accomplished Guru.

Just a few hours of training and practice and you are on the way to master the perfect breathing techniques and rhythm in breathing. Get that strength, power and vitality required for day to day existence. The disciplined breathing will help your mind to concentrate and help you attain robust health and longevity.

“Yogi Gopal Krishan Ji” is an accomplished Yoga and Pranayama Guru and an authority in the art and science of breathing. He has been studying, practicing and teaching for over 25 years and has conducted numerous workshops specialized in the teaching of correct breathing practices. He has published some books covering all aspects of Yoga, Pranayama and Naturopathy.
A Clinical Study of Heart Failure with Preserved Ejection Fraction in Patients at College of Medical Sciences, Teaching Hospital: A Tertiary centre from Central Nepal


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Abstract- Heart failure is growing epidemic condition and nearly half of the patients have preserved ejection (EF>50%). We aim to observe the baseline clinical characteristics and factors affecting hospital stay and outcomes after 28 days of follow up. An observational study was conducted among 200 patients who presented clinical features of heart failure according to Framingham Criteria, with Left ventricular EF ≥ 50%, in College of Medical Sciences in the Department of Cardiology over a period of June 2015 to January 2017.Data were analyzed using IBM-SPSS 20.0 and descriptive and inferential analysis was performed.

Of 200 patients, 114(57%) were females and 86(43%) were males. The mean age of patient was 51.57±16.81 years with range of 20 to 89 years. The most common risk factors were Hypertension (78%) followed by obesity (55.5%), smoking (50%), dyslipidemia (48%), and Diabetes mellitus (48%). The most common presenting symptom was dyspnea (96%) followed by fatigue (51%) and cough. Most of the patients had Grade I Left ventricular diastolic dysfunction 84%. Associated regional wall abnormalities were found in 11%, pulmonary arterial hypertension in 57.5% and pericardial effusion in 10%. Total mortality in this study was (n=7)3.5% of them 2% within 24 hours of hospitalization and 1.5% during subsequent hospitalization within 30 days of discharge. We concluded the incidence of heart failure with preserved ejection fraction (HFPEF) was more in female. Hypertension was the most common risk and worse NYHA functional class was associated with prolonged hospital stay and mortality, both significant statistically.

Index Terms- Ejection fraction, Heart failure, Risk, outcomes

I. INTRODUCTION

Heart failure (HF) is an epidemic affecting 5.1 million American adults based on 2013 estimates, and this epidemic will grow 25% by 2030 as the United States population continues to age. [1] HF is one of the leading causes of death, approximately 30,000 deaths per year. Recent studies have indicated that more than half patients diagnosed with HF even though ejection fraction (EF) is normal or near normal. [2] Heart failure is a clinical diagnosis. [3] An ejection fraction (EF) of <50% in a patient with heart failure symptoms is termed heart failure with reduced ejection fraction (HFREF), and an EF of ≥50% in a patient with heart failure symptoms is termed heart failure with preserved EF (HFPEF). Heart failure can occur in patients in whom left ventricular systolic contractile function appears to be normal when measured by the ejection fraction. Since systolic function was presumed to be normal in these patients, this form of heart failure was thought to be due to diastolic dysfunction or abnormal filling. [4] Studies have demonstrated that HFPEF is as prevalent as HFREF. [5] It is important to note that the above terms are not mutually exclusive as nearly all patients with systolic dysfunction have some degree of concomitant diastolic dysfunction. [6]

There has been an apparent increase in the prevalence of HFPEF over the past decade. [7] Despite this, there has been considerable controversy with regards to the existence of the condition, its terminology, the characteristics of the condition and the diagnostic criteria for HFPEF. The confusion has arisen as some authors suggested that systolic function is normal in HFPEF patients, [8] while others questioned if the two entities exist as a continuum of heart failure or whether they are distinct entities. [9] There are differences in microscopic and neuroendocrine features which consequently lead to differences in left ventricular structure and echocardiographic characteristics between HFPEF and HFREF. These differences are attributed by underlying or contributing factors such as aging, hypertension, diabetes, female gender, dyslipidemia and obesity. [10] Diastolic dysfunction is categorized by Doppler echocardiographic findings into the following progression. [11] Mild (Grade I), defined as impaired relaxation without or with mild evidence of increased filling pressures respectively; Moderate (Grade II), defined as impaired relaxation associated with moderate elevation of filling pressures or pseudonormal filling, and Severe, defined as advanced reduction in compliance or reversible (Grade III) or fixed (Grade IV) restrictive filling.

The common risk factors associated with HFPEF i.e. hypertension, diabetes and coronary artery diseases are more prevalent in India. [12] The exact prevalence and incidence of HFPEF are not known, it indicates a need to carry out the study which gives us an idea regarding the prevalence, etiology, morbidity and mortality pattern of this study. So, we have carried out the study to obtain the clinical profile of the patients experiencing HFPEF along with etiology, pharmacological treatments and short-term outcomes.
II. METHODS

This was a tertiary care centre hospital based cross sectional observational study conducted at the cardiology unit of college of medical sciences Bharatpur, Nepal. Ethical approval of this study was obtained from the same hospital with written informed consent from each patients or relatives wherever necessary. We observed 200 newly admitted patients in coronary care unit and cardiology ward who fulfilled the Framingham’s criteria of heart failure [13] for clinical diagnosis and LV ejection fraction more than or equal to 50%. A Performa was used for collecting information at admission on demographics and comorbidities including history of hypertension, diabetes mellitus and others. Physical assessment was done on all patients, and patients classified according to NYHA classification. For the study, ECHO either done during in-patient stay or done in past two months was accepted for the study.

The investigator administered structured questionnaires to obtain information on outcomes at discharge, and on drug prescriptions related to heart failure at discharge. Patients were then given follow-up visit date. The investigator administered structured questionnaires and collected information on common symptoms of heart failure, NYHA classification, and QOL at one month. Data were analyzed using IBM-SPSS 20.0 (IBM Corporation, Armonk, NY, USA). The t-test and Chi-square test were used for statistical analysis. A p-value < 0.05 was considered statistically significant for all statistical tests unless otherwise stated.

III. RESULT

Out of 200 cases, 114 (57%) were females and 86 (43%) were males. The mean age of patient was 51.57(±16.81) years with range of 20 to 89 years. 2/3rd of cases were in the age group of 40 to 80 years. (Table 1)

Table 1: Clinico-epidemiological profile of patients (n=200)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>21-40</td>
<td>58</td>
<td>29</td>
</tr>
<tr>
<td>41-60</td>
<td>75</td>
<td>37.5</td>
</tr>
<tr>
<td>61-80</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>&gt;80</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Mean age ± SD (years)</td>
<td>51.57±16.81</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>86</td>
<td>43</td>
</tr>
<tr>
<td>Female</td>
<td>114</td>
<td>57</td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brahmin</td>
<td>76</td>
<td>38</td>
</tr>
<tr>
<td>Chhetri</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td>Newar</td>
<td>33</td>
<td>16.5</td>
</tr>
<tr>
<td>Magar</td>
<td>17</td>
<td>8.5</td>
</tr>
<tr>
<td>Tharu</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Gurung</td>
<td>9</td>
<td>4.5</td>
</tr>
<tr>
<td>Others</td>
<td>27</td>
<td>13.5</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The most common risk factors in our patients were Hypertension (78%) followed by obesity 55.5%, smoking (50%), dyslipidemia (48%), and Diabetes mellitus (48%), shown in figure 1. The most common presenting symptom was dyspnea (96%) followed by PND (55%), fatigue (51%) and cough (26%). Two patients presented with syncope as a presenting complaint. Figure 2.
et al. (2014),[14] the prevalence of HFPEF approaches 10% for people >80 years of age; and incidence rates seem stable in the face of a growing population. In a study conducted in central Italy that found a 4.9% prevalence of HFPEF in 65–84 year-old individuals.[16] Hedberg et al. (2001),[17] reported that the prevalence of HFPEF in a population-based sample of 75-year-old participants was 6.8%. In the present study, majority of the patients, 2/3rd belong to age group 40-80 years. The mean age being 51.57±16.81 years, this is slightly lower than other studies.

The present study shows dyspnea (96%) and fatigue (51%) as commonest symptoms. 56% of the patients having dyspnea were in NYHA functional class III-IV. In a study done in India by Devasia et al. [18] Tachycardia was the commonest clinical sign (96%). Others were pedal edema (86%), raised JVP (63%) and pulmonary edema (46%). In present study commonest risk factor was HTN (78%), followed by obesity (overweight and class I & II obesity) 55.5%, smoking 50%, DM (48%), hyperlipidemia (48%) and AF(35%). In a study done in UK by Sosin et al,[19] obesity was found in 36.3% with BMI>30 kg/m², 29.2% had diabetes,50.0% had hypertension, 5.7% had a history of myocardial infarction, and 1.9% had history of arrhythmia. In a study by Liang Guo et al,15 risk factors of HFPEF were hypertension 44.9%, dyslipidemia 38.4%, history of heart disease 16.6%, abdominal obesity 15.7%,diabetes in 11.3% and BMI>30 was seen 5.9% patients.

In a study done in 2014 by Burke et al. [20] in USA, risk factors of HFPEF were hypertension 77%, dyslipidemia 38.4%, history of heart disease (CAD) 48%, chronic kidney disease in 33%, diabetes in 33% and mean BMI of patients in study was 30±9. Similarly, a study done in patient with HFPEF in USA by Sosin et al.[19] obesity was found in 36.3% with BMI>30 kg/m², 29.2% had diabetes,50.0% had hypertension, 5.7% had a history of myocardial infarction, and 1.9% had history of arrhythmia. In a study by Liang Guo et al,15 risk factors of HFPEF were hypertension 44.9%, dyslipidemia 38.4%, history of heart disease 16.6%, abdominal obesity 15.7%,diabetes in 11.3% and BMI>30 was seen 5.9% patients.

IV. DISCUSSION

Heart failure is growing burden around the world. In the current study, 10.5% of the patient admitted in the cardiology unit had HFPEF which was 48.6% of the total heart failure cases over the study period. In epidemiological cohort studies done in USA in 2014 by Charlotte Andersson et al. (2014),[14] the prevalence of HFPEF approaches 10% for people >80 years of age; and incidence rates seem stable in the face of a growing prevalence. In a study done in Northeast China in 2012 by Liang Guo et al. [15] the prevalence of HFPEF was 4.8% in participants over 65 years old, which was consistent with the result of a study conducted in central Italy that found a 4.9% HFPEF prevalence in 65–84 year-old individuals. Hedberg et al. (2001),[17] reported that the prevalence of HFPEF in a population-based sample of 75-year-old participants was 6.8%. In the present study, majority of the patients, 2/3rd belong to age group 40-80 years. The mean age being 51.57±16.81 years, this is slightly lower than other studies.

In this study, 92.5% patients received diuretics (loop diuretics, potassium sparing diuretics or combination),65% received Antiplatelets, 53% were prescribed Statins. Similarly, Amlodipine (CCB), Angiotensin receptor blockers, Angiotensin converting enzymes inhibitors, Beta blockers, Nitrates and Digoxin in 39%, 22%, 17.5%, 14%, 9% and 8% respectively. Out of 200 patients, 4 patients died within 24 hours of hospitalization, all of them presented in NYHA class III-IV. 196 patients were discharged; only 117 patients were able to follow up either by telephone contact or during OPD visit or re-hospitalization within 30 days. 12.5% patients were re-hospitalized within 30days, among them 3 patients died and cause of death being refractory cardiogenic shock in 2 patients and the other died of sudden cardiac death.

Table 2. NYHA at presentation and duration of hospital stay in patients with heart failure (n=200)

<table>
<thead>
<tr>
<th>Duration of stay in ward (days)</th>
<th>NYHA I- II</th>
<th>NYHA III-IV</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4</td>
<td>61(30.5%)</td>
<td>2(1%)</td>
<td>0.127</td>
</tr>
<tr>
<td>4-7</td>
<td>4(2%)</td>
<td>68(34%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>&gt;7</td>
<td>15(7.5%)</td>
<td>38(19%)</td>
<td></td>
</tr>
</tbody>
</table>

In this study increase in BMI (overweight, obesity class I and class II) was found in 55.5% which was statistically significant for development of left ventricular diastolic dysfunction (LVDD), P=<0.05. Similarly, HTN was classified according to JNC-7, Pre-hypertension range of BP was found in 41.5%, stage 1 HTN in 24%, stage II HTN in 11%, 3% had isolated systolic HTN and 1% had isolated diastolic HTN. In our study 73% of patients were having abnormal ECG. The most common abnormality was LVH (31%) followed by sinus tachycardia (19.5%) and AF (17.5%).

Echocardiographic study showed mean LA 41.4±8.4 mm, MR (Mitral Regurgitation) in 48%, TR (Tricuspid Regurgitation) was seen in 49.5%. Most of the patients had Grade I LVDD (84%) and none had Grade IV LVDD. LVMI (left ventricular mass index) was statistically significant with the Grade of LVDD (p<0.01). Similarly, E/A ratio, tissue doppler, at mitral annulus Septal E/e’ & Lateral E/e’, Deceleration time (msec) and IVRT (msec) were also statistically significant with the Grade of LVDD. Table 3.

Table 3: Correlation of echocardiography parameter and grade of LVDD (n=200)

<table>
<thead>
<tr>
<th>LVDD GRADE</th>
<th>LVDD GRADE II</th>
<th>LVDD GRADE III</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>E/A Ratio</td>
<td>0.71(0.40-0.79)</td>
<td>1.0(0.8-1.2)</td>
<td>1.5(1.1-2.85)</td>
</tr>
<tr>
<td>TDI,mitral annulus</td>
<td>5.02(3.83-11.5)</td>
<td>10.4(9.2-11.9)</td>
<td>13.02(12.7-14.22)</td>
</tr>
<tr>
<td>Septal E/e'</td>
<td>4.11(4.31-7.22)</td>
<td>9.1(7.31-11.91)</td>
<td>12.01(11.23-15.20)</td>
</tr>
<tr>
<td>Lateral E/e'</td>
<td>226(216-260)</td>
<td>190(174-220)</td>
<td>160(145-207)</td>
</tr>
<tr>
<td>Deceleration time (msec)</td>
<td>91(73-106)</td>
<td>74(71-90)</td>
<td>66(55-58)</td>
</tr>
</tbody>
</table>
Lam et al.[21] Hypertension was present in 96% patients with mean SBP(132±23 mmHg) and mean DBP(67±14 mmHg).

In current study, Echocardiographic study showed mean LA 41.4±8.4mm, MR was seen in 48.5% and TR was seen in 49.5% cases. Most of the patients had Grade I LVDD 84%. PAH was seen in 57.5% and Regional wall motion abnormalities were seen in 11%. 10% patients had pericardial effusion among them 3 had moderate to large pericardial effusion and LA thrombus was seen in 1 patient. In a study done by Kaneko et al.[22] mean LA size was 4.13±1.0cm. In a study done by Yamamoto et al.[23] was 4.4±0.8cm. Similarly In a study done by Rossi et al.[24] mean LA size was 41±1.0cm. LA size is determined mainly by LV diastolic dysfunction. The relatively load-independency of a dilated LA provides an important advantage over Doppler parameters that are related to filling pressures. This is crucial as patients with HFpEF may have normal filling pressure at rest with disproportionate increase during effort. Thus, LA imaging may provide important clue for HFpEF diagnosis.[25]

In this study most of the patients 92.5%, were under diuretics which is the mainstay of treatment in heart failure. Other medication includes Antiplatelets, (65%), Statins (53%), CCB (39%), ARB (22%), ACEI (17.5%), B-blockers (14%), Nitrates (9%) and Digoxin (8%). In a study done in India by Devasia et al.[18] drugs prescribed to the patients with HFpEF were Diuretics (92%), Antiplatelets (68%), Statins (63%), ACEI (58%), Amlodipine (34%), Nitrates (12%), B-blockers (8%) and Digoxin in 6% patients. There are several clinical trials in the HFpEF population targeting on clinical symptoms, exercise capacity, diastolic dysfunction, and quality of life (QoL). Although there are tested treatments improving these outcomes, no confirmed positive outcomes in regard to mortality were obtained from all pharmacological therapies including diuretics, beta-blockers, RAAS antagonists, digitalis, HMG-CoA-reductase inhibitors (statins), nondihydropyridine calcium channel blockers, and phosphodiesterase-5 inhibition (PDE-5 inhibition) so far.[25]

In this study QOL score at 30days was significantly associated with NYHA class on Admission (p<0.05), similarly QOL score at discharge was also significant with outcomes at 30days follow up (p=0.012), anemia at the time of admission as well as AF as risk of HFpEF were significant with outcomes at 30 days, (p=0.014) & (p<0.05). Out of 200 patients, 4 patients died within 24 hours of hospitalization, all of them presented in NYHA class III-IV at the time of hospitalization. A recent meta-analysis of 7688 patients with HFpEF followed for about 4 years found an overall mortality of 32% (about an 8% annual mortality rate).[27] In a study by Henkel et al.[28] annual mortality rates ranged from about 3.5 to 6% in 3 of the large randomized clinical trial to about 15% in the observational community-based Framingham Study.

V. LIMITATIONS

This was a hospital based study at a single site so the results may not be generalized to the community, however they could potentially be reference for further study at secondary and tertiary level hospitals. All the echocardiographic assessment parameters for left ventricular diastolic function could not be done in all the patients (eg.pulmonary S/D ratio, atrial reversal velocity was done in selected cases whenever required). However, E/A ratio, reversal with valsala (whenever indicated) and E/e’ was done in all the studied patients. Proper and timely follow-up of the all patients could not be done.

VI. CONCLUSION

In conclusion, the incidence of heart failure with preserved ejection fraction (HFpEF) was more in female. Hypertension was the most common risk and worse NYHA functional class was associated with prolonged hospital stay and mortality. Although this study was done on single hospital and in a small population size, it revealed baseline information on heart failure with preserved ejection fraction which can be used as reference for further studies.

ACKNOWLEDGEMENT

The authors express sincere gratitude to lab technician Mr. Indra Prasad Dumre and all the staff in the department of Cardiology. Also the authors are thankful to Mrs Ruchi Gupta for her contribution in preparing this manuscript. Authors also sincerely thank Mr. Naresh Manadhar for his contribution in the statistical analysis.

REFERENCES


Review on Potential of Mobile Phone Usage in Agricultural Information Dissemination in Ethiopia

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Abstract- Globally, agriculture takes center stage as the engine that can transform nations’ economies. Smallholder farmers, who produce the majority of agricultural products, face various challenges, including access to adequate information, services, and key value chains. ICT is believed to play a pivotal role in disseminating information and linking farmers with clients in the agricultural value chain. The latest information and training tool, which many farmers already carry in their pockets, is the mobile phone. Information plays a vital role in agricultural development and production and their effective communication will help facilitate mutual understanding among farmers, agricultural scientist and extension workers. Increasing production is a major challenge facing present agriculture. Smallholder farmers which dominate the landscape of developing world need to improve farming through acquiring adequate knowledge and information. The objective of seminar is to review the potential of mobile phone usage by farmers for dissemination of agricultural information in Ethiopia. Main factors that influence the use of mobile phone as: high cost of available technologies, inadequate infrastructure and low ICT skills, poor and expensive connectivity, inappropriate ICT policies, language barriers, low bandwidth, inadequate and/or inappropriate credit facilities and systems. The ministry agriculture when designing strategies for effective and efficient use of mobile phone for disseminating agricultural information, they have to consider those identified factors of mobile phone usage.

Index Terms- Agriculture, Information, Mobile phone, Ethiopia

I. INTRODUCTION

Globally, agriculture takes center stage as the engine that can transform nations’ economies. Similarly, the place and role of smallholder farmers from local to global levels are recognized by the respective governments and international partners as a way to avoid age-old problems like hunger and miserable lives. Currently, it is believed that smallholder farmers can feed the world’s undernourished people (Mammo, 2015). Accordingly, agriculture employs about 62% of the population in SSA (excluding South Africa) and generates about 27% of the Gross Domestic Product (Staatz and Dembélé, 2008). Agriculture accounts for the vast majority of the poor’s livelihood activities and also holds the most promise for pro-poor economic growth (DFID, 2014). Smallholder farmers, who produce the majority of agricultural products, face various challenges, including access to adequate information, services, and key value chains (Henze, J. et al, 2010).

Information and Communication Technology is believed to play a pivotal role in disseminating information and linking farmers with clients in the agricultural value chain (Bayissa, U, 2014). ICT is helping and has some unlimited potentials to help improve the livelihoods of the rural communities and can increase the income and in the long run help in the fights against poverty (IFRAH, T, 2014). Expansion of mobile phones’ coverage is considered one of the remedies for such an information problem. The percentage of the world’s population with mobile phone coverage rose from around 12% in 1999 to around 76% in 2009. Almost three-fourths of the world’s mobile phones in 2010 were in developing countries (Donovan, 2011). In many developing countries, more people have access to mobile phones than to older technologies like telephone landlines, newspapers, and radio (Zewge, Dittrich, & Bekele, n, 2015). For instance, telephone access in SSA has been much lower than other developing regions, although exponential increase in total of mobile phones subscriptions from 53% at the end of 2005 to 73% at the end of 2010 has now put the region on a path for continued expansion in communications connectivity (ITU, 2010). According to Adam (2010), assessment of the ICT sector performance review states that Ethiopia has some ICT related opportunities that can be utilized in the dissemination of agricultural information to the users. Information is currently regarded as a factor of production like other factors such as labor, capital and land (“Dreibe. K,” 2016). Mobile phone is one of the more exciting forms of ICT, particularly in the context of developing nations. It has the potential to allow countries to leapfrog older technologies and begin converging with the rest of the world in terms of economic performance. According to Dutta, & Lanvin, (2013)12% of the world’s population lives in areas without mobile coverage. Of those that are uncovered, 92% live in rural areas. An estimated 427 million people without coverage of mobile phone from this number 52% of those without coverage are located in Sub-Saharan Africa, South Asia and South East Asia.

Telecommunication and specifically mobile phones have the potential to provide solution to the existing information asymmetry in the sectors like agriculture (Jehan, Auja, & Shahzad, 2014). The latest information and training tool, which many farmers already carry in their pockets, is the mobile phone. In theory, once set up with the relevant applications, both smart and none-
smart phones have the potential to inform, train and monitor farmers, as well as change operational processes when established as open platforms that include input supplier and markets (Henze Jet al, 2010). Across urban-rural and rich-poor divides, mobile phones connect individuals to individuals, information, markets, and services. Mobile phones have greatly reduced communication costs, thereby allowing individuals and firms to send and to obtain information quickly and cheaply on a variety of economic, social and political topics (Aker & Mbti, 2010). The rapid spread of mobile phone networks into rural areas communications infrastructure, has the potential to connect people in all the ways that global telecommunications now offers (local, national, international) (Owiny & Maretzki, 2014). Simultaneously, innovators across emerging markets are creating mobile-enabled solutions that serve market needs, building new businesses, benefiting consumers and bolstering emerging market economies (“Mobile For Development mobile operators & start-ups,” 2016).

In rural parts of Ethiopia, where access to information on individual basis may be costly and also unavailable, such arrangements are believed to have the potential to bring the required information to the rural community in the most cost effective way (BWalya et al., 2012). In agriculture, like in many other sectors, information is becoming a major input, whilst, knowledge and information plays a central role for farmers to respond to opportunities that could improve their agricultural productivity (Nyamba & Mlozi, 2012). Agricultural information is a key component in improving small-scale agricultural production (Masuki, K. F. G., n.d.). Information plays a vital role in agricultural development and production and their effective communication will help facilitate mutual understanding among farmers, agricultural scientist and extension workers. Knowledge and information are basic ingredients for increased agricultural production and productivity (Hasan, 2015). Lack of access to vital agricultural information, as well as training and advice on topics such as pests and diseases, proven farming practices and weather, has been cited as part of the causes of the current problems (Mwangi, 2012).

1.2 Statement of problem

Increasing production is a major challenge facing present agriculture. Smallholder farmers which dominate the landscape of developing world need to improve farming through acquiring adequate knowledge and information (Aker, 2010). Farmers exhibit ambiguous risk-averse behavior when they lack information pertaining to the likelihood of occurrence of the possible outcomes of new technology, which might have a detrimental impact on adoption (Tessema, et al., 2016). A mix of several factors prevents the adoption of new agricultural technology and innovation by farmers and involves the level of education, individual risk preferences, capital, perception, as well as inputs such as land, labour and credit, as well as access to information (Aker, 2010). Relevant and suitable information on best practices, new technologies, post-harvest handling, and value-addition are key in order to boost productivity (Henze, J, 2010).

According to Asayehegn et al, (2012), In Ethiopia most agents use individual extension methods (farm or home visits and use of contact farmers) to communicate and to disseminate agricultural technologies to farmers. Agents are also working under areas characterized by lack of infrastructural facilities such as transportation. Conventional extension methods such as farm or home visits and the use of contact farmers do not provide the needed agricultural information on timely basis (Deribe.K, 2011). The impact of mobile phones on development will, however, in the end be determined not only by the number of owners of SIM cards and subscription rates, but also by the actual ways in which mobile phones are used and the benefits that Africans derive from using mobile phones (Bornman, 2012).

According to Deribe.K (2016), Moreover in Ethiopia one kebele, where three DAs each for crops, livestock and natural resource management are deployed, has approximately 800 -1200 farm households. This makes it practically difficult to reach the farmers by face-to-face or individual contact methods. The above mentioned problems calls for the use of ICTs to support agricultural extension services, because ICTs, particularly mobile phones, can be very effective in delivering timely and relevant information to farmers, even to those living in remote areas. Though the potential of mobile phones is vast, little is known regarding the use of mobile phones in agriculture in Ethiopia.

1.3 Objective of the seminar

1.3.1 General objective

The overall objective of this seminar was to review the potential of mobile phone usage by farmers for dissemination of agricultural information in Ethiopia

1.3.2 Specific objective:

- To review penetration of mobile phone across in Ethiopia
- To review role of mobile phone usage in disseminating agricultural information in Ethiopia
- To review factor affecting mobile phone usage of farmer in Ethiopia
- To review mobile phone initiatives and policy intervention in Ethiopia

1.4 Significance of study

There are not much review related to this title so, it can be an opportunity to the next students or other researchers who study related to this title use as reference and the university organize document that can serve as a guideline in the future. In addition, it can indicate directions and supply information for further research, extension and development efforts for non-governmental organizations whose main concern with agricultural information by ICT or by mobile phone in general.
II. POTENTIAL OF MOBILE USAGE IN DISSEMINATION OF AGRICULTURAL INFORMATION

2.1 Conceptual understanding of mobile phone and agricultural information dissemination

The mobile phone is the primary connection tool for most people in the world. The mobile phone now with significant computing power of primary internet connection and the only one for a majority of the people across the world, providing information in a portable, well-connected form at a relatively low price (Lee Rainie and Janna Anderson, 2008). Mobile phones-as information platforms that receive short message service, menu or voice message information-provide the ability to get connected to new knowledge and information sources not previously available with the possibility of real-time, highly tailored information delivery (Mwangi, 2012). Mobile phone usage by farmers reduced the information search costs, thereby dramatically lowering transaction costs and enabling greater farmer participation in commercial agriculture (Ogboma, 2010).

Information has a vital role to play in improving and sustaining agricultural production of any nation. Therefore, it is necessary to identify the nature and type of information that farmers need so as to provide them with relevant, reliable, and timely information not only to help them make accurate decisions, but also to contribute to increase productivity (“Deribe K,” 2016). The broad categories of information required by farmers can be categorized as know-how, which helps a farmer with fundamental information such as what to plant and which seed varieties to use; contextual information such as weather, best practice for cultivation in the locality; and market information such as prices, demand indicators, and logistical information (Mittal et al., 2010).

Information from external sources, such as agricultural extension agents, m-services, radio, TV or newspapers, can play a central role in the assessment of suitability and risk of a technology (Woodill and Udell, 2012). Importantly, farmers will also require the necessary information to assess the suitability of the technology for their farming system and to understand the potential risks associated with the use of the technology. For instance, farmers may be uncertain about the profitability of the new technology or differences in economic returns between new and old technologies. Such uncertainties may arise due to insufficient knowledge about yields of new technologies, the types and costs of needed inputs, or expected market prices and demand for the produce (Baumüller, 2012). Farmers also often lack information on current market prices to be able to negotiate better deals. Disseminating price information, for instance through mobile phones, is seen as a way of reducing information asymmetries and increasing the bargaining power of farmers (Baumüller, 2012).

M-Agriculture is the more recent term used to describe the various mobile technology based services, which are used in the agriculture sector. Term has evolved from the term e-agriculture, to specifically mean the mobile phone services developed in the past few decades. Globally there are few hundred different services in use, developed by both the private companies and international organizations (OXFAM, 2013). Several m services have already been developed that deliver information to farmers either on demand or by sending updates via SMS or audio recordings. M-services may also serve to facilitate farmer-to-farmer or farmer-to-buyer relations, such as sharing of experiences on farming practices and market information related to prices, supply and demand (Baumüller, 2012).

2.2 Mobile phone and agricultural information dissemination in Ethiopia

2.2.1 An overview of agricultural extension service in Ethiopia

In Ethiopia, public agricultural extension services have been in action for about half a century. Studies show that Ethiopia has the largest agricultural extension system in Sub-Saharan Africa, and third largest in the world after China and India (Swanson and Rajalahti, 2010). According to the Bill and Melinda Gates Foundation (2010), a total of 8,500 farmers training centers have been established and 63,000 field extension workers (known as development agents-DAs) have been trained. Agricultural extension services include transferring knowledge to farmers, advising and educating farmers in their decision making, enabling farmers to clarify their own goals and possibilities, and stimulating desirable agricultural developments. Traditional public-sector extension services use a variety of extension programs to overcome barriers to technological adoption without much success (Aker 2010).

The current extension approach, therefore, follows FTC-based extension system. The FTCs are positioned to facilitate agricultural knowledge and information exchange among researchers, extension workers and farmers. Woreda level agricultural offices are responsible for managing the operation of FTCs with the support of zonal and regional agriculture bureaus and are the frontline administrative structure for implementing agricultural extension services in the country (“Promoting ICT based agricultural knowledge management,” 2012). Despite the potential role that FTCs and DAs can play in knowledge and information dissemination, a number of factors pose limits to the proper implementation and success of the program. In this regard, inadequate infrastructure and localized technical information, as well as budgetary shortfalls are some of the major constraints that inhibit effective agricultural knowledge management and delivery of agricultural extension services in Ethiopia (Davis et al, 2010 and BMFG, 2010).

2.2.2 Knowledge management and information in Ethiopia

Knowledge is power and agriculture is no exception. However, information and communication technologies (ICTs) are deeply implicated in knowledge flow and innovation (Masuki, K. F. G, n.d.). Knowledge management deals with the process of capturing, sharing and using of knowledge and techniques (“Promoting ICT based agricultural knowledge management,” 2012). In agriculture, education and access to knowledge creates conditions that enable farmers to acquire and use information for decision making regarding allocates and technical matters effectively. This leads to growth in the adoption of technology; the use of modern inputs like machines and fertilizers improves yield (Mittal & Mehar, 2012). Knowledge is considered as the fourth production factor after labor, land and capital and is particularly critical in the agricultural sector. Making relevant knowledge accessible to the farming community helps improve production, productivity and brings higher returns (AFAAS, 2011).
Agricultural information and knowledge created from these sources is stored in various forms before it is disseminated for use. The stored knowledge and information is then disseminated to users, such as rural farmers, through intermediaries notably during trainings, field visits, exhibitions, publications, and using traditional forms of ICT (TV and radio), modern forms of ICT (internet, mobile phone, etc.), and others (“Promoting ICT based agricultural knowledge management,” 2012).

Effective knowledge management is achieved when the right knowledge and information is delivered to the right person at the right time in a user friendly and accessible manner that helps the recipients to perform their jobs efficiently (Islam, 2010).

2.2.3 Agricultural information dissemination in Ethiopia

A better understanding of farmers’ agricultural information needs and information seeking behaviors could support extension system to better target specific groups of farmers according to their preferences (Babu et al., 2012; Deribe.K, 2011; Ogboma, 2010;). Smallholder farmers in Ethiopia as well as elsewhere in the developing world require up to date knowledge and information in order to effectively and efficiently perform their farming practices. The information that farmers demand ranges from accessibility of new farming methods, availability of weather forecast and supply as well as price of inputs and outputs, among others. In Ethiopia, various institutions and organizations are engaged in the creation, collection, storing, and dissemination of agricultural information (“Promoting ICT based agricultural knowledge management,” 2012). Print formats and ICTs such as radio, mobile phones, Internet, and emails can be used to share and distribute knowledge among farming communities to supplement what was gained verbally (Lwoga et al., 2011).

In Ethiopia extension services help to disseminate information regarding the technology relevant for their geographical areas and cropping system and generate awareness among farmers by recommending the appropriate quantity and quality of inputs and their timely use (Mittal & Mehar, 2012). Reducing the costs of disseminating information could increase the extension system’s geographic scope and scale, as well as facilitate more frequent and timely communications between extension agents and farmers. Yet the impact of these reduced costs on farmers’ adoption decisions will depend upon the ability of such information to serve as substitute for in-person mechanisms(Adongo, 2013). The information needs of the farming community are partly addressed by the public extension system in FTCs supported by trained Development Agents assigned at FTCs (Davis et al., 2010).

2.3 Mobile subscription and penetration in Ethiopia

The number of mobile phone subscriptions in Ethiopia has been rising by a compound annual rate of 128% (ITU, 2009), which is the second-highest rate in Africa, after Guinea-Bissau. The Ethiopian government is currently undertaking a number of reforms to improve the existing telecommunications infrastructures and to expand the telecommunication services both in rural and urban areas. The Ethiopian mobile-cellular telephone subscriptions and penetration show dramatic change starting from year 2009 (Deribe.K, 2016 and ITU, 2012). Comparative analysis of the communications market in Ethiopia with neighboring countries like Kenya and Sudan shows that Ethiopia lags far behind its neighbors and is unlikely to catch up with the rest of the world unless it develops competitive policies that stimulate sector growth (Adam, 2010).
Table 1: Mobile Penetration Ethiopia with Neighbors

<table>
<thead>
<tr>
<th></th>
<th>Ethiopia</th>
<th>Kenya</th>
<th>Sudan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile (2008)</td>
<td>3%</td>
<td>39%</td>
<td>30%</td>
</tr>
<tr>
<td>Internet Users (2009)</td>
<td>360,000</td>
<td>3,360,000</td>
<td>3,800,000</td>
</tr>
<tr>
<td>Broadband Penetration (2008)</td>
<td>0.0005%</td>
<td>0.01%</td>
<td>0.02%</td>
</tr>
<tr>
<td>Driver of Universal Access</td>
<td>Incumbent</td>
<td>CCK</td>
<td>NTC</td>
</tr>
<tr>
<td>Regulator</td>
<td>Partially independent</td>
<td>Fully independent</td>
<td>Partially independent</td>
</tr>
</tbody>
</table>


Ethiopia telecommunication has been aggressively expanding rural connectivity. Technologies and services that have particularly experienced expansion include telephone infrastructure and services, mobile/cellular telephone, mobile radio communication, payphones, the internet, internet cafe services and community centers, which provide a broad range of multipurpose communication (Deribe.K, 2016 and FDRE, 2009).

Table 2: Ethiopia rural mobile phone coverage compare to other countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent of World's Population Living Outside Coverage</th>
<th>Rural Population Outside Coverage</th>
<th>Number of People Living Outside of Coverage (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>0.15%</td>
<td>0.7%</td>
<td>0.8</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>9.92%</td>
<td>95.5%</td>
<td>81.4</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.6%</td>
<td>26%</td>
<td>38</td>
</tr>
<tr>
<td>Kenya</td>
<td>0.4%</td>
<td>11.5%</td>
<td>3</td>
</tr>
<tr>
<td>Nigeria</td>
<td>4.7%</td>
<td>31.9%</td>
<td>38.8</td>
</tr>
<tr>
<td>Pakistan</td>
<td>1%</td>
<td>7.8%</td>
<td>7.9</td>
</tr>
<tr>
<td>Tanzania</td>
<td>0.4%</td>
<td>8.7%</td>
<td>3.4</td>
</tr>
<tr>
<td>Uganda</td>
<td>0.1%</td>
<td>3.4%</td>
<td>1</td>
</tr>
</tbody>
</table>

2.4 Role of mobile phone usage in dissemination of agricultural information

New mobile phone-based agriculture extension services are increasingly offering solutions to address challenges as traditionally extension services are struggling to fill the knowledge gap and drive structural changes. Other extension channels for agriculture information are TV, radio and print media and manuals that might create initial interest in new systems with farmers, but are static tools and do not allow questions, clarification or in-depth training. These tools and extension services primarily address the information gap, yet do little to address the structural challenges farmers face, and hence lack the transformative power required (Henze. J. et al, 2010). Mobile phones may help users to substitute phone calls for travel, which reduced farmers’ time and cost burdens. Time savings are important for agricultural households, because many crops have extremely time-sensitive and labor intensive production cycles. Farmers receive calls with potentially useful agricultural information on their mobile phones and need not leave their fields to access the information. In case a farmer misses a call, she can call back and listen to that information on the main line (Cole, Fernando, & Cole, n.d.).
2.4.1 Phone usage and agricultural productivity

Ethiopian rural areas are populated by small-scale subsistence farmers who cultivate 95% of all crop land and account for 90% of the national production. However, despite the prevalence of agriculture across the society, Ethiopia remains dependent on food aid because of inefficient and ecosystem-degrading farming practices (Mojo et al., 2010). Early in the season, the phones are used to inquire about time of planting, source and availability of seeds and other inputs. During mid-season, most farmers use the phone to inquire about availability of pesticides for pest and disease management. Later in the season during harvesting, the phones are used to inquire about the prevailing market prices for agricultural commodities (Masuki, et al, 2007).

2.4.2 Phone usage and market access

In the last number of decades, different formats and channels (containers of information) were used to provide market and price information, particularly for rural smallholder farmers. According Mammo, (2015), to a key informant, in West Hararege, Ethiopia in the 1950s, agricultural market and price information about different commodities was provided from person to person, with people travelling from one place to another on horseback. After that the same information was provided through post offices. Currently, globally market, price and mobile commodity exchanges offices provide other market-related information. Agricultural marketing information available to farmers would not only help farmers to sell their products at better prices, but also provide reliable food price information to policy makers to prevent price volatility and speculation (Sustainability, Program, Papo, Jessee, & Moorthy, n.d.).

2.4.3 Phone usage and natural resource management

The phone was not specifically used to seek information or advice on natural resource management because such information was thought to require lengthy explanations which would be expensive to follow on phone (Masuki et al., 2007). A lack of information has been cited as the main barrier to Ethiopian farmers’ adoption of more sustainable and effective practices. Since 1970, agricultural experts have reportedly increased their efforts to improve information dissemination within the sector but with little success (Matous, 2014).

2.4.4 Phone usage and knowledge base

The presence and usage of the phones built self confidence in the farmers some of whom managed to buy their own. The experience in using the village phone contributed to building confidence in using any other phone, knowing phone alerts, for example, when the phone is busy, not available, dropped calls, low credit, low battery, unstable network and using extra phone features like short message services, checking credit, alerting (beeping), playing phone games and changing ringing tones. The greatest contribution of phone usage especially on accessing markets is farmers realizing the necessity of prior knowledge of prevailing market prices and how to negotiate at competitive prices.
prices so as to enhance negotiation for better prices for their commodities (Masuki et al., 2007). The concept of utilizing mobile phones to bridge information and knowledge gaps among farmers and rural service providers is based on two assumptions. The first is the near ubiquity of access and use of mobile phones. The second is that farmers (especially in developing economies) have specific information and knowledge needs that are currently only met partially, if at all (Hasan, 2015).

### 2.5. Information need by farmers and sources of agricultural information
Agriculture-related information has been produced and published by a number of government agencies and academic sectors as well as relevant private companies. The agricultural information has been available in either primary or secondary form according to the purpose of use. Product market price, for example, may be more accurate if it is directly gathered from local markets. On the other hand, a proper use of new agricultural technology, for example, dissemination of real-time data or information through wireless sensor network, may be more reliable if it is proved and delivered from government bodies or research centers (“communities in Thailand . Edith Cowan University,” 2011).

#### Table 5: Farmers Information Needs Prioritization

<table>
<thead>
<tr>
<th>Source</th>
<th>Information provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRICULTURE</td>
<td>NATURAL RESOURCES MANAGEMENT</td>
</tr>
<tr>
<td>Source of quality seeds</td>
<td>Soil erosion prevention and control</td>
</tr>
<tr>
<td>Knowledge on what grows in which soils</td>
<td>Soil fertility management</td>
</tr>
<tr>
<td>Source of pesticide and its application</td>
<td>Soil moisture control</td>
</tr>
<tr>
<td>Management of diseases and pests in animals and crops</td>
<td>Tree planting</td>
</tr>
<tr>
<td>Nursery bed preparation</td>
<td>Control and management of water sources</td>
</tr>
<tr>
<td>Post harvest handling</td>
<td>Byelaws formulation</td>
</tr>
<tr>
<td>Formulating byelaws</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Masuki, K. F. G, n.d.

#### Table 6: Source of agricultural information

<table>
<thead>
<tr>
<th>Source</th>
<th>Information provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government extension service provide</td>
<td>Management</td>
</tr>
<tr>
<td>Agro dealers</td>
<td>Inputs</td>
</tr>
<tr>
<td>Veterinary personnel</td>
<td>Disease control and treatment</td>
</tr>
<tr>
<td>Others progressive farmers</td>
<td>Management</td>
</tr>
<tr>
<td>Markets</td>
<td>Commodity prices and market</td>
</tr>
<tr>
<td>Brokers</td>
<td>Marketing</td>
</tr>
</tbody>
</table>

**Source:** Mwangi, J. W. (2012).

### 2.6 Mobile applications in agriculture of Ethiopia
Information provided by the application should be relevant to the farmer’s location, climatic zone, current position in the agricultural cycle, income level and availability of agricultural inputs (OXFAM, 2013). In Ethiopia appropriate mobile technologies are being assembled even in-country, which are suitable for different mobile applications and which practically overcome our existing infrastructure and network problems. The idea of using mobile computing in agriculture (also known as m-Agriculture) is a new concept in North America, while m-Agriculture in the developing world has been known and written about for almost a decade (Woodill and Udell, 2012). Mobile financial services are among the most promising mobile applications in the developing world. Mobile money could become a general platform that transforms entire economies, as it is adopted across commerce, health care, agriculture and other sectors (World Bank, 2012). Mobile applications in agriculture in Ethiopia is a new phenomenon, despite that there are many and various mobile applications in agriculture in many African countries (Mammo, 2015). In Ethiopia appropriate mobile technologies are being assembled even in-country, which are suitable for different mobile applications and which practically overcome our existing infrastructure and network problems. The farmers know well that ‘the use of mobile is more than just talking on it.’ It is obvious that ICTs are the future of extension. Put differently, the time has come to move from accessibility of mobile-to-mobile applications. Actually, agriculture does not lack resources; it lacks policy and ICT application (Yared.M, 2015).
2.7. Mobile-based initiative on agricultural information in Ethiopia

2.7.1 The 8028 hotline information service initiative in Ethiopia

Agricultural Transformation Agency (ATA) started by collaborative effort between the Ministry of Agriculture (MoA), the Ethiopian Institute of Agricultural Research (EIAR) and Ethiopia Telecommunication, since 2014. ATA, the 8028 hotline is revolutionizing traditional agricultural extension services by providing smallholder farmers with direct access to “best practice” agronomic advice (Telecom & Wondirad, 2015). As an Interactive Voice Response (IVR)/Short Message Service (SMS) system, the 8028 hotline currently provides smallholder farmers free access to information on cereal, horticulture, and pulse/oil seed crops, as well as a wide range of general agriculture-related activities. Automated and voice-recorded information on pre-planting, planting, crop protection, post-harvest, fertilizer application, processing, and irrigation is accessible to callers through 90 service lines (Telecom & Wondirad, 2015).

Twelve weeks after its launch in the Oromia, Amhara, Tigray and SNNP regions, the hotline received nearly 1.5 million calls from 300,000 farmers. There were more than 90 lines taking an average of 35,000 calls a day. Within 6 months of its launch, the system handled approximately 3 million phone calls from over 500,000 registered callers. On the average, the system received 176,431 new and 879,573 return calls in a month. Of the total number of callers, 86% were farmers, 5% were development agents and 2.2% were agricultural experts. Women made up 19% of total callers. The service was available in three of Ethiopia’s main languages: Amharic, Oromiffa and Tigringa. The responsible agency, ATA, worked closely with the gates foundation, the Netherlands embassy in Ethiopia and Canada’s department of foreign affairs, trade and development (ATA, 2014b).

2.7.2 Ethiopia commodity exchange

The Ethiopian Commodity Exchange (ECX) is another organization that has embarked on some modern types of ICT-based information management system. In addition, ECX has developed a prototype for data dissemination using short message services (SMS) and interactive voice response (IVR) (Bwalya et al., 2012). ECX also provides market data in four local languages via automatic telephone messaging. According to the executive director of ECX, on average, about 20,000 calls are made daily via a toll free number seeking for price information, while SMS service applies mobile telephony for market information delivery to users (World Bank, 2011).

2.7.3 Ethiopian livestock market information system

The Ethiopian Livestock Market Information System (ETLMIS) provides regular livestock prices and volume information on most of the major livestock markets in Ethiopia. This system provides near real time market information which is available on request via SMS text message system, email, world space radio systems and on the Internet. The ETLMIS was created as part of the links sub-project within the global livestock collaborative research support Programme being implemented by texas and university and funded by United States Agency for International Development (USAID).
2.7.4 Kifiya financial technology in Ethiopia

Kifiya is a digital service provider leveraging innovative technology to enable and provide electronic, branchless banking and mobile money services. Kifiya financial technology was established in February 2010 by global computing solutions plc. Mobile money enables customers to make transactions using the power of their mobile phones. Products range from utility bill payments to electronic airtime top-up, bank balance enquiry, and money transfer. Mobile agents are equipped with end point devices (EPDs), allowing customers in remote, rural areas to conduct transactions and access previously unavailable financial services with simple biometric authentication (Kifiya, 2014). The additional money spent on mobile phone had effect on the use of mobile for agricultural purposes. Spending more money on mobile communication had positive effects on mobile phone usage.

2.7.5 Improving productivity and market success

The IPMS project only operates in the ten pilot learning woreda in Ethiopia (Deribe.K, 2016 and Lemma et al., 2011). In addition, IPMS project has also developed web-based portal called the Ethiopian agriculture portal. This portal aggregates information from diverse national and international sources. It contains technology, market related as well as extension packages for a wide range of crops, forest products, and livestock.

2.8 The Combination mobile phone with radio

Nowadays mobile phone devices include FM radio applications, and this allows smallholder farmers to listen to radio programs and also call into live programs. Therefore, farmers in rural communities who have mobile phones can interact easily with agricultural radio program broadcasters. In Ethiopia, over the last two decades the dramatic improvement of broadcasting sector has been seen with the growth in government, commercial and community radio stations (Adam, 2010). According to Deribe.K (2016), as expected mobile phone with handset FM radio had positive relationship with the use of mobile phones for agricultural purposes. Mobile radio coverage and quality is generally uneven across the country, with the capital Addis Ababa the most connected, and some regions, such as Southern Nations and Nationalities People (SNNP) and Benshagul-Gumuz, barely connected with only about 1% population coverage (Adam, 2010). About 90% of the country is covered by radio signal (EBA, 2012). Therefore, these technologies have the potential to completely transform the relationship between listeners and content providers.

2.9. Factor affecting mobile phone access and usage of farmers in Ethiopia

According to Falola and Adewumi (2011), main factors that influence the use of mobile phone has, high cost of available technologies, inadequate infrastructure and low ICT skills, poor and expensive connectivity, inappropriate ICT policies, language barriers, low bandwidth, inadequate or inappropriate credit facilities and systems. In effect, the combination of these constraints would result in a digital divide between the urban and rural areas. Yakubu et al. (2013), on socio-economic factors affecting the adoption of mobile phone by extension workers revealed that education, income, training, awareness, access, age and membership of agricultural organizations were significant factors to mobile phone adoption. According to Hasan (2015), The growth of mobile phone uses for disseminating the information towards the farmers for the development of agricultural is obstacle over the years for so many factors. Some of those factors are been mentioned below:

- Education

  Education, which is the backbone of a nation, is unfortunately seen as a corrupted sector in a developing country. Although the percentage of literacy is been increasing day by day in written but the matter-of-fact is that their education is limited only to put the signature. But to get the maximum benefit from the technological aspect the real education is been required and there is a huge lacking on it. The assumption that basic skills of literacy and numeracy can make a difference to productivity in the home, farm or household enterprise has long informed research around skills development and agriculture (King and Palmer, 2010). For instance, UNESCO (2014a, p. 147), cites evidence that educated farmers were more likely to make better use of technologies (irrigation technology in China, increased fertilizer use in Ethiopia) and move into higher-value crops. Education may facilitate the rural people to be simply adopting the technology which helps them increase their awareness towards using mobile phone for market information gaining.

- Language proficiency, native language content

  Language barrier was also another problem that they were facing, and make them not to use mobile phone. Language plays an important role in influencing internet usage as well as mobile usage. Since the Internet is dominated by English language content, English speaking countries have a strategic advantage in popularization of the Internet use. On the other hand, non-English speaking countries face enormous difficulty in tapping into the potential of the Internet as an information source (Ensafi. R et al, 2007).

- Lacks of Public Awareness and Knowledge of ICT

  The public ICT literacy is still very low and almost nothing for the farmers. What concerned us the most is that ICT literacy among students and teachers are also low, especially those that live in the perimeters or remote areas. Here public awareness campaign through various media is absent. The problem is that many computer literacy and information technology programs are still in the infant stage (USECO, 2014a).

- Lacks of initiatives from the government

  The way all modern facilities are available in city places are not been available in remote areas. The farmers who are living in the remote areas are still in the dark. They are deprived from all facilities what they should get. And because of that they are not been able to implement the latest technological aspect in their farming process.

- Lack of financial solvency

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The farmers are not financially solvent enough. Most of them lead their lives from hand to mouth. So they are not been in a position to use the latest technology like mobile phone to get the latest information for their betterment. Mobile phones can facilitate a greater export orientation in agricultural practices and marketing, potentially bringing higher incomes for farmers. Farmers felt that mobile phones had helped to raise incomes by improving their ability to deal with risks and take advantage of income opportunities (Furuholt and Matotay, 2011).

- **Inadequate infrastructure**

  The access to ICT infrastructure in Ethiopia is still very low despite some noticeable improvements registered in recent years. According to the country diagnostic report of the World Bank issued in March 2010, the coverage of ICT in Ethiopia is one of the lowest in Africa (“Promoting ICT based agricultural knowledge management,” 2012). The ICT infrastructure in rural areas is very limited. According to (Zewge et al., n.d.) The findings from this study that, In Ethiopia 62% of the rural people lived without electricity, which also implies the lack of landline telephony.

### 2.10 Policy and investment priorities for effective agriculture information in Ethiopia

In Ethiopia the application of mobile phonies very limited except for few programs and initiatives whose coverage is currently very low to generate the desired agricultural production and productivity outcomes. As a result, policy and investment priorities are identified and recommended to help make smallholder farmers benefit from ICT based agricultural knowledge and information management (“Promoting ICT based agricultural knowledge management,” 2012). Ethiopian government has naturally made the development of ICT one of its strategic priorities and has placed a significant emphasis on its role of economic infrastructure as set out in the second Growth and Transformation Plan (GTPPII). This stems from the recognition that ICT especially mobile phone is a key driver and facilitator for transforming Ethiopia's predominantly subsistence-agriculture economy to a knowledge-based economy and information society. It put that ICT will be fundamental for Ethiopia’s aspiration to become a middle income country. The Ethiopian government established the Ministry of Communication and Information Technology (MCIT) in 2010 recognizing this critical role of ICT to national development.

### III. CONCLUSION AND RECOMMENDATION

#### 3.1 Conclusion

Among modern ICT modes, mobile telephony has been most recent and widely accepted mode of delivering information not only in Ethiopia but also in other South Asian and other African countries. According to Baumüller (2015), Several studies conclude that the general use of mobile phones to access information has helped to reduce search times and costs. Increasing mobile phone and mobile phone based services enhances the availability to knowledge and information and will further help in improving awareness, education, better adoption of technology, better health and efficiency, reduced transaction costs, better market efficiencies. Extent of mobile phone usage for disseminating agricultural information in Ethiopia is high, especially in phone calling, receiving call and listening to radio for agricultural purposes.

Mobile phones are becoming more and more important in agricultural extension services. In this regard, knowledge about information needs and seeking behavior of farmers, the extent of usage of mobile phone for accessing agricultural information, the interaction between mobile phone and radio and factors constraining the use of ICTs are crucial. These are also important for mobile phones and other ICTs to be used efficiently to facilitate agricultural extension services (Deribe.K, 2016). Effective knowledge and information management in the agricultural sector will be achieved when the right knowledge and information is delivered to the farmers and other stakeholders at the right time in a user-friendly and accessible manner (“Promoting ICT based agricultural knowledge management,” 2012). The major challenges inhibiting the use ICT in disseminating agricultural knowledge and information, which includes the low level of access to ICT infrastructure and services, need to be addressed.

#### 3.2. Recommendation

- **DAs are major source of agricultural information to farmers, so that they will have an alternative extension method like mobile phone for accessing relevant and accurate agricultural information on timely bases than the face-to-face contact of farmers.**
- **The ministry agriculture when designing strategies for effective and efficient use of mobile phone for disseminating agricultural information, they have to consider those identified factors of mobile phone usage.**
- **Government should encourage adult education, creating awareness, giving trainings for farmers enables them to use mobile phone and get more knowledge which could help them to maximize their production. It is recommended to approaching educated and elderly people to disseminate the information and trainings on mobile phone utilization. This is the time to move from discussing simple mobile distribution, affordability and accessibility to different mobile applications.**

**ACKNOWLEDGEMENT**

First of all, I would like to thank my God for helping me to successfully complete this work. I am also thankful to Ass. Prof. Akalu Dafisa for his comments and guidance at time of review. I am highly indebted to all my friends who are the source of special
strength towards the successful completion of this review. Also like to thanks source of article, journal and book especially google and outers.

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PODDANTA PULUWAN: Educational Game for Toddlers Based on Leap Motion Technology

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Abstract- Addict on to new technologies lead the children away from educational activities. The main problem is that will mainly affect to child’s future because of the early childhood does not developed on correct way. Considering about this problem project development team implemented an educational base gaming application based on how to use technologies toward to better future by navigate children to educational activities and reducing time wasting for useless things through the modern technologies. Poddanta Puluan is a windows tablet computer gaming application for children of 6-8 age category. The system was developed prototype methodology to implementation. There are many educational base gaming applications were developed using English language. The developed gaming application based on Sinhala language and includes many features. Application developed to improve child’s cognitive skills in mathematical, language, decision making, and reading areas. Different game categories used to develop child’s different kind of skills and each category included different levels. The variation of gaming categories will be motivating child to do different sides. Most of the children showing negative feedback about educational applications. To avoid that, application uses leap motion technology to detect inputs and this will make the child, feeling interesting about application. When considering about parents, within the busy lifestyle some parents have not time to check child’s skills improvements. As a solution, developed application calculates brain development. Application will navigate children to other activities to stop addicting.

Index Terms- Toddlers, Educational base gaming applications, Cognitive skills, Leap motion technology

I. INTRODUCTION

In the modern world, children are practiced to use smart devices with the development of the technology. Most of the children are using their parent’s electronic devices like smart phones, tablets as a habit. Because of that, children are addicted to these devices. Those children use these devices to waste their time instead of taking advantages from them for educational purposes. This will directly affect to child’s knowledge and their skills. As a solution for this problem this educational base gamming application is developed based on Sinhala language. Application will provide a game that preferable for age 6 to 8 children. It includes different educational areas to improve children’s mathematical skills, reading skills, decision making skills, memorization skills etc. Application detects the improvements that had happen to child through the game by keep tracking of child’s activities. Application provides several levels with different areas which increase the knowledge of the child step by step. To make easier to play this game project team developed it using leap motion technology. This technology will attract children to this game application. Application provides instructions/advices to child to reduce game addiction and motivate to do other activities. This application will be helpful for children to use smart device towards educational purposes. Most of the researches carried out in the children’s game development field are focused only on the game and entertainment. There are less number of game applications to keep track of child’s improvement rate or mind growth rate along with gaming and entertainment. And there are no such educational gaming applications in motion detection area. Objectives of this research project are,

- To identify the gaming characteristics that effect on a child’s education.
- To identify the features to be added to a gaming application to improve a child’s knowledge that entertainment purpose.
- To define rules to control game addiction.
- To develop an educational game based on Leap motion technology to attract toddlers.
- To identify cognitive skills can be improved via a gaming application.
- To develop an algorithm to measure the performance of a toddler.

The rest of the paper is organized as follows. Section 2 has provided the background through the Literature Review. Section 3 describes the methodology of this system. The discussion of the developed system has described in Section 4. Section 5 contains results of this research. Finally, the conclusion is discussed in section 6.

II. BACKGROUND AND RELATED WORK

A. Children Educational Applications

Sinhala language is one of a most difficult language to pronounce and write. In this position, technology is the most effective way to teach Sinhala alphabet to Children. There are only few modern technological solutions for enhancing the learning experience of Sinhala Language. A Mobile Application with Augmented Reality to Enhance Sinhala Learning Experience for Children, was a solution is focused on teaching Sinhala alphabetical letters to children and improve their language fundamental knowledge using augmented reality. The android application implemented by prototype methodology and application provides AR 3D Sinhala letters with animations, pronunciation. The problem of
this research is there is no such away to predict child’s improvement [1].

Currently considerable numbers of mobile applications are available to accomplish educational purposes, but not improving child’s cognitive skills. Considering about this OntoCog: developed for improve Cognitive skills and English knowledge of preschool children. Mainly this includes classification and relatedness in addition with memory skills related activities. Children must categorize the images according to understanding the relationship with the random question that they got. As a disadvantage child will not feel a variety, because of same type of game activities [2].

New technological educational applications were developing day by day for many different subjects. Yang et.al have implemented Map-Puzzle Application for the Evaluation of Children’s Spatial Knowledge. This android application is mainly focused on geographical education. In previous jigsaw-puzzle games, predicting the result by calculating total time that child spent to finish the task. But the mentioned application calculate result by consider about total time that taken to finish the task and total movements that made. This gives more accurate result than the previous [3].

A game-based platform which is designed for teaching English to preschool children in many nations. Application mainly designed for iPad tablets and pcs and it provides two platforms for children to learning and playing as a game to practice the learnings. Application contains more than 150 interactive lessons and teacher tools, with a focus on listening to, speaking, writing and reading English. Game will give rewards to child to motivate child to complete new tasks [4].

B. Skill Development Applications

In the abundance of mobile application in the market, there is less availability of educational games particularly for toddlers and pre-schoolers [5]. Rojo et.al have implemented mobile application that would cater the toddlers and pre-schoolers in terms of reading, spelling and mathematics. In this gaming application, the user chooses the category what user wants to play and there are five categories of the game specifically alphabets, body parts, colours, shapes and numbers. Each game has its time limits and the score is dependent to the strategy and deepness of each game. Once the player loses the game the application will give and show the score. The problem of this research method is costlier than using the manual and computer process [5].

Previous studies demonstrated the value of serious games for learning, not sufficient efforts were made to apply serious games to reduce children illiteracy. As a Solution team designed a serious game an interactive virtual learning environment, introducing concepts of Mathematics and English. The gaming application implemented a tablet serious game as virtual learning environment of 2D technology using the Unity3D game engine. This game improves memory enhancement and mathematical development of kids using problem solving [6].

One of difficulties in learning mathematics counting can be overcome by providing a relaxed and fun learning for preschoolers. Games can be used as an alternative solution. This has been the research basis in improving cognitive abilities, especially for preschool children numeracy skills through the game [7]. The method conducted in this study was a modified linear sequential model. The problem in this research is that, it focuses on only the mathematical content.

The research paper explains about an Android-based application which is designed to teach and help the preschool children, to achieve literacy skills, is presented [8]. The key benefit is that it improves the literacy skills of children while familiarizing them with the technology. Progress and the performance of the child is stored in database using the server. Parents will be tracking the child’s performance using the other android application via a mobile device. This research application only focuses on languages. So, the child will not feel any variations.

C. Leap Motion Technology / Sensor Technology Applications

Using new technologies like leap motion and sensor technology is one of the additional ways for the effective learning. The kids are more attracted towards new technologies and considering this problem in 2016 Game Based Learning with the leap motion controller application was developed. The research was carried out with a small group of kids at an elementary school and they covered the area of using innovative input devices in school education. A small 3D infrared camera will track the user’s hand and finger movements in the 3D space and allow the user to play the game [9].

A Gestural Interface for Practicing Children’s Spatial Skills is a research carried out in 2016. This research will help the children to practice and learn spatial reasoning skills. In this game the player requires to create several 3D objects by moving, rotating and assembling smaller pieces in correct paths through a gestural interface. The gestures were designed by having a congruent mapping between hand gestures and spatial operations and discussed about the development of a theoretical frame work for designing gestural interfaces for educational games [10].

Utilizing Motion Sensing Technology in Storytelling for Young Children: Puppet Narrator, is about how children’s narrative ability can be trained and how to develop the competencies of cognition and motor coordination of children using gestures by utilizing depth motion sensing technology as the human computer interaction method. The system allows them to use hand gestures to play with the virtual puppet and manipulate it to interact with virtual items in virtual environment to assist narration [11].

Leap Mania is a research which has discussed about gesture control technologies in game based learning. This application generates an interesting learning environment for the kids to learn different colors, different shapes and numbers using a leap motion controller which will overcome the problem of short attention spans of the children. The research has focused on
building an enthusiastic and pleasurable learning environment to enhance the self-learning skills and knowledge of kids [12].

D. Analyzing Applications

In the current world, medical and healthcare is one of an area that highly use new technologies. Autism spectrum disorder is a cognitive and neurobiological disease which shows deficits in social and communicative skills. Some parents cannot identify this disease. As a solution for that Elizabeth et.al have developed a gaming platform to analyze child’s neural and body based reactions and mainly focuses on human social and emotional cognition. Application analyze child’s behavior through the game and predict child has autism or not by analyzing the time taken to complete a task, behaviors, gaming style, selection of gaming patterns, responsiveness, heart rate using sensor technology and used different kind of biological terms that connected with autism. Less user friendliness and less attraction of the children are the problems of this research [13].

III. METHODOLOGY

The prototype methodology is used to achieve the goals of the project. In prototype methodology the three phases analysis, design, and implementation are performed concurrently, and they repeat until the entire system get completed. First prototype was built with minimal number of features and the rest of the features were added to each prototype produced.

A. Planning

Planning and controlling of the system handled in this phase. The research problem was identified, and scope of the project was discussed among the team members and the stakeholders. Business value was identified which will show why the system should be built. Finally, the project charter was created including a brief description of the proposed system to get the approval for the project. Once the need for the system and its basic functionality has been clearly identified a feasibility analysis was carried out to determine whether the project is technically, economically and organizationally feasible.

B. Analysis and Requirement Gathering

First the current systems and the weaknesses and the strengths of the current system were identified.

After analyzing the current system, the next step was to gather the requirements. Questionnaires were prepared for the preschool kids to get more information about them. A psychiatrist was interviewed to get the knowledge of the psychological characteristics of the kids. Parents and teachers were interviewed and collected more information about behavioral and educational patterns of the kids. Finally, the information that was gathered during the analysis and information gathering phase were organized and documented.

This research paper is discussed about developing children’s acquisition of emotional knowledge of skills like recognition, appreciating and understanding emotions and their expressions and problem-solving abilities. when considering about this paper Koivula.et.al have come up with this application’s humorous features, creative opportunities, and possibilities to make progress while playing motivate the child to learn. By practicing through the game and in peer group interactions simultaneously the application becomes an effective learning environment [14].

This application is developed specially for the kids who are suffering from Development Dyslexia (DD). This game helps the children to obtain an early identification of DD during preschool years which consist of serious games which predict the risk of DD in preschoolers and potentially training specific skills impaired in this learning disability [15].

Based on the statistical analysis results it can conclude as mobile games can affect to child’s brain development. Gender does not affect to this and however if there is a good family background for the child the brain development level can be maximized.

Research team created all the user interfaces in blue and pink related colors because most of the responded selected blue when comes to the user interfaces. Research team used red, green, yellow and orange colors. Research team used frozen characters and Mickey Mouse cartoon characters in game because most of the respondent voted for that particular character. Research team used different characters according to the game background and the situations. Lot of children like back ground music when play games. More than 50% of the respondents like to play games with Sinhala language. They are addicted to mobile games and other games. So it is a high possibility to think that nowadays students are less interest to do studies. Majority of the respondents stated that they use tablets more than mobile phone. This application developed in windows platform.

C. Design

The logical diagrams that were designed during the analysis phase converted to physical diagrams which defines how the operations are done and how the final system will work including the technology used and kids and parents’ interactions with the system. The user interfaces were developed more appealing to the kids and suitable to the research project. The databases were created using SQLite database and data stored in database. The whole system designed as very user friendly. The high-level architecture diagram is given in figure 1.
IV. RESULTS AND DISCUSSION

A. RESULTS

Figure 3 illustrates the login and register page. At the very first time of application opens it direct to registration page. Parents can register to the system by providing parent’s username, email and password. All the inputs will be validated, and wrong inputs will be result in an error message. After the registration, parent can log into the system using user name and password. Wrong inputs will be result in an error message and the user cannot logged in to the system.

Figure 4 illustrates the menu window. A logged user can play the game by clicking “play” button and check the child’s development by clicking “check development” button.

Furthermore, the user can exit from the game by clicking the exit button.

Figure 5 illustrates the game category window. This window will appear after user click “play button” in “menu window”. User can select any game category and play each category’s game levels.

E. TESTING

After completing each function to validate that unit testing will be done for identify individual units of source code are working properly. Integration testing will be done after completing and combine all the functions. System test will be performed to verify that the system meets requirements and its usability, security and performance under a great workload. Documentation testing will be performed by checking all the documents for correctness.
Figure 6 illustrates the Puzzle game window. This window will appear when user select the “puzzle” category from the “category” window. Puzzle category contains these kinds of multiple puzzle levels and child can select the puzzle level he or she want to play. Each puzzle level contains different kind of puzzle games with different kind of random questions. Child can drag and drop each letter until each letter drop to the correct place. When child drag and drop a wrong letter, letter will be return back to the previous place with a beep noise. By clicking home button, user can return to the “menu window”.

Figure 1: Puzzle Level1 Window

Figure 7 illustrates the Maths game window. This window will appear when user select the “maths” category from the “category” window. Maths category contains this kind of multiple maths levels and child can select the maths level he or she want to play. Each maths level contains different kind of mathematical games with different kind of random questions. Child can type the answer in the given text field. The correct answer will be display when move to the next question. This level contains 6 questions.

Figure 2: Maths Level1 Window

Figure 8 illustrates the word game window. This window will appear when user select the “word” category from the “category” window. Word category contains this kind of multiple word levels. Each word level contains different kind of word games with different kind of random questions. Child can select the answer within the given answers. If child select a wrong answer it will make a beep sound.

Figure 3: Word Level1 Window

Figure 9 illustrates the story game window. This window will appear when user select the “story” category from the “category” window. Story category contains this kind of multiple story levels. Each story level contains different kind of story games with different kind of random questions. At the first, story will be displayed and then questions will be display which are related to the story. If child select a wrong answer, application will mark it as wrong.

Figure 4: Story Level1 Window

Figure 10 illustrates the brain development window. This window will appear when user click the “check brain development” button in the “menu window”. Parents can view child’s overall brain development using this window. Child’s development calculating by considering the marks, number of movements and the time taken to complete each level. This overall development displays all the developments through all four game categories. By clicking “home” icon, user can return to “menu window”.

Figure 5: Category Window

Figure 6: Puzzle game window

Figure 7: Maths game window

Figure 8: Word game window

Figure 9: Story game window

Figure 10: Brain development window
B. Discussion

Poddanta Puluwan contains functioning components improve child’s cognitive skills and Sinhala knowledge, measure the brain development and mechanism to stop game addiction through windows tablet application. The reliability of the system is that the system provides smooth and simple operations. Using leap motion sensor will improve the game experience for user. The system will provide proper error messages and alerts if incorrect operations performed. Proper advices are provided to stop game addiction. System reliability is 70% and accuracy rate is 95 %. Research team tested the application 50 times application and 45 times it worked properly. 5 times the system was frozen due to some tablet issues and database connection issues. There are some technical limitations of this application, such as, to process with leap motion sensor tablet need some processing power and if the game played continuously windows device get heat. There should be a high processor. The accuracy of the brain development calculations varies according to the amount of data in the database. The accuracy of calculation may increase based on playing attempts.

V. Conclusion

“PODDANTA PULUWAN” the mobile game application that work as a children’s brain development application. The possible functionalities that research team developed in this game application is measure the brain development and improve child’s knowledge and cognitive skills. This project covering several levels with different areas which increase the knowledge of the child step by step. Application is measure improvements of child that by keep tracking what are the marks that child has got.

VI. Future Work

As the research was limited to a specific time period the research group was able to focus only on a limited number of components. This game application can be implemented as a 3D game for many different languages in the future by adding more features. Moreover, there can be featuring to sending notifications to parent if child spent more time on application and child’s brain development as an email or a SMS. Also, a data mining algorithm can be used to predict the child’s week points of a subject.

ACKNOWLEDGMENT

The research team sincerely acknowledge the individuals and groups who have provided guidance and assistance throughout the project, First and foremost, we would like to deeply thankful to research supervisor, Ms. Gayana Fernando of Sri Lanka Institute of Information Technology(Pvt) Ltd for giving us the guidance and Dr. Yasas Jayaweera and rest of the Academic and non-Academic staff of the SLIIT. We thank Dr. Nishali Fernandoepulle, Clinical psychologist child and adolescent for providing information. Finally, we would like to acknowledge with gratitude, the support provided by others whose names were not mentioned.

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Effectiveness of Sofosbuvir in Treating Patients with Hepatitis C – Risks Vs Benefits Ratio

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Abstract- Objectives: the aim of the study was to observe prevalence of hepatitis C, the effectiveness of sofosbuvir in treating hepatitis C, various signs and symptoms of hepatitis C and their prevention, plot between the risks & benefits ratio associated with the use of sofosbuvir.

Methodology: This observational study presents the prevalence of hepatitis C, patient’s category, symptoms, drug regimen, effectiveness of sofosbuvir, side effects with the previous regimen and side effects seen with sofosbuvir therapy in the general population seeking treatment in the government sector hospitals of Lahore.

Results: The study found out that among the total population affected 57% males suffer from hepatitis C. 60% of the respondents had chronic hepatitis C. Common symptoms experienced by the patients were fever & fatigue (40%), pale coloration (35%). Commonly prescribed drug regimen was sofiget and ribavir (35%). 100% of the respondents agreed that sofosbuvir is a more effective therapy as compared to Peg Interferons given previously.

Conclusion: Prevalence of Hepatitis is common in government and private sector hospitals of Lahore. Sofosbuvir is considered to be a more effective and patient friendly therapy nowadays. Patients experienced a decline in incidence of side effects from this oral therapy.

Index Terms- effectiveness, risks and benefits, sofosbuvir

1. INTRODUCTION
Hepatitis refers to an inflammatory liver disease. It is believed to be caused essentially by a viral infection. Hepatitis (A, B and C) are the most prevalent types of the disease. “Hepatitis A” is a virulent and infectious liver ailment. It is essentially caused by hepatitis A virus (HAV). It may range in severity from mild to severe. The ailment may even last for several months. Hepatitis B is also a serious and communicable liver disorder. It is in effect caused by virus called the hepatitis B virus (HBV). It starts as a moderate illness. However, if it goes untreated it might continue to become lifelong chronic condition. Therefore, it also has a mild to extreme severity. [1]

HCV or the hepatitis C virus is the cause of the contagious disease called Hepatitis C. This in line with the other variants is also a liver disease which can take various magnitudes of illness from mild which last for a few weeks to extremely long illness which harms the liver throughout the life time. Depending on the time the virus lives in a body it can also be categorized as chronic or acute.

Acute Hepatitis C is the form of virus infection that culminates within the duration of first six months after exposure to HCV. There is a decent probability however that the acute infection might lead to chronic severity. Chronic Hepatitis C is the form of virus infection which is has rather long-term effect on the liver. Chronic form of Hepatitis is extremely severe and cause life-long ailment which may lead to diseases like liver cancer. [2]

Hepatitis C is becoming a globe-wide disease encompassing about 2.2% of the entire global population. It is especially become a serious health concern in the developing countries inclusive of Pakistan. Pakistan has one of the most alarming figures when it comes to Hepatitis C. According to a study the disease is costing more than three thousand patients their lives on daily basis. With these statistics Pakistan ranks second most susceptible region for hepatitis C. Figures suggest that about twenty million people in Pakistan are affected with the HCV infection. Pakistan is right behind Egypt in the statistics of the HCV breakout. [3]

Hepatitis C Virus can be transmitted in a variety of ways. The most common way to get hepatitis C is through exposure to infected blood, sexual transmission, by tattooing or piercing or through genetic connection etc. Patients do not show signs that indicate the
presence of HCV in them in approximately 70 to 80% of the cases. This is because the symptoms could appear from 2 weeks to about six months after the body is subject to the HCV virus. The primary symptoms include high temperature, eating disorders, stomach aches, rashes, concentrated urine, jaundice, lethargy etc. [4]

HCV is predominantly widespread in the rural areas compared to the urban areas of Pakistan as the rural population is more susceptible to it. This fact becomes highly alarming once looked at in conjunction with the statistic that about 66% of the population of Pakistan lives in areas categorized as rural. These areas are highly vulnerable due to lack of awareness of hygiene and medical and health practices. This also includes lack of health care facilities and their reach, uncontrolled blood transfusions, general illiteracy, financial challenges and most importantly abuse of drugs. Presence of these issues impacts the society and medical professionals equally. [5]

The treatment of hepatitis C has seen variety of advancements in the past years. Initial studies used therapy called the interferon (IFN) mono therapy. Later on, a combination of ribavirin and Interferon or of Interferon to which polyethylene glycol (PEG) molecules have been added (i.e. PEG-IFN) were used for 48 weeks or 24 weeks depending upon the case severity. Protease inhibitors have sprung up as a third feature of combination therapy. [6]

Interferon and ribavirin combination therapy to treat hepatitis c results in a number of prominent adverse effects like fatigue, hematological problems, influenza-like symptoms and neuropsychiatric abnormalities. Other drawback of this treatment is that it is a painful and long-term therapy consisting of a course for 24 weeks to 48 weeks depending upon the severity of disease condition. [7]

Lately, “HCV NS5B polymerase inhibitor”; sofosbuvir was shown to successfully contain HCV replication. It has been established as a major component of currently recommended regimens. In December 2013, the FDA sanctioned an entirely oral regimen of simeprevir plus sofosbuvir for patients who had already been treated with interferon mono therapy or interferon and ribavirin combination therapy. While the duration of treatment is 3 months (12 weeks) for patients without cirrhosis, it is 6 months (24 weeks) for those with cirrhosis. [6]

Sofosbuvir is a newly introduced nucleotide analogue and is highly potent inhibitor of HCV NS5B polymerase in HCV. It has shown promising results in numerous in vitro studies against all HCV genotypes. It has a number of ideal properties like its high potency, once daily dosing, oral administration, few adverse effects, low incidence of drug-drug interactions and higher barrier to resistance. It is generally well tolerated. However exact safety profile can be established only when the drug is used on a large scale. The risks associated with sofosbuvir seem to occur only when it is used with ribavirin. They involve fatigue and headache. [7]

Treatment of HCV infection necessitates implementing a combinational treatment by using multiple antiviral agents. Depending on the subject’s HCV Genotype, previous medical history related to HCV, concomitant comorbidities and present medication, this combination treatment would involve the use of two or three antiviral agents with varying duration of treatment based on the cited factors. [8] Due to increased complexity that the new treatment regimens will introduce, Primary care providers or specialists might not be in the best position to provide clarification and to recommend appropriate therapy courses for patients on case to case basis; however, pharmacists are in a better position provide a more prudent acumen. Moreover, Pharmacists can also prove helpful in handling the individual cases by studying and obviating drug interactions which is a critical aspect while supervising the use of these new regimens due to its clinical significance. Pharmacists therefore carry a significant role in the team of multidisciplinary treatment providers through knowledge sharing of HCV treatment routes. [9]

2. MATERIALS AND METHODS

Questionnaire-based observational cross-sectional study was conducted from April to August, 2017 to observe prevalence of hepatitis C, patient’s category, symptoms, drug regimen, effectiveness of sofosbuvir, side effects with the previous regimen and side effects seen with sofosbuvir therapy in the general population seeking treatment in the government and private sector hospitals of Lahore. A convenient sampling of 100 sample size was done including both male and female patients.

A data collection form was designed covering the aspects related to Patient’s demographic information, signs and symptoms of hepatitis C, pattern of prescribing sofosbuvir in various hospitals, evaluation of side effects caused by the therapy and was filled during a face-to-face interview with patients in public and private sectors hospitals of Lahore. The collected data was analyzed, arranged and presented in the form of graphical results.

3. RESULTS
The data was collected from 100 patients of which all of them were suffering from hepatitis C and were using sofosbuvir as major medication therapy. Prevalence of hepatitis C was slightly more common in males (57%) as compared to that in females (43%) (Fig.1). According to this survey, it has been found that most of the patients were suffering from chronic hepatitis C, which is a long-term illness that occurs when HCV remains in the person's body for a longer period of time. Only 30% of the patients belonged to the acute category of hepatitis C (Fig. 2). Common symptoms which prompted the patients to visit the physician were fever, fatigue, pale coloration, rash and itchy skin (Fig. 3). Combination of sofosbuvir (HCV NS5B Polymerase Inhibitor) and Ribavirin (Anti-Viral agent) were given. The brands most commonly prescribed were Sofiget & Ribavir (35%), Sosof & Ribavir (25%), CHC & Alcorib (25%), Sovaldi & Ribazole (10%) and Abriva & Ribazole (5%) (Fig. 4). As a result of the survey conducted, it was found that sofosbuvir was a more effective treatment regimen as compared to the interferon therapy (Fig. 5). Side effects commonly observed with the interferon therapy were nausea, vomiting & diarrhea (30%), anemia (20%), fatigue (10%), xerostomia & mouth ulcers (10%) (Fig. 6) while the side effects experienced after using sofosbuvir were headache & fatigue (35%), nausea, vomiting (35%), myalgia & irritability (15%) (Fig. 7). 85% of the patients claimed that occurrence of their side effects was minimized after 2 to 3 months of regular medication use.

**Figure 1: Prevalence of hepatitis C**

**Figure 2: Patient Category**
Figure 2: Patient Category

![Patient Category Diagram]

Figure 3: Symptoms

![Symptoms Diagram]

Figure 4: Drug Regimen

![Drug Regimen Diagram]
Figure 5: Effectiveness of Sofosbuvir

Figure 6: Side effects associated with previous regimen
4. CONCLUSION

Prevalence of hepatitis C was studied in various government and private sector hospitals of Lahore and it was concluded that hepatitis C is more common in males (57%) than in females (43%). Common signs and symptoms that prompted the patients to visit the physician were fever & fatigue (40%), pale coloration (35%), rash & itchy skin (20%). Sofosbuvir and ribavirin oral therapy was a more effective treatment plan as compared to interferon injection therapy in terms of effectiveness as well economically. The incidence of side effects has also been decreased to an extent by the use of sofosbuvir. Patients claimed that their side effects presided after some time ranging from 2-4 weeks of using sofosbuvir and this was a major reason for their adherence to therapy. Most of the patients were satisfied with the treatment regimen. Patients were properly counselled about the correct usage of medicines, precautionary measures and dietary instructions.

ACKNOWLEDGMENTS

We are highly grateful to the Institute of Pharmacy, Lahore College for Women University, for providing us an opportunity to conduct this research. This work was supported by Services Hospital, Lahore, Jinnah Hospital, Lahore, Combined Military Hospital, Lahore & Private clinics.

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Communication between Deaf-Dumb People and Normal People: Chat Assist

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Abstract- Chat applications have become a powerful media that assist people to communicate in different languages with each other. There are lots of chat applications that are used different people in different languages but there are not such a chat application that has facilitate to communicate with sign languages. Sign languages are used by deaf and dump people to communicate among them but those Sign languages vary from nation to nation as American Sign Language, British Sign language, Japanese Sign language etc. The developed system has based on Sinhala Sign language. The system has included four main components as text messages are converted to sign messages, voice messages are converted to sign messages, sign messages are converted to text messages and sign messages are converted to voice messages. Google voice recognition API has used to develop speech character recognition for voice messages. The system has trained for the speech and text patterns by using some text parameters and Signs of Sinhala Sign language is displayed by emoji. Those emoji and signs that are included in this system will pave a new way for the normal people to be more close to hearing disable people and also hearing disable people to be more close to normal people.

Index Terms- Sinhala Sign Language, Google voice recognition API, Gifs, Text parameters, Deaf dump people

I. INTRODUCTION

For years scientists have worked to find a way to make it easier for deaf and dumb people to communicate. Researchers have used image recognition to translate sign language into ‘readable language’ and the tool could one day be used on smartphones. There were some researches about translation of sign language to human readable language. This research was also about finding a proper method to translate sign language to human readable language but in this research, the research team expected to develop a chat application that translates human voice and texts to sign language. This is an android based chatting application that can use anytime anywhere with assist of internet.

A sign language is a language which chiefly uses manual communication to convey meaning, as opposed to acoustically conveyed sound patterns. This can involve simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to express a speaker's thoughts. Sign languages share many similarities with spoken languages (sometimes called "oral languages"), which depend primarily on sound, and linguists consider both to be types of natural language. Although there are some significant differences between signed and spoken languages, such as how they use space grammatically, sign languages show the same linguistic properties and use the same language faculty as do spoken languages.

Sign languages are different according to the country and nations. The system has developed for Sinhala sign language. The Sinhala Sign Language contains different set of signs and those signs were studied by group member. Voice has translated to the text and then translate to the sign language is another component of this project. That component has added for make more efficient real time face to face chatting feature to this system.

This research not only translates voice and text to the sign language. Totally this research scope was expanded up to four main areas. Those main areas were translating voice to the sign language, translating sign to the voice, translating text to the sign language and translating sign language to the text.

Another important aspect of this research was performance and accuracy. The system has focused on voice and text and it was needed to clarify whether voice to sign translation consumes more time. If it does not consume more time, then we needed to research about accuracy of translated sentences and utterances. The main objective of this application was, reduce the communication gap between normal people and deaf-dumb people by giving some help to deaf-dumb people to do their works at their convenient and also allowing them to chat with ease by using this tool.

The project team searched and found some applications that support some of the functionalities as listed. Examples are Signspeak, V2S, Sign Mobile and Hand Talk. They all were designed for some kind of communication and learning process. There was no chat application to communicate with deaf-dumb people and normal people. Thus, our group has developed an application that can cover the application of all the area of deaf-dumb people.

II. LITERATURE REVIEW

There are many research have begun carried out in this research area.

Oi Mean Foong et al has discussed about sign language translation system using Speech and Image processing technique in “V2S: Voice to Sign Language Translation System for Malaysian Deaf People”[1]. The Advantage is Voice (English Language) to sign language of Malaysia. Main disadvantage is System first needs to be trained with speech pattern based on some generic spectral parameter set.
Jonathan Gatti et al have authored “Voice-Controlled Artificial Handspeak System” [2]. Methodology was Prototype. Advantages of this paper robotic hand designed with openSCAD and manufactured with a low-cost 3D printer used, core automation comprises an Arduino UNO controller by a raspberry Pi computer and uses open source speech recognition engine Julius. One and only main disadvantage of this research was robotic hand has its limitations and possible future developments.

Tirthankar Dasgupta et al has proposed an application that can be used as an educational tool to learn ISL[3]. This research has used prototype methodology. The system was not only improve information access, but it can also get as main advantage and disadvantages of this research. It was not translate Indian sign language in to the text, system takes only simple English sentences as input, sign synthesis module using an animated avatar has not been developed, and some grammar rules cannot be applied to translate English to ISL, not given clear idea about how system works properly.

“Sign Speak: American Sign Language Translation through Sensory Glove.” authored by JanFizza Bukhar, Maryam Rahman, Samna Ishtar Malik, Awaits M. Kamboh, Ahmad Salman [4]. Methodology was to design a glove that would enable deaf and mute people to communicate by translating their sign language gestures into speech according to the American Sign Language, different modules were: glove design, data acquisition system, feature extraction, feature matching, wireless link and android application. There were main two advantages has this research. Those were focused the translation of gestures of the alphabets and also the words, gestures were classified very efficiently and accurately. And also there were many disadvantages. Those were required the user to wear clothes with full sleeves to cover arms. Plus, lighting effects could adversely affect this method, no communication happens between two people, more hardware used (flex sensors, Accelerometer, Contact sensors), only supported Android OS.

Dalia Nashat et al has discussed an android application in “An Android Application to Aid Uneducated Deaf-Dumb People”[5]. Main advantages were, support uneducated Deaf-Dumb people who could not read and write Arabic languages to communicate with others, to learn and to entertain, represent quizzes and games for training deaf and dumb people/kids to identify Arabic and English words, introduce Sign language keyboard. Main disadvantage was, only Support Android OS, no face to face communication happens, educational tool rather than Real world tool, use one sign for the one alphabet.

Dr. Sami M.Halawani et al have authored “Arabic Sign Language Translation System on Mobile Device” authored by [6]. Advantages were 3D Animated characters gave more attraction & realistic to the system users, application could work with online & offline. There were more disadvantages. System had not translated sign language in to text, no option of face to face communication, need more database space (Arabic Sign, applications for translating text to sign animation, other external systems or library).

Noor Saliza Mohd Salleh et al has proposed “Sign Language to Voice Recognition: Hand Detection Techniques for Vision-Based Approach” [7]. Advantages were, more flexible and useful than prior approach, fast processing. Main disadvantage was video analysis problems.

“Sign Language to Speech Translation System Using PIC Microcontroller” authored by Gunasekaran and Manikandan. R [8]. Advantages were, system offered high reliability and fast response, more precise on hand movement, different languages could be installed without altering the code and main disadvantage was high manufacture cost.

Sachin Bhat et al has proposed an application on “Translating Indian Sign Language to text and voice messages using flex sensors” [9]. Main advantages were, user independent, portable system to convert the sign language to text message form which consumes less power because of the low ultra-power AT89S52 microcontroller was designed, used the simple mobile application and also main disadvantage was higher cost.

A. Sujith Kumar et al has discussed mobile chat application on “Sign Mobiles (An android app for especially able People)” [10]. Advantages are enable sign language finger spelling communication, briefly allowed to use mobile communication with face to face chatting, automatic translation and speech recognition. Main disadvantages were large size database was needed to store video clips, mismatch of voice with video clips cannot be handle, it took time to comparing a video clip and voice rather than matching text with signs.

A. E. E. El Alf et al has proposed Arabic sign language mobile chat application on “Intelligent Arabic text to Arabic Sign Language Translation for Easy Deaf Communication” [11]. Advantages were this knowledge based system has solved number of Arabic language problem such as synonyms, inflectional, derivational, diacritical and plural, allowed finger spelling translation and disadvantages were this system had not allowed to video processing, this system had not translated Arabic language text to Arabic sign language, it was difficult to match grammar rules of Arabic language with Arabic sign language.

III. METHODOLOGY

The research is developed according to the prototype methodology. There was a necessity to run many iterations of the system phases. Therefore prototype methodology was selected to implement this system. Research team identified the research problem firstly. Then the research team gathered requirements about android chat application structures, hardware resources and software resources that were used for develop a chat applications. Then develop the time frame for the system to complete within one year. The initiative states of the system, the research team divided the whole research component into four sub research components. Then the research team researched about Sinhala sign language signs and how those signs were created etc. Then the Gantt chart created that has indicated tasks and allocated time for each task. Then feasibility analysis was done for clarify that this system is feasible for develop to research team. The research group had gone through around twenty research papers and analyzed the details of the similar systems. The research team met a sign language teacher and had an interview. The information about Sign language words that were gathered in that interview was analyzed. Then research team decided to design emoticons for those signs. The research team needed to observe the idea of normal people about this android chat application.

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Then had a survey by creating questionnaires. Around three hundred participants were participate to this survey. 90.9% participants’ parentage has given positive response for this project. Therefore the research team was confident to build this application.

Figure 1 shows the framework of the application. It shows the interaction between the software or hardware devices and people. There are two users mainly involved in this system as deaf dumb user and normal user. The system is installed in the smart phones. Internet is a must to run this application as indicated in the diagram and the system has been included the firebase database to store user details and messages that are sent in chat sessions.

Designing of the system was done as similar chat application like WhatsApp, Viber etc. The main difference of the project was the Sinhala sign language signs. Those signs displayed as animated emoticons. Sinhala sign language signs were designed according to the way of deaf and dumb people used to express their ideas in day today life. Those signs were designed using Adobe Photoshop, Illustrator software. The designing part of emoticons was done as step by step. If we considered a sign like “Good morning”. It was designed under three steps as follow.

Figure 2: “Good” word in sign language

Then designed the signs for “morning” word.

Figure 3: “Morning” word in sign language

Figure 4: “Good Morning” word in sign language

After that the signs were merged as a one sign that depicted “Good morning” sign. The emoticons could not cover up all the possible sentences in the chat. Therefore research team decided to develop a keyboard that has signs and those signs converted when the receiver received the message into normal language such as English language.

After that designed interface and move to the implementation phase. In implementation phase project team had to code and develop the system. Features of system divided into four parts then each group member contributed to implement the android application. After completed whole system, it was forwarded to the testing phase. Implementation of this system was done under four main categories. Those categories were

- Converting text messages to sign language signs
- Converting voice messages to sign language signs
- Converting sign messages to text messages
- Converting sign messages to voice messages.

Signs that were designed in designing phase was used for develop this application. The voice recognition part of the system was done using Google voice recognition API. The Google voice recognition API was embedded in this system and the user voice should be trained for the system for recognize the voice messages. Text patterns were analyzed word by word and the developed a text message converting to sign messages part as well.

The system should be tested that ensured the high system performance and reliability. Unit by unit of this chat application was tested in development process under unit testing. Then those units were merged and tested under integrated testing. Then research team used white box testing and black box testing methods. In white box testing research team tested the android application coding errors in line by line. In black box testing whole application distributed amount few android users to get their feedback to improve the application performance. After all the whole system was tested under system testing and finalize the whole testing process.
IV. RESULT & DISCUSSION

Screenshots of interface of various components of ChatAssist results are included as evidence.

Figure 5: Home interface of the ChatAssist Application

The Figure 5 shows the screenshot of the home interface. User can select the user that he want in the list then he can click the relevant user for chat. In the left top of the interface show the user menu. It has “Change Background Wallpaper”, “Profile”, “About Us” and “Logout” button.

Figure 6: Chat interface with customized sign keyboard

Figure 6 shows the screenshot of chat interface of the application. In this interface user can input using sign letters from A – Z from the sign keyboard.

Figure 7: Chat interface with emoticons

Figure 7 shows the screenshot of chat interface of the application. In this interface user can select and send emoticons from the emoji list.

Figure 8: Voice input from the chat interface

Figure 8 shows the voice input from the user and send to another user feature.

“ChatAssist” contains functioning components such as text to sign, sign to text, voice to sign, sign to voice through android mobile application. The system that has been implemented for sending and translation of voice or text to sign language and retrieve from the database and then give the result. Already there were many researches about chat applications but very less of it in sign chat. Because of that the research team decided to complete our research of sign chat. After having meetings with our supervisor and lecturer, the idea of creating android application that goes along with our chat technology was proposed. Tasks of the android application was not easy since the team could not find and information source regarding how to create an android application that is gone along with chat communication technology. Finally after all the discussions with our supervisor and related lecturers project team decided the sign chat communication research component for the application. After doing further research on this idea the team managed ourselves to create the schema and retrieve the information from the Ceylon School for the Deaf & Blind. After discussed with Ceylon School about the Deaf & Blind project, Research team found relevant information regarding the Sinhala sign language. The system was built based on the details the research team gathered.

The reliability of the system was measured by considering maturity, fault tolerance and recoverability attributes. Those reliability attributes were checked with in a given time period. Then the accuracy level of functionalities, accuracy of messages was also checked and clarified because this was an android chat application. Level by level the system was designed and implemented under four categories. Iteration wise and the designing, implementation, development parts were repeated until the system reached to the final level.

<table>
<thead>
<tr>
<th>Component</th>
<th>Total Tested result</th>
<th>Tested result as percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emoji testing</td>
<td>Iteration no</td>
<td>1 2 3</td>
</tr>
</tbody>
</table>

Table 1: Brief summary of test cases of emoji
The research team needed to cover up all the signs but it was not a better idea therefore a sign keyboard embedded to the system. Signs were included to the system as emoji. Technically less amount of errors.

Table 2: Brief summary of test cases of sign keyboard

<table>
<thead>
<tr>
<th>component</th>
<th>Total tested result</th>
<th>Total (result as percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Iteration no</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Text to sign</td>
<td>21/26</td>
<td>23/26</td>
</tr>
<tr>
<td>Text to voice</td>
<td>21/26</td>
<td>25/26</td>
</tr>
<tr>
<td>Sign to text</td>
<td>22/26</td>
<td>24/26</td>
</tr>
<tr>
<td>Sign to voice</td>
<td>21/26</td>
<td>24/26</td>
</tr>
</tbody>
</table>

Research team had to face for a technical issue. That was trained the user sound to the system. Technically the system had not found out a system. Text patterns also analyzed in the system codes user message was sent. The research group has covered the system parts and upgraded but it continued until the system become the perfect.

V. CONCLUSION

The main objective of this research was to implement an android based application for deaf and dumb people to communicate with normal people. One of the area with the greatest potential impact was in the contribution that mobile application can reduce the communication gap between deaf and dumb people with normal people. Recently, communication through mobile phone is considered very important in enhancing better understand in social situation.

Even though there are many similar applications are available in the world, most of them do not meet the basic requirements. Some are very much complex, not user friendly and it’s difficult for both side understand the application. Most of them don’t provide the exact outcome what user wants.

The project “ChatAssist” has better solution, it is a simple and understandable chat application, which really suits the deaf people, hearing impaired people and normal people to communicate with each other. The ChatAssist system has four components integrated into a single system, which are Translating voice to the sign Language, Translating sign Language to the voice, Translating text to the sign Language and Translating sign Language to the text. User can choose any chat type to chat with other person.

VI. LIMITATIONS

Even though team “ChatAssist” went through a good process in the research project, the team had to deal with so many difficulties when completing the system. Most of problems were taken care by the team to complete, though some still exists. Some of the difficulties are listed down as followed,

- If the Internet connection is down, cannot send messages.
- Designing sign for selected few words.

VII. FUTURE WORKS

“ChatAssist” system can be developed in several ways since the concept is applicable to this kind of situation.

- Designing signs for more words.
- Designing application for support iOS.

ACKNOWLEDGEMENT

We acknowledge who supported us to providing information and deeply thankful to research supervisor, Ms. Nideshika Ellepola for give us the guidance.

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Abstract- The purpose of this study was to evaluate the rainfall trend for El Niño seasons over Malawi and its impact on electricity and agricultural production from 1970 to 2016. Monthly and annual rainfall time series of over 45 year period to 15 meteorological weather stations across Malawi were constructed for all El Niño rainfall seasons. This study reveals a high variability of both monthly and seasonal El Niño rainfall seasons. From the selected rainfall stations, 34.7% had rainfall above normal in the south, 39.2% in the central and 52.6% in the north. Substantial rainfall was recorded in the months of December, January, February and March. 70.4% of the stations in the southern half Malawi showed decreasing November rainfall, while the northern half of the country had decreasing December rainfall for 63.7% of stations therein. April rainfall was gaining importance as its contribution to seasonal rainfall was increasing in 68% of the seasons over central and north of Malawi. 65% of the stations in the south had Onsets in November. Similarly, 73% rainfall stations in the northern Malawi experienced rainfall Onset in December. El Niño seasons had a fluctuation decreasing rainfall average trend of 972.4±53 mm. However, the stations in the north of the country had an average increasing rainfall trend of 105±13 mm under El Niño rainy seasons. Total trend of an average number of rainy days was decreasing under El Niño seasons, 75.3% in the south, 81.3% in the central and 43.7% rainfall stations in the north had a decreasing trend in rainy days. The length of the El Niño seasons had a gradually reducing trend by an average of 103±14 days. Within the progression of El Niño rainfall seasons, longer spells were experienced in southern parts of Malawi with an average of 6±2 days. 75% of the “cessation” of the El Niño rainfall seasons were from the months of March over the south, and April over the north with a trend of shifting to the next months in both parts of the country respectively. The El Niño borderline conditions led to extensive rainfall deficits, resulting in widespread drops in crop production. The study underscores the clear link between El Niño events and drops in national maize yield as well as low Shire river flow rate leading in mean lower amounts of water flow to the dams that produce electricity in Malawi.

Index Terms- El Niño season, Rainfall trends, Climate change, Malawi, Onset, Progression and Cessation

I. INTRODUCTION

El Niño is a term given to a warming of at least 0.5°C for at least 5 months in a row of the eastern tropical Pacific occurring every few years, which alters the weather pattern of the tropics [1]. The El Niño-Southern Oscillation (ENSO) is a naturally occurring phenomenon that involves fluctuating ocean temperatures in the equatorial Pacific. The Malawian summer (October to April) rainfall is very crucial for the economic development, electricity generation, disaster management and hydrological planning for the country [2]. Annual rainfall and run-off averages show that overall water resources are abundant, ranging from 725 mm to 2 500 mm. with Lilongwe having an average of 900 mm, Blantyre 1127 mm, Mzuzu 1289 mm and Zomba 1433mm [3]. The resulting mean annual runoff of Malawi, minus evaporation, is estimated at 588 m³/s or 18 480 x 106 m³. The mean annual runoff over the land area of the whole country is 196 mm (i.e. an equivalent of 588 m³/s), and this constitutes 19% of the mean annual rainfall [4].

The main rains start from November in the south and progressively spreading northwards. During this period, the main rain bearing systems that influence rainfall over Malawi include the Inter-Tropical Convergence Zone (ITCZ), Congo air mass, Easterly Waves and Tropical Cyclones [4]. The key driving factors on rainfall systems over Malawi include the Sea Surface Temperatures (SSTs) over the Pacific, Indian and Atlantic tropical Oceans. La Niña, unusual cooling of waters over the Eastern and Central Equatorial Pacific Ocean, affects rainfall pattern over the world including Southern Africa and Malawi [5].

In the context of climate change, it is pertinent to ascertain whether the characteristics of Malawian rainfall pattern also are changing. Serious concerns are mounting that Malawi might continue facing low hydropower generating and poor crop harvest, possibly a disastrous ones. For Malawi, El Niño usually means less annual rainfall [6]. The impacts of El Niño, with poor rainfall being observed across the country (in some areas less than 25% of the average seasonal rainfall), and at times leading to declaring drought emergencies in the country [7]. Right Now, 90% of Malawians rely on rain-fed sources of water, which are heavily impacted by floods and droughts. Future climate change risks in insufficient hydropower, rising temperatures, increased risk of drought, and late onset of rains will affect food production and increase food poverty [8]. Seasonal forecasts for the past El Nino seasons were optimistic, providing indications of wide spread lower than average rainfall for the duration of the season in Malawi. The past performances of the rainfall may give an indication of the future scenario.

This study aimed at evaluating the trend in rainfall for El Nino seasons over Malawi from fifteenth selected areas across
the country by analyzing the rainfall season variability in terms of onset, progression, cessation, length and dry spells occurrence in relation with the normal (monthly and seasonal) rainfall at each station. It also overlays the impacts brought by El Niño rainfall seasons on crop yield and hydropower generation in Malawi. The study used acceptable data from The Department of Climate Change and Meteorological Services (DCCMS) to provide reliable estimate rainfall climatology for Malawi. The rainfall station network in Malawi is of higher density (approximately 28 Principal Meteorological Stations in total), where rainfall is recorded once per day at 08:00. Daily totals recorded each morning at 08:00 are attributed to the previous day e.g. a rainfall reading of 20mm made at 08:00 on the 18th is the actual total for a 24hr period beginning at 08:00 on the 17th and is attributed to the 17th. These data are communicated to Meteorological department of Malawi by post and digital methods at the end of every two weeks. They are then quality controlled and entered into the rainfall database [9]. For the purpose of this study, the quality control and database entry from 1970 in the target stations was thoroughly revisited at DCCMS.

II. MATERIALS AND METHODS

This study used quantitative data collection method based on one stage sampling technique. Such triangulation is important for ensuring objectivity and representativeness of data. However, for a season to be regarded as an El Niño, it had to cover, strong or very strong thresholds, as such all weak and moderate El Niño season were excluded. Table 1 below shows all El Niño rainfall season that occurred between 1970 and 2017.

<table>
<thead>
<tr>
<th>Name of Site</th>
<th>Elevation (m)</th>
<th>Location (lat)</th>
<th>Location (long)</th>
<th>Length (yrs.)</th>
<th>Completeness (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSanje</td>
<td>55</td>
<td>-16.92</td>
<td>35.26</td>
<td>1940-Current</td>
<td>100</td>
</tr>
<tr>
<td>Nchalo</td>
<td>74</td>
<td>-16.26</td>
<td>38.087</td>
<td>1965-Current</td>
<td>100</td>
</tr>
<tr>
<td>Chikwawa</td>
<td>106</td>
<td>-16.03</td>
<td>34.38</td>
<td>1948-Current</td>
<td>100</td>
</tr>
<tr>
<td>Bvumbwe</td>
<td>1149</td>
<td>-15.67</td>
<td>35.07</td>
<td>1923-Current</td>
<td>100</td>
</tr>
<tr>
<td>Liwonde</td>
<td>499</td>
<td>-15.07</td>
<td>35.23</td>
<td>1900-Current</td>
<td>100</td>
</tr>
<tr>
<td>Mangochi</td>
<td>482</td>
<td>-14.47</td>
<td>35.25</td>
<td>1947-Current</td>
<td>100</td>
</tr>
<tr>
<td>Nkhotakota</td>
<td>500</td>
<td>-12.92</td>
<td>34.28</td>
<td>1965-Current</td>
<td>100</td>
</tr>
<tr>
<td>Chitedze</td>
<td>1149</td>
<td>-13.97</td>
<td>33.63</td>
<td>1968-Current</td>
<td>100</td>
</tr>
<tr>
<td>Mchinji</td>
<td>1186</td>
<td>-13.80</td>
<td>32.88</td>
<td>1922-Current</td>
<td>98</td>
</tr>
<tr>
<td>Dowa</td>
<td>1361</td>
<td>-13.65</td>
<td>33.94</td>
<td>1961-Current</td>
<td>97</td>
</tr>
<tr>
<td>Mzimba</td>
<td>1349</td>
<td>-11.84</td>
<td>33.60</td>
<td>1948-Current</td>
<td>100</td>
</tr>
<tr>
<td>Chikangawa</td>
<td>1729</td>
<td>-11.84</td>
<td>33.80</td>
<td>1953-Current</td>
<td>98</td>
</tr>
<tr>
<td>Bolero</td>
<td>1108</td>
<td>-10.97</td>
<td>33.74</td>
<td>1953-Current</td>
<td>96</td>
</tr>
<tr>
<td>Karonga</td>
<td>529</td>
<td>-9.88</td>
<td>33.95</td>
<td>1949-Current</td>
<td>100</td>
</tr>
<tr>
<td>Misuku</td>
<td>1413</td>
<td>-9.67</td>
<td>33.53</td>
<td>1946-Current</td>
<td>98</td>
</tr>
</tbody>
</table>

Table 2: Name, elevation (meters), location, length record (years), and the completeness (%) For the daily rainfall databases on Malawi

NB: Current is referred to as the time when this report was written (2017)

A. Epochal patterns of Malawian rainfall

It is well known that Malawian rainfall displays multi-decadal variations in which there is a clustering of rainfall anomalies [10]. To examine the epochs of above and below normal rainfall, 30-year running means Malawian rainfall was calculated to determine frequency behavior. These epochs of above and below normal rainfall are shown in appendix 1. To understand the epochal behavior of rainfall series for different months, the researcher had calculated 30-year running mean of each of the seasonal month. In order to examine further, whether the contribution of each month’s rainfall in the annual rainfall showed any significant trend, the researcher prepared a time series of contribution of rainfall for each month towards the annual total rainfall for rainfall season in actual rainfall amount (mm). Trend analyses were carried out for each month and for all the 15 weather stations.

B. Description of sample

To have a better estimate of rainfall trends over Malawi, it was necessary to select rainfall stations across the country. This report contains an analysis of 15 rainfall stations in Malawi (at least 5 from each region), namely: Nsanje, Nchalo, Chikwawa, Bvumbwe, Liwonde, Mangochi, Nkhotakota, Chitedze, Mchinji, Dowa, Mzimba, Chikangawa, Bolero, Karonga, and Misuku which are full weather observing stations. Most rainfall station had had reported 100% daily rainfall report from 1970 up to 2016.
C. Data
The rainfall data were obtained from the DCCMS, and also from Global Historical Climatological Network (GHCN). Historical annual crop harvest datasets were obtained from Food and Agriculture Organization (FAO) and MAFS data base. Additional datasets for production of electricity was extracted from Electricity Supply Cooperation of Malawi (ESCOM) and Energies Africa portal.

D. Data analysis
The quantitative data was organized using Microsoft Excel (2007). IBM SPSS version 20 was used to work on daily rainfall data and coming up with monthly rainfall values, the monthly readings were summed up to yearly rainfall values. The qualitative data was analyzed by organizing the information and identifying the pattern, developing relevant themes and drawing conclusions. Rainfall values of the stations were then compared to show the trends.

E. Starting dates of the rain season
For this study, the beginning of the rainy season was evaluated with the following parameters: 0.3 mm and above is regarded as a rainy day (this value is also regarded as a rainy day by DCCMS) [2]. The beginning of the rainfall season had to reach the following threshold; the rainfall station had to record an average of ≥ 12.6mm of rainfall within 7 days, also, there must not be a dry spell of more than 3 days within the given days. Furthermore, within those 7 days, the precipitation should not equal to evaporation such that the soils must retain enough moisture to sustain seed germination for agricultural purposes [11]. The months of October, November and December were mostly focused because the ITCC shifts from northern to southern hemisphere, thus brings the rains with it [7]. The rain season was expected to start (“onset”) during this period. Instat software application is used in seasonal Onset analysis.

F. Duration of the rain season
The duration of the season is the number of all days that lay from the date of the beginning of the rain season (season Onset), to the day when the season has to end. In these months, the rainfall was expected to be in “progression” period. The last date of rainfall recorded, which is followed up to 15 days of no rainfall recorded (cessation). This meant that the rainfall season was leaving over Malawi.

G. Trends in monthly and annual (seasonal) rainfall patterns
Monthly totals were the sum of the daily values. The analyses were done similarly to each rainfall station. Discrepancies were discussed, resolved into a single consensus analysis. Each month from all the stations was analyzed on how much rainfall reported since 1970 to 2016. The monthly rainfall values were summed up to give seasonal rainfall records which ranges from October to September (12 Months). Graphs were plotted to portray the trends for monthly and seasonal rainfall since 1970 to 2016 under El Niño events. IBS SPSS version 20 and Microsoft excel was used in this analysis.

H. Patterns of dry spells
Dry spell incidences were determined on how each rainfall El Niño season at every station especially in the months of January to March. In these 3 months, the rainfall season is expected to be in “progression” period because the rainfall bearing system is well established over Malawi [4]. The pattern in which dry spells behaved from 1970 to 2016 (in days) was analyzed using Instat application so as to come up with the number of days and then Microsoft excel to show the trends in graphs.

III. RESULTS AND DISCUSSIONS
A. Onset, Cessation and Monthly rainfall trends under El Niño seasons
The rainfall season had been starting from the southern region of the country and gradually moving to the north. The El Niño precipitation of the month of January recorded highest rainfall values in 83% stations. On average, the “onset” of the El Niño rainy season was found to be the month of November which was shifting to December from stations in the southern part of Malawi. 65% of the El Niño station in the south had Onsets in November which was shifting toward December. Similarly, 69.7% of the stations in the northern Malawi experienced rainfall Onset in December, which was also shifting toward January. The months of January and February (with a rag of one month to the north part of the country) recorded seasonal rainfall “progression” phase over the country.

B. Length of the rainfall seasons.
The total trend of average number of rainy days was 103±14 and was narrowly decreasing (within the El Niño rainfall season progression) over the country. Under El Niño seasons, 75.3% in the south, 81.3% in the central and 43.7% stations in the north had a decreasing trend in rainy days. 75% of the “cessation” of the El Niño rainfall seasons were from the months of March over the south, and April over the north with a trend of shifting to the next months in both parts of the country respectively.

C. Dry spell occurrences trends under El Niño

Within the progression of El Niño rainfall seasons, longer spells were experienced in southern parts of Malawi with an average of 6±2 days at the onset of seasons. Unlike in the south, longer dry spells in the northern half was due to late establishment of the season (late onset). Longer dry spells were experienced across the country in January in El Niño seasons with an average of 10 days with the south and central region being more vulnerable. In February, dry spells of about 11±3 days were experienced, more common in the Shire Valley region (N’gabu, Liwonde and Mangochi) and over some parts in northern Malawi (Bolero and Misuku). In March, longer dry spells were also observed in the central and north of Malawi under El Niño seasons of up to 9±2 days. Longest spells were experienced over central areas in 1983-84 El Niño season. On average, dry spells of about a week were more likely in the middle of the season in various parts of the country. These early rainfall deficits led to widespread dryness at the start of the El Niño season and resulted in delays to the start of the crop growing season.
D. Total seasonal Rainfall trends under El Niño seasons.

From 15 selected rainfall stations, the total El Niño rainfall trend from 1970 to 2016 was decreasing with an average of 972.4±53mm. However, the stations in the north of the country had an increasing rainfall trend of 105±13 mm. Under El Niño seasons, 34.7% of the stations had rainfall above normal in the south, 39.2% in the central and 52.6% in the north. The rainfall pattern in Malawi suggests that local factors like topography and location have a dominant role in the spatial distribution of rainfall.

E. Poor Maize performance during the El Niño growing season

The El Niño growing season of 1970 to 2016 were characterized by extensive rainfall deficits during its key stages. These should have led to a delayed start of the season and dry spells during the flowering and grain filling stages of the staple maize crop. This implies short seasonal cropping seasons and major risks to dry spells which were exacerbated under climate change. This resulted in crop production deficits across the country which were particularly acute in 1991/92 and 2002/03 (as shown in table 3 below) impacted very severely on agriculture in Malawi which accounts for the major part of maize production. The El Niño rainfall variability Periods of below average or erratic rainfall were less extreme and less general in their impacts in the 1970s and 1980s than in the 1990s and 2000s.
F. Evidence from Agricultural Statistics in Malawi and other neighboring countries during El Niño rainfall seasons

Historical crop statistics (1961 to 2016, from FAO-STAT) clearly reflect the impact of El Niño events on regional maize production. El Niño seasons have led to low and unstable maize prices - very pathetic in Malawi where the majority of households are net consumers, and food accounts for over 60 percent of household income. Since then, the country has managed to have a food deficit in most season. National maize yield data for the country, when expressed as variations from its thirty five year average, show a clear relationship with El Niño. Negative variations in maize yield (values below 0%) are mostly associated with El Niño events as shown in table 4 below.

There is already a current 860 MW power deficit and the Electricity Supply Commission of Malawi (ESCOM) has implemented power rationing/load shedding in the country since 1970s. Malawi experiences deep deficit regarding electricity production from the drought conditions that are as a result of El Niño rainfall seasons as depicted on table 5 below.

G. Hydropower in Malawi

Malawi’s electricity generation relies predominantly on large hydro, which accounts for 97% of the total installed capacity.

<table>
<thead>
<tr>
<th>Country</th>
<th>Rainfall season</th>
<th>35yr Avg</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>72/73 864 557 568 67 1351 979 451 1749 1110 58%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>852 1004 579 712 67 934 1370 456 15 62 -75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesotho</td>
<td>235 104 54 97 227 49 337 114 81 92 -12%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malawi</td>
<td>874 967 753 1007 1186 1976 3005 2745 2945 3883 -24%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mozambique</td>
<td>996 1032 2100 917 2001 1894 1973 2967 2255 2338 -4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Namibia</td>
<td>109 60 105 89 48 71 56 88 51 126 -60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSA</td>
<td>9731 8734 6793 10254 7593 12486 10653 9286 13149 14420 -9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swaziland</td>
<td>27 56 53 70 109 95 83 99 82 78 5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td>3904 4200 3980 5098 4278 6430 7351 5893 7382 6973 6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>698 900 1056 1472 692 2963 1084 3481 2846 2943 -3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>1045 487 1162 2714 1046 762 2071 1090 800 1373 -42%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SADC figures-2017
Table 5: Generation Installed Capacity

<table>
<thead>
<tr>
<th>Name</th>
<th>River Type</th>
<th>Discharge (m³/s)</th>
<th>Capacity (MW)</th>
<th>Expected Generation (GWh/year)</th>
<th>Generated in El Niño year (GWh/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nkula A + B</td>
<td>Shire RoR</td>
<td>246</td>
<td>124</td>
<td>582</td>
<td>365 401 205 367 297 368 297 476 376</td>
</tr>
<tr>
<td>Tedzani I + II + III</td>
<td>Shire RoR</td>
<td>276</td>
<td>92.7</td>
<td>502</td>
<td>205 374 287 306 274 315 308 442 397</td>
</tr>
<tr>
<td>Kapichira</td>
<td>Shire RoR</td>
<td>135</td>
<td>129.6</td>
<td>210</td>
<td>189 153 193 103 95 183 83 126 118</td>
</tr>
<tr>
<td>Wovwe</td>
<td>Rukuru RoR</td>
<td>76</td>
<td>4.56</td>
<td>113</td>
<td>76 83 74 69 84 56 75 89 61</td>
</tr>
</tbody>
</table>

Source: MERA and ESCOM (2016)

IV. CONCLUSION

The inter-seasonal and monthly fluctuation of El Niño rainfall over a 45 year period was studied in 15 sites of Malawi. This study reveals a high spatial variability of both monthly and seasonal rainfall under El Niño seasons, where 34.7% of the seasons had rainfall above normal in the south, 39.2% in the central and 52.6% in the north. Substantial rainfall was recorded in the months of December, January, February, March and November. November rainfall was decreasing for 70.4% stations of southern half Malawi, while December rainfall was also decreasing for 63.7% stations of the northern half of the country during El Niño seasons. However February and March rainfall is increasing for the central parts of the country. April rainfall was getting importance as its contribution to El Niño seasonal rainfall was increasing in 68% of the seasons over central and north of Malawi. 65% of the El Niño seasons in the south had Onsets in November. Similarly, the stations in the northern Malawi experienced rainfall Onset in December. El Niño seasons had a fluctuation decreasing rainfall average trend of 972.4±53 mm. However, the stations in the north of the country had slightly increasing rainfall trend of 105±13 mm under El Niño seasons. Total trend of an average number of rainy days was decreasing under El Niño seasons, 75.3% in the south, 81.3% in the central and 43.7% rainfall stations in the north had a decreasing trend in rainy days. Within the progression of El Niño rainfall seasons, longer spells were experienced in southern parts of Malawi with an average of 6±2 days at the onset of seasons. 75% of the “cessation” of the El Niño rainfall seasons were from the months of March over the south, and April over the north with a trend of shifting to the next months in both parts of the country respectively. The El Niño borderline conditions led to extensive rainfall deficits, resulting in widespread drops in crop production. The overall finding was that the length of the El Niño seasons is gradually reducing in Malawi. These patterns typically resulted from significant dry spells during the El Niño periods, which had severe impacts on maize crop production in Malawi. The study underscored the clear link between El Niño events and drops in national maize yield in Malawi. The relationship throughout Malawi between maize and electricity production volatility and El Niño events was striking. Climatic variability and the Malawi economy. Periods of below average or erratic rainfall were less extreme and less general in their impacts in the 1970s and 1980s than in the 1990s and 2000s. Maize production declined by around 60% in 1991/92 to the equivalent of only 45% of average production levels for the previous five years. The low rainfall and more dry spell pattern in 1997/98 and 2002/03 with the very strong ENSO event led severe drought in Malawi and very low crop yields. The effects of El Niño rains contribute to low Shire river flow rate leading in mean lower amounts of water flow to the dams that produce electricity, impacting on the power supply for Malawi. Focusing on rainfall and output has provided better understanding of the consequences of climatic variability historically and in the future with implications for food security, hydropower generation and economic policy in Malawi.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

Acknowledgment

We greatly appreciate the effort made by Malawi Government for making the reports and documents available for development purposes especially through the Department Climate Change and Meteorological Services. We are thankful to Shire River Basin Project for the support. We extend our heartfelt gratefulness to Data section at DCCMS for their help in rainfall data analysis.

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Use of heat pump dehumidifiers on industrial drying of chili

Abeyrathna R.M.R.D., Amaratunga K.S.P.

Abstract - Chili, a potential cash crop in the world is considered as one of the most important spices due to its multiple uses and vital role in most of the cuisines. Traditional drying systems use direct sunlight or indirect heating sources and hence difficult to control the drying conditions. Convective drying systems use hot air and because of high temperature, volatile compounds tend to remove from the product leading to a quality reduction. Use of dehumidified air for drying has been suggested as one of the solutions as drying can be done at relatively lower temperatures while preserving the volatile compounds. In this study, a heat pump drying (HPD) system was designed, evaluated and then validated to be used as an alternate method of drying chili in the industry level. Weight and the bulk density of the evaluated sample were 8,000 kg and 98 kg/m³ respectively. The Specific Moisture Removal Rate (SMER) value of the evaluated HPD system was 1.027 kg/kWh. The moisture content of chili was reduced from 10.8% to 5.05% (wet basis) within three hours. The relative humidity of the dehumidified room was reduced to 8% from 55% and the temperature of the dehumidified room increased from 29°C to 41°C within three hours. Average water condensed rate was 5.2kg/h. Results suggested that the developed heat pump drying system has performed well serving its purpose and hence it can be concluded that the established closed cycle heat pump drying system can be effectively used to dry chili in industrial level.

Index Terms - Heat pump drying, Specific Moisture Removal Rate, Dehumidified air, Food preservation.

I. INTRODUCTION

Chili is an important spice and a potential cash crop in the world and used as a basic ingredient in most of the cuisine all over the world and more especially in South Asian countries like Sri Lanka. Chili is consumed in both fresh and dry forms and the per capita consumption and the national annual requirement of dry chili are estimated in Sri Lanka as 2.32 kg per annum and 42,634 metric ton respectively (Amaratunga & Fernando, 2014). Chili is dried for making chili powder for both short and long-term storage (Hossain et al., 2005). Due to the lack of postharvest processing facilities, considerable amount of produce is wasted. Therefore, identifying proper methods for preserving chili is in need over the time along with the concept of food security.

Drying is one of the most widely used methods of preserving foods and more especially chili around the world in both domestic and industrial level. The preservation in drying is due to the removal of water from the food preventing the growth of microorganisms (Gupta, et al., 2002). Traditional drying is done by direct sunlight or using indirect heat sources but it is difficult to control the drying conditions and highly dependent on weather. Hot air is used in convective drying systems however due to high temperature, flavor compounds tend to volatilize leading poor quality of spices. Well-developed conventional drying methods are widespread in the food industry and such methods are exemplified by heat pump system. Heat pump drying (HPD) is a rapidly emerging technology, which can be used to dry spices within a controllable drying environment, specifically the temperature and humidity.

Heat pumps transfer heat from a source of heat to a destination called a "heat sink" and one of the important factors to be noted here is that it uses comparatively a small amount of external power to accomplish this task. Heat pumps have been designed in such a way that the thermal energy moves in the opposite direction of spontaneous heat flow by absorbing heat from a cold space and releasing it to a warmer one.

Maintaining and controlling the correct levels of moisture content throughout the processing is the key factor in achieving the expected quality and it can be achieved using HPD system as it uses dehumidified air for drying at relatively low temperature while preserving the volatile compounds. In addition, environmental concerns are minimal and economic viability is in an acceptable range. It is therefore HPD can be considered as an alternative method for drying chili owing to its specific characters. However designing and evaluating of HPD system in the Chili processing industry is yet not well developed and it is therefore the study was conducted with the main objective of evaluating the compatibility of HPD system for mass drying of chili to be used in industry by analyzing the specific moisture extraction rate (SMER).
II. METHODOLOGY

The fundamental principle in the process of drying in the developed HPD system involves creating a moisture gradient between material and the surrounding air by removing the moisture in the air. In order to facilitate this process the chili dehumidifying system was designed with three main components namely i) an evaporator; to condense moisture in the air, ii) an industrial blower; to facilitate air circulation and, iii) a container fabricated with a capacity of 8,000kg; to hold chili. Air circulation facilitate the movement of high RH/low-temperature air to the dehumidifier and taking away low RH/heated air. As the drying percentage depends on moisture content (humidity) of the air and temperature a special attention has been given for maintaining required airflow rate in order to keep the relative humidity and temperature at the required level. The top and front views of the dehumidifying system are illustrated in the figures 1 and 2.

![Figure 1: Top view of the dehumidifying system](image1)

![Figure 2: Front view of the dehumidifying system](image2)

*Chili holding container*

Dimensions of the designed metal container were 10 × 2.50 × 1.20 m. The bottom was sealed and covered with a wire mesh to facilitate the air movement. The gap between wire mesh and the floor was 0.25m. Air flow movement through the container is illustrated in Figure 3.
Air circulation in the dehumidified room was facilitated by using a centrifugal industrial blower. Air was sucked by the blower from the bottom of the chili container and pushed toward the evaporator. The air flow rate of the centrifugal industrial blower is 0.14 m/s. Dehumidify system absorbed air coming from the blower, which has high moisture content and low temperature. Simultaneously, it released heated air with low RH. Throughout the process, the blower was switched on to facilitate air movement from the top to bottom of the chili container. The blower was attached to a three-phase motor, which has 1600 rpm. Current usage for the motor was measured using a clip-on ammeter (HTC Instrument CM-2030 Digital Ac Clamp Meter).

Heat pump was used to reduce the relative humidity of air with elevated temperatures to facilitate the drying process. The working mechanism of dehumidifier is illustrated in Figure 4. Evaporator in the dehumidifier receives cold air, which contains high RH from the blower, and then the moisture in the cold air condenses at the evaporator while passing through. As a result of that cold air with low RH comes out from the evaporator. Then cold air is directed into the condenser. Cold air gradually increases its temperature while passing through the condenser and the relative humidity of air decreases.

Dehumidify machine and blower were attached to the floor to avoid vibrations. The temperature and relative humidity inside the dehumidified room were measured and recorded using an Arduino circuit (Genuino Uno Rev3) and a RH and temperature sensor (DHT11 Module) unit. The current and voltage consumed by the dehumidifier and the industrial blower was measured using clip-on meter (HTC Instrument CM-2030 Digital Ac Clamp Meter). Air flow rate was measured using a portable hot wire anemometer (XINTEST, HT-9829).

The energy consumption of the heat pump drying system was calculated using equation 1, 2, and converted to kilowatt hour using equation 3.

\[
p = \sqrt{3} Ul \cos \phi \quad (1)
\]
P = power (W, Js⁻¹), U = line-to-line voltage (V), I = current (A), \( \cos \varnothing \) = power factor (0.86)

\[ E = pt \quad (2) \]

\( E \) = Energy (J), \( t \) = time (s)

\[ Energy = \frac{E}{3.6 \times 10^6} \quad (3) \]

Condensed water from the dehumidifier was collected and measured one hour time intervals while system working. The specific moisture removal rate (SMER) was calculated using equation 4.

\[ SMER = \frac{Amount \ of \ water \ evaporated}{Energy \ input \ to \ the \ dryer} \quad (4) \]

III. RESULTS AND DISCUSSION

The duty cycle of the HPD system is one hour on time and 10 minutes off time. Current usage of the HPD system shown in Table 1. Evaporated water from the dehumidifier was recorded with the time Table 2. Relative humidity and temperature variation inside the dryer was recorded with the time.

Table 1: The current usage of HPD system

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Status of the machine</th>
<th>Current (A)</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>on</td>
<td>8.5</td>
<td>400V</td>
</tr>
<tr>
<td>10</td>
<td>off</td>
<td>0</td>
<td>400V</td>
</tr>
</tbody>
</table>

Table 2: Amount of condensed water by HPD system with time

<table>
<thead>
<tr>
<th>Time interval (min)</th>
<th>Condensed Water (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>5600</td>
</tr>
<tr>
<td>60</td>
<td>5200</td>
</tr>
<tr>
<td>60</td>
<td>4800</td>
</tr>
</tbody>
</table>

Initial moisture content of the chili was 10.80 % wet basis. Moisture content was measured using an infrared moisture meter (Sartours, MA45) in the top layer of the chili container and the middle of the container. Moisture content was recorded with the time (table 3).

Table 3: Moisture content variation with time

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>Chili moisture content (wet basis)</th>
<th>Chili moisture content (wet basis)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Top layer of the container</td>
<td>Middle of the container</td>
</tr>
<tr>
<td>1</td>
<td>6.09</td>
<td>9.31</td>
</tr>
<tr>
<td>2</td>
<td>5.93</td>
<td>7.23</td>
</tr>
<tr>
<td>3</td>
<td>5.05</td>
<td>7.17</td>
</tr>
</tbody>
</table>

Average water condensed rate was 5.2kg/h. Following data were obtained using equation 1 and 2,

\[ p = 5.064 \, kW \]

\[ E = 18.23 \, MJ \]
Power consumption per hour was 5.064 kW/h calculated using equation 3. Specific moisture extraction rate was 1.027 kg/kWh calculated using equation 4.

The Specific Moisture Removal Rate (SMER) value indicates the performances of the dryer. It is expressed as the ratio of the amount of water evaporated to energy input to the dryer. In other words, it is the amount of energy required for to remove 1 kg mass of water from the food material. Normally SMER values in heat pumps vary between 1.0 – 4.0 (Rahman, et al., 1998).

Initially, there was around 48% RH in the room, but with the operation of the dehumidifier, the RH reduced to 8% after three hours as shown in Figure 5. The temperature of the dehumidifying room was 29 Celsius and with time, it increased to 41 Celsius as shown in Figure 6. The temperature in the dehumidified room did not exceed 41 Celsius and it is important to maintain the quality of the product. Otherwise, oregano sulphur compounds and volatile fatty acids will be evaporated at higher temperatures.

IV. CONCLUSION

The developed heat pump drying system performed well with chili. SMER for the heat pump drying system was 1.027 kg/kWh. The moisture content of the chili at the top layer was reduced from 10.8% (wet basis) to 5.05% (wet basis) within three hours. Relative humidity of the dehumidified room reduced from 55% to 8% within three hours. The temperature of the dehumidified room increased from 29°C to 41°C within three hours. Therefore, it can be concluded that the established closed cycle heat pump drying system could be effectively used in drying chili in industrial scale.
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Smart Cultivation Partner

Mobile Application (Android) Service to Increase Cultivation and Sales

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Abstract- Mobile applications and services make things simpler fulfilling people daily needs. There is a lack of applications, which can be really useful for the professionals to improve their working capabilities. Though mobile phones are used by people living in rural areas, but there are hardly any relevant applications for them to improve their productivity. In this paper research team proposed one such mobile application “Smart Cultivation Partner”, which can be operated on their mobile phones. In Sri Lanka Farmers Faced many problems because they do not know such technical and technology skills. They cannot find the actual merchants, they do not know the actual prices, they do not know the suitable market for their sales, and also they cannot predicate the price of their cultivated products. This app will help to the farmers working with the motive of greater profitability by direct communication between farmers-to- Merchant, farmer-to-farmer and also farmers can know the contact details of the relevant agriculture and agrarian department. The system is an effort to fill the gap between farmers and merchants. It provides detailed information about which crop to grow in which season and which crop is suitable for that particular area in where the farmer is living. The proposed system will use the Global Positioning System (GPS) for location tracking. Predicate the prices of their cultivations in future using Data predictive mining. Farmer can provide inputs related to crops being cultivated and location specific information to get specific suggestions, alerts and recommendations to improve productivity. Whenever a farmer observes some anomalous behavior for crops or climate, the system is able to generate recommendations based on inputs provided. This device can help to them and achieve that goal.

Index Terms- Farmers, Data Mining, Android, Mobile application, Cultivation, Harvesting

I. INTRODUCTION

Cultivation is important to human beings because it forms the basis needs food security and also Farming has been an important part of civilization for thousands of years. In Sri Lanka Farmers Faced many problems because they do not know such technical and technology skills. Mobile phones have become an integral part and personality of the present generation and they like to embrace all the things in the scope of this modern technology. This modern generation is much more advanced of usage of modern technical gadgets. In fact, a lot of research is happening on the use of mobiles.so the project team decided to introduce a mobile application to the farmers. Farmers cannot find the actual merchants, they do not know the actual prices, they do not know the suitable market for their sales, and also they cannot predicate the actual weather and price of their cultivation. There are no such a web/mobile apps in Sri Lanka to increase the cultivation and sales and also there are no apps to help to the farmers. [12]

Smart Cultivation Partner Mobile apps Service to help the farmers working with the motive of greater profitability by direct communication between farmer-to- Merchant, farmer-to-farmer and also farmers can know the contact details of the relevant agriculture and agrarian department .This service is also provide the new technology features news to introduce to the cultivations, new fertilizer, new crops details to the farmers. This service boosts business communication and brings transparency in the system. This innovative site allows a good farmer, retailer and Merchant communication. It provides an option of login to farmers and communicates to respective dealers. The farmers also have an option to submit their grievances and complaints to respective dealers or authorities using their farmer login on a separate complaints page and authorities will get access to that page regularly using their login id and passwords. The proposed system has lot of benefits to the user .that are Separate login areas with appropriated functionality for farmers, Merchants and administrator. An effective Graphical User Interface (GUI) so that rural people may easily use the service, this app can be used in 3 languages (Tamil, English, Sinhala), this app locate the actual location of the farmer and provide the suitable details, new technology news and videos can post to the farmers, Predicate the price of the vegetables using the previous data predicative mining. This App is to use for Vegetables, Fruits and Coconut Cultivation farmers .Farmers can advertise their vegetables and coconut details and estimate price, Pages where dealers / retailers may post their requirements and estimate price. A separate page where only farmers can post complaints and only assigned administrators can read and edit the page features. Farmers are notified of these notifications via Short Message Service (SMS) whenever new advertisements are published. Can be over for multiple villages to communicate and deal with each other. Farmers can directly contact Merchants by searching online. Farmers may submit their grievances online. Farmers get notification of any new offers/schemes. Farmers can compare price in different areas.

The application requires internet connectivity in order of installing the app and to work with it. But in our field of study of the research area the left out which were made by the existing applications were considered. As a result the system is to be developed mainly for the Sri Lankan citizens where they could
II. LITERATURE REVIEW

Agriculture is a major source of raw food production in the world where it plays the major part of the human food consumption. However, the uses of latest technologies in the field are not being implemented widely unlike in other industries despite the fact that the agricultural industry is in a declining state. Lack of interest among the current generation, absence of proper motivation factors, low marginal profits, use of outdated and time consuming methods and technologies for cultivation are few major factors which contributes to the downfall. The research will focus on eliminating hassles faced by the farmers by using the latest and innovative technologies and how they can be applied in real world farming activities. Agriculture is carried out for generations which means we have a huge data of the past cultivation methods. Data mining methods could be used for future recommendations and support services for farming. [10], [11]

According to [1] Kiran Shinde et.al provides an in-depth review of the use of data collection for cultivation guidance on topics such as Crop Recommendation and Crop Rotation Recommendation. The Data Tier consists of databases which consist of data of past agricultural activity, cost of agriculture, Fertilizers etc. The Business Tier consists of Servlet modules which consist of all the business logic for the system which are hosted on a separate application server. Several combinations of algorithm to be used to recommend certain crops based on the soil, location, season but no limited to demand / supply for the crop. System will generate some suggestions for the crops based on the Location, Season. [3] The suggestions will have a rating system which allows the user to decide on the crop to be planted. Apart from the crop recommendation, the system is capable of recommending crop rotation ensuring the high level of productivity. The frequency of the crop rotation will be displayed based on the crop type.

Sanjay Chaudhary et.al [3] emphasizes the use of GIS (Geographic Information System) in rural farming villages in India. The purpose of the GIS is to collect, record data about farming activities based on the location and use it when needed. Hence, this could be used by other applications and technologies which are targeted towards agriculture. Data collected will be stored in a database. GIS can store data, such as soil type, nutrient levels, temperature, administrative boundary etc. and assign this information to the specific geo location. Therefore, this can be useful for farmers on deciding their crops and location of the cultivation.

The above topic further discussed in the research done by Yvette E. Gelogo and Haeng-Kon Kim under the title —A Design of u-farm Mobile Application Framework (2014).[6][3]The research was regarding the development of a mobile assistant app for farmers which is similar to the above research done in India based on the data mining. The latter includes various outputs compared to the previous where this research encourages the use of the data for various purposes such as farmers in monitoring their resources, crops, generate reports and statistics. Further this research includes the usage of sensing devices as well. [2] This paper also includes the development of mobile gateway which makes it possible for integration for sensor devices. As per the framework and the architecture presented the in this research also presents the mobile gateway interface to support the mobile devices to be a device to receive sensing information from the sensor devices. It performs environmental (temperature, water level, humidity, plant growth and etc.) sensing capability. It’s highly unlikely that rural communities will adapt towards an advanced app as suggested in the second research. More and training sessions should be conducted. Further, the requirement of data transfer technologies such as 3G, 4G, Bluetooth, etc. is also questionable when it comes to remote areas where the agriculture is prioritized. [4]

Wireless Farming: a mobile and Wireless Sensor Network based application to create farm field monitoring and plant protection for sustainable crop production and poverty reduction By Elias Edo Dube (2013).[6] The first one suggests the use of Wireless Sensor Networks (WSN) for the purpose as the world is ICT is moving towards —more wireless approach. The research is based on farmers in Ethiopia and how they use WSN to monitor and control their farms. The main component of WSN is the use of mobile phone – which is something accessible for almost every sector of the population. It is notable that mobile phone penetration in Sri Lanka exceeds 100%. Therefore, going towards a WSN method suits our communities too. WSN devices can be divided into these units Sensing unit, Processing unit, Transmission unit, Power Unit. Possible details which are Soil Moisture, Soil pH, Air moisture and Air condition, Humidity, Weather Condition, Irrigation Water Resources Monitoring System for Farming Operations with Wearable Devices Utilized Sensor Networks – The research done by the Tokihiro Fukatsu, and Terasahi Nanseki (2009) looks at an advanced usage of WSN device which includes wearable devices as well.[6][7] The system is based on a centralized Field Server System. A Field Server enables crop and environmental monitoring by using various sensors and cameras. However, it also points out the fact that farmers may also be used a data source where as it will be considered as a manual input method. Using them for inputting data on devices could be troublesome and will also affect their field work. A voice guided input system will be a good solution for this. The researchers have developed a Radio Frequency Identification (RFID) system for the purpose which communicates with the Field Server.Compared to WSN method, this one mainly focuses on farmer’s activities to obtain data. Hence, a wearable device with RFID is being used.[5]

“Performance Analysis for DCAR and CMDC Using Shopping Complex Dataset” [13], in this paper, Shopping complex dataset is applied in the existing algorithms DCAR and CMDC for evaluating the experimental results to predict accuracy and time complexity. It is clearly stated that CMDC algorithm provides better accuracy than existing algorithm.
“Spatial data mining and geographic knowledge discovery - An introduction” [15]. Due to the widespread application of geographic information systems (GIS) and GPS technology and the increasingly mature infrastructure for data collection, sharing, and integration, more and more research domains have gained access to high-quality geographic data and created new ways to incorporate spatial information and analysis in various studies.

III. METHODOLOGY

Smart Cultivation Partner was developed using the prototype methodology, this methodology was selected because there may be many complex situations. Repetitive behavior of this methodology in analysis, design and implementation phases gave more space for the development team to understand the requirement better and study the new technologies in the meantime. Using this methodology, the project team will perform the analysis, design and implementation phases concurrently whenever changes approached by the client. This would allow making changes to the project process by repeating the relevant phases with relevant corrections to accomplish the client requirements, if in case any deliverable fails. The advantage of using prototype methodology is after implement the prototype system gets the feedback, go back to the same process (analysis, designing, and implementation) and fix the errors according to the feedback. The following sections describe work done by the development team at each phase of system development lifecycle.

Planning

Initial planning for successful development of Smart Cultivation Partner was carried out in this phase. The project team identified the need for Smart Cultivation Partner by studying the issues with traditional cultivation sale system currently used by Sri Lankan Markets. Hence project team studied the current statistics on traditional system and identified the project need. Project team then formulated the basic functionalities by explaining the needs at a high level of understanding. A project charter was created as a result. Eventually, Work Breakdown Structure (WBS) and Gantt chart were developed to determine how the project team will go about building Smart Cultivation Partner. Project team carried out feasibility analysis to identify potential risks associated with development and deployment of Smart Cultivation Partner.

Requirement Gathering & Analysis

In this phase project team began to understand the user requirement by analyzing the data gathered using various techniques. Initially data necessary for Analysis is collected as Primary data and secondary data. Project team carried out an Interview session with the farmers and merchants to gather accurate statistical information about traditional sales system used in Market. Statistic about current sales system, issues faced by farmers in cultivation, Predicate the prices in future, technical and technology skills in farming are the major areas covered during this interview. Furthermore, Project team conducted crucial literature review on Applications of GPS, Farming and cultivation, Android Application related to farming, data mining and similar systems related to efficient cultivation management system. As the final process of data gathering, project team distributed Questionnaires to open public of all categories in order to study the system requirements from public point of view. The team also studied existing technologies relevant to the project in order to select the technologies to use in implementing the system. Project team initiated process modeling and data modeling by analyzing the gathered information. Use case diagram was created as a result of process modeling whereas Logical Entity Relationship diagram was created as a result of data modeling.

Designing

A proper design leads to flexible, secure and efficient system. More effort in designing phase makes implementation easy. Project team worked on various designing techniques with great concern to make sure that the client requirements finalized from analysis phase has been meeting as accurately as possible. Designing techniques used by the project team are as High-level Architecture Design, Hardware and software requirements, Database design, Class diagram, Test plans, Interface Designing, Web interface designs, Android Application interface design, Flow Charts etc.
Implementation
Most amount of time was spent by the project team in this phase to build the system to fit the requirements and design constraints identified in the prior phases. The project team worked on the construction of Smart Cultivation partner by dividing it into several components. These following sections are implemented: Mobile Application, Web Application, Database, Web service, and Firebase.

Testing
Errors are unavoidable in any software products. Cost of these bugs may range from a penny to many millions. Quality and success of Smart Cultivation Partner has a vital need of error-free operation. Initially, project team refined the test plans created at the design phase to create a new set of test plans to suit the final system. Web application, Android Application was identified as the major components for testing.

Unit testing
Overall all the individual components were tested using black box testing except some complex codes. Complex codes such as prediction of price, sending and receiving notification, connect actual merchant with the farmer and real-time monitoring were subjected to white box testing.

Integration testing
Integration testing was carried out as Use interface testing, use scenario testing, and System interface testing. Navigation between different activities and fragments were tested in user interface testing whereas data flow between database and other components like mobile application were tested using system interface testing.

System testing
Smart Cultivation partner was tested as a whole to ensure errorless operation of entire system as a whole. Project team focused on overall usability of the system. Identified whether all the requirements of Smart Cultivation partner has been achieved.

IV. RESULTS
Here the final results of the system are shown with the screenshots of the interfaces. In this evidence section it briefly discuss about the output with the performance, reliability and the accuracy of the system.
Main Window and Select the user level of the application (Figure 3)
In this interface user can select the preferred language using the button. After the button click it will be directed to the user level selection Activity. In this interface user can select their role it will be directed to the login Activity
Post Advertisements (Figure 4)
This interface user needs to select the crop name, user type and also location. System will show the vegetable image to the user so user can easily use the system. Finally user need to enter the quantity and estimate price for their cultivation and then post it.
View Crop Advertisement (Figure 5)
In this window farmer and merchant can view the crop advertisement. If farmer want to see the merchants post farmer need to select option to post by farmers and also merchant do the wise versa select posted by farmer.
View Crop Predications and Departments Details (Figure 6)
Farmer and Merchant can view the past and future crop predictions using this interface. First select the crop and select a range of date and click the view button. It will navigated to the crop predication interface. It will show the graph by using data predicative mining algorithms. This graphs change according the price and date

Reliability
The reliability of the overall program depends on the reliability of the separate components. The applications should have the ability for real time data transferring and the system should have high performance. Mobile app users will it easy to use the application even with a moderately budget level phone, since the app does not take much space, it won’t affect the performance issues of the mobile phone.

Availability
The system is available whenever a user wants it. The system and its functions can be use whenever the user wants. The system would be fault tolerant, in other words system will be able to continue functioning when part of the system fails.

Security
The Managers have respective accounts with password that enables only the Manager/s to login onto the system. Passwords are required so that no one else can access the system or database. The security purposes in application it prompts a login which contains user name and passwords. All login user data are stored in the database.

Maintainability
The research team is responsible for this product and all the maintenance and modifications will be handled by research team. By increasing the efficiency of the system modifications will need to be done in the future.

V. DISCUSSIONS
Implementing this proposed system which provides the user major facilities for the cultivation and life quality. This system provides the user some facilities which have not been provided by the other similar android mobile applications or websites. Predicting the price of their cultivated products issue by pattern analyzing of the past data will provide the application some reliability and trust ability. The application is to be designed in a user friendly and easy handle way so that rural people who are not used of using these kinds of facilities will get easy to learn how to handle the system. Significance of the project is implementing some special feature which gives convenience through, implementing a system where it detects location, recommendations for the crop, gives predicate prices etc.

VI. CONCLUSION AND FUTURE WORK
Smart Cultivation Partner Mobile apps Service to help the farmers working with the motive of greater profitability by direct communication between farmer-to- Merchant, farmer-to-farmer and also farmers can know the contact details of the relevant agriculture and agrarian department. This service is also provide the new technology features news to introduce to the cultivations, new fertilizer, new crops details to the farmers. This service boosts business communication and brings transparency in the system. An effective Graphical User Interface (GUI) so that rural people may easily use the service, this app can be used in 3 languages (Tamil, English, Sinhala). Predicate the price of the vegetables using the previous data predicative mining. This App is to use for Vegetables, Fruits and Coconut Cultivation farmers. System is tracking the GPS of the current location of the farmer and it connects to the most suitable merchants. Thus Smart Cultivation Partner System plays an important role in improvement of traditional cultivation sales system in Sri Lanka.

Limitations
Deployment of Smart Cultivation Partner System carries some limitation constraints which should be taken into consideration.
The limitations are as follows,
- Disable people will not be able to use the system at all
- Need to get the actual user location.
- Application will be connect with the system via internet and user need internet connection to use this application

Recommendations
- User should have a mobile phone with a screen size of minimum 4.0 inches to get a proper view on the mobile and have a fast internet connection for communication.
- Placing the Collection point in a fixed location

Future work
Smart Cultivation Partner covers a very large scope with an ultimate goal of revolution in cultivation. Till the Goal is met numerous number of research paths will be open to researchers. This research area will stay fresh with the rise modern technologies. Project team has identified following as immediate set of future works which may interest researchers in this area.
- Connect the farmers through mobile with the Agriculture departments
- Establish System in every Agriculture department
- Expanding the system targeting Cultivation management system of entire nation
- Identify the defects in the plants using image processing system
- Add Instant online payment system

www.ijsrp.org
ACKNOWLEDGEMENT

It is with great admiration and pleasure we convey our heartfelt gratitude to our research Supervisor Ms. Nipunika Vithana and lecturer in charge for the subject Comprehensive Design/Analysis Project Ms. Gayana Fernando whose help, stimulating suggestions, knowledge, experience and encouragement helped us in all the times of study and analysis of the project in the pre and post research period. Also very special thanks to Dr. Yasas Jayaweera for their endless support given at times of difficulty as well as to our seniors and the lecture panel.

VII. REFERENCES


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Siegel Harmonics – A Sound Like No Other

Hayden B. Siegel
Musician and Researcher

Abstract- By utilizing proper technique one can produce a harmonic tone equal to a minor third from the fingered note.

Index Terms- Siegel, Harmonic, Bass, Music

I. INTRODUCTION

The purpose of this article is to provide a stepwise walkthrough for the reproduction of Siegel Harmonics. It will identify proper finger placement, plucking, and tuning of an electric bass guitar in order to replicate the end-result desired.

II. MATERIALS

• Electric Bass Guitar
• ¼” Audio Cable
• Bass amplifier

III. IDENTIFYING THE SOUND, RESEARCH AND METHOD

The foremost preliminary step to identify the sound that we are trying to reproduce which is a minor third from the root fingering that reverberates harmonically across the string. The effect is most observable along the following locations of the fret board.

1) The seventh fret along the E-string or a B produces a harmonic D-minor chord
2) The ninth fret along the A-string or a F# produces a harmonic A-minor chord.
3) The eleventh fret along the D-string or a C# produces a harmonic E-minor chord.
4) The seventeenth fret along the G-string or a D produces a harmonic E# chord.

The collection of the initial data occurred on October 22nd, 2007 with the first discovery being made using a Squire P-Bass. Thereafter continued experimentation to reproduce the effect in order to assess the musical qualities of the sound the entire process was repeated along the length of the neck of the bass several times along each string. Later I confirmed my findings by reproducing the effect with a 100% success rate across multiple electric bass guitars of various makes and models by using the steps provided in Section IV. Eventually I came to produce the song titled “The Cerebral Chauffer” in order to show off the musical qualities of a Siegel Harmonic.

IV. STUDY & FINDINGS

A. Steps to reproduce

In the case of this reproduction, and for the remainder of the paper, we will be using the fingering for the Siegel Harmonic along the seventh fret of the E-string of a bass tuned at 440hz in order from thickest string to lightest: E, A, D, G.

Apply full pressure to the E-string along the seventh fret, which would when normally plucked produce a B, but leave enough room between your hand and the other strings so that they will vibrate fully.

Pluck the E-string and only the E-string from behind the fingering hand so that the fingering hand is further from the instrument’s headstock than the plucking hand.

Continue to apply pressure to the E-string to allow the sound to resonate. In this example, the resonance should occur at 36.708hz.

B. Overview of findings

Siegel harmonics produce a sound that is equal to a minor 3rd up from the fingered root. The sound is generally short lived, but can be sustained by multiple strikes of the string so long as the non-fingered strings are allowed to vibrate freely.

C. Detailed findings

The sound is created due to shortening the string length between the fingering hand and the headstock. However, since the fingering hand is muting the vibrations along the string towards the pick-up the vibrations are instead transferred up the neck of the instrument past the plucking hand and through the headstock; wherein they travel down the string just past the neighboring string. In the case of our example with the E-string the string that would carry the vibrations from the headstock would be the D-string. Subsequently, it is observable that if G-string was being fingered then the A-string would vibrate when this technique is applied, then if the A-string the G-String vibrates and if the D-string then the E-string vibrates. The other strings carry vibration as well, but their effects are negligible at best when compared to the primary vibrating string and as such they may be muted so that additional tones may be played along them while Siegel Harmonics are in use.

V. CONCLUSION

That a new musical phenomenon known as Siegel Harmonics
has been discovered creating a foundation for future research into capabilities, specifics, and ability to replicate across additional string instrumentation.

ACKNOWLEDGMENT

Bill a.k.a. Just Plain Bill, assisted in the publication of this paper by forcing me to write it in-order for the technique to be added to Wikipedia so that future musician could utilize it in musical works and in order to preserve an art form.

Bruce N. Miller, assisted in research by explaining how the vibrations in instrumentation worked so that their root source of them could be identified in this instance.

Alejandra Mendoza, assisted in proofing and editing.

DEFINITIONS

American Standard Tuning – E1 at 41.204Hz, A1 at 55Hz, D2 at 73.416, G2 at 97.999hz

Electric Bass Guitar – A four stringed guitar designed to carry the bass frequency through it’s instrumentations.

Minor Third – A musical interval that contains three half steps.

Harmonically – The effect of an overtone accompanying a fundamental tone at a fixed interval produced by the vibration of a string.

Musical Qualities – The ability to be included in a piece of composition.

Pluck – To strike a single string with a finger so that it vibrates.

Plucking hand – The hand dedicated to plucking the string.

Fingering – The term used to describe the gesture that it used to tune a string instrument by shortening the length of the string in-order to augment it’s tuning.

Fingering hand – The hand used to apply fingering to an instrument.

Fret – Segments of a guitar’s fretboard that are designed to guide the fingering hand in order to create set frequencies that correspond to musical notation.

REFERENCES
https://soundcloud.com/user2679539/the-cerebral-chauffeur

AUTHORS

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Estimating Base Saturation Flow Rate for Selected Signalized Intersections in Khartoum State, Sudan

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Abstract — The environmental characteristics of the roads and the behavior of the drivers are the most important performance factors of signalized intersections. The Highway Capacity Manual provides factors that may not correspond to the nature of local traffic. To address this issue, the Ideal saturation flow rate was studied by analyzing the preliminary data and presenting these results to show the change between the capacity factor in the Highway Capacity Manual and the local reality of Khartoum State and with the technical factors to develop traffic to reduce congestion and safety, there are several external factors such as the behavior of pedestrian movement; Drivers' behavior which is negatively affects the traffic performance, in development countries. Results showed that the ideal capacity saturation flow rate in Khartoum is 1636 passenger cars per hour of green time per lane which is lower than the value mentioned in the Highway Capacity Manual. Moreover, the results and outputs can be used in signalized intersection design and traffic analysis in Sudan. In spite of the technical factors to develop traffic to reduce congestion and safety, there are several external factors such as pedestrian behavior and drivers' behavior negatively affects traffic performance and reduce the capacity. Traffic Awareness and Traffic Enforcement must be applied with the technical improvements to optimize the traffic performance in development countries.

Index Terms — Saturation flow rate, Base saturation flow rate, Signalized intersections Capacity, [1]

I. Introduction

At-grade intersection is one of the most critical elements that influence the performance of urban traffic network. For safe and efficient movement of large volumes of traffic, intersections are usually signalized. The design and operations of a signalized intersection rely critically on its capacity. The Highway Capacity Manual (Transportation Research Board, 2000), Canadian Capacity Guide (Telph, 1995) and the Australian Road Research Board's (ARRB) Special Report on Traffic Capacity and Timing Analysis (Aktefur, 1981) provide general guidelines concerning operational characteristics and estimating the capacity of a signalized intersection. Teply and Jones (1991) and Khosla (2006) summarize the concepts and compare the measurement techniques used by agencies and researchers in different countries. In general, the capacity of a signalized intersection relies on the Saturation Flow Rate (SFR) in ideal condition and adjustment factors to accommodate prevailing geometric and traffic conditions. Although manuals specify values for these parameters, researchers have observed significant fluctuation in these values among different locations due to variations in behavioral and environmental characteristics (Bester and Meyers, 2007; Bonneson et al., 2005; Liu et al., 2005; Turner and Hatahap, 1993 and Zegeer 1986) [1].

Sudan has experienced rapid growth in traffic volume and various modes of transportation on the road network. With the limited capacity of the network, this has led to increasing traffic congestion and traffic jams can be observed on many roads and intersections in Khartoum City and for prolonged periods of time.

For the efficient design and operation of a road network in the city traffic flow parameters, including intersection capacity and corresponding adjustment factors, should be reassessed on the basis of local traffic characteristics. To predict the capacity of signalized intersections in Sudan, this research focuses on the determination of Ideal Saturation Flow Rate for urban roads in Khartoum State – Sudan by analyzing the saturation flow rate for approaches at signalized intersections in Khartoum. [1]

II. Review of the Literature

The Highway Capacity Manual (HCM) defines saturation flow rate as "the equivalent hourly rate at which previously queued vehicles can traverse an intersection approach under prevailing conditions, assuming that a green signal is available at all times and no lost time is experienced." [4] It suggests an ideal saturation flow rate of 1900 passenger cars per hour of green time per lane (pcphpl). Adjustment factors are applied to address the impacts of prevailing (local traffic) conditions that deviate from ideal conditions relating to roadway geometry (e.g. lane width, lateral clearance, number of lanes, grades), vehicle composition and proportion of turning movements (Highway Capacity Manual, 2000). [3]
HCM recommends measurement of saturation flow rate for each lane based on observed headways as vehicles pass over the stop line of the intersection approach. It observes that for most cases the first four headways include lost time. For measuring saturation headway it proposes to commence with the fifth headway in the queue and end when the front wheels of the last vehicle in the standing queue crosses the stop line. The saturation flow rate is calculated as the reciprocal of the mean saturation headway. The discharge headway method is also widely used for estimating saturation flow rate at signalized intersections. Previous studies indicated that discharge headway would converge to saturation headway after the fourth to sixth discharged passenger car crossing the stop line since the beginning of the green light (Roess et al., 2004).

The Research analyses the saturation flow rate at signalized intersection in Khartoum, Sudan to facilitate improved design and operational management. Furthermore, movement are examined and headway are analyzed to predict the capacity of signalized intersections in the city.

III. Data Collection
To determine the saturation flow rate at signalized intersection, three signalized intersections in Khartoum, Sudan, Fig. 1 shows the location of the study sites. All data were recorded during peak hours on weekdays, during the period from March 2015 to May 2015, traffic operation at the study area has been recorded by using a video camera, volume and headway data were then transcribed manually using stopwatch and headway form and $S_0$ factor has been calculated by Excel Spreadsheet for three periods 9 hours Morning, Afternoon and Evening time period 3 hours for each period.

Figure 1. Location of selected intersections

- INT#1 Gamaa Street & Meknemer Street Intersection
- INT#2 Meknemer Street & Gamhoria Street Intersection
- INT#3 Baladia Street & Mauna Street Intersection

For the study four leg intersections have been selected in Khartoum State – Sudan Figure 1. Show intersections locations in Khartoum State.
The average cycle length of intersection is 122.5 seconds while the average green interval in major approaches of the different intersections is 35 seconds.

As vehicles in the queue begin crossing the reference line at a signalized intersection after the signal becomes green, the time elapsed between successive vehicles provides the corresponding discharge headway which determines the capacity and adjustment factors for different types of movements. From video images headway information was transcribed in accordance with the HCM standard procedure (Highway Capacity Manual, 2000) [1]. Saturation headway was estimated from the average of the uniform headways which generally occurred after the fourth or fifth vehicle in the queue. For adjustment factors, headway data for each type of movement was transcribed and analyzed using the equations described below.

### IV. Saturation Flow Rate Measurement

The basic saturation flow rate was measured for thru lanes during cycles containing only passenger cars and satisfying the criteria for ideal conditions. It was estimated on the basis of measured average headways using Equation (1) to calculate average headway

\[
S = \frac{3,600}{h}
\]

Where:
- \(S\) = saturation flow rate, vehicles per hour of green per lane (veh/h/g/ln)
- \(h\) = saturation headway, seconds/vehicle (s/veh)

HCM 2000 uses a default base saturation flow rate of 1,900 pc/h/ln, this value may be increased or decreased on the basis of local field measurements. Approaches with lower approach speeds (less than 50 km/h) often have lower base saturation flow rates, on the order of 1,800 pc/h/ln. Approaches with higher approach speeds (greater than 80 km/h) may have base saturation flow rates higher than 1,900 pc/h/ln. [1]

### V. Saturation flow rate in Khartoum State, Sudan

The uses of Saturation flow rate 1900 pcphpl may affect the signal design, phasing and operation and will lead to poor traffic signal design. Table 1 Shows comparison between using default HCM factor 1900 pcphpl in signal design and Modified ideal saturation flow factor due city traffic environment

<table>
<thead>
<tr>
<th>INT</th>
<th>Direction</th>
<th>EB</th>
<th>WB</th>
<th>NB</th>
<th>SB</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersection #1</td>
<td>Volume (vph)</td>
<td>1298</td>
<td>315</td>
<td>1491</td>
<td>1532</td>
<td>4636</td>
</tr>
</tbody>
</table>
Table 1 Total delay for HCM default factor and modified factor

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Volume (vph)</th>
<th>Total Delay (hr) HCM Default S0 Factor</th>
<th>Total Delay (hr) HCM Modified S0 Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT#1</td>
<td>62</td>
<td>5</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INT#2</td>
<td>87</td>
<td>6</td>
<td>109</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INT#3</td>
<td>0</td>
<td>2119</td>
<td>1395</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Table 2 Statistical summary for headways

<table>
<thead>
<tr>
<th></th>
<th>INT# 1</th>
<th>INT# 2</th>
<th>INT# 3</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.5</td>
<td>2.2</td>
<td>1.9</td>
<td>2.20</td>
</tr>
<tr>
<td>Median</td>
<td>2.5</td>
<td>2.2</td>
<td>1.9</td>
<td>2.20</td>
</tr>
<tr>
<td>Minimum</td>
<td>1.7</td>
<td>1.9</td>
<td>1.6</td>
<td>1.60</td>
</tr>
<tr>
<td>Maximum</td>
<td>2.6</td>
<td>2.4</td>
<td>2</td>
<td>2.60</td>
</tr>
</tbody>
</table>

Analysis and results focuses primarily on the estimation of saturation flow rate and adjustment factors for signalized intersections in Khartoum. Results show that the ideal saturation flow rate in Khartoum is 1636 pcp/hln. Although the value is about 13.8 percent lower than that recommended in the Highway Capacity Manual (2000), it is consistent with different observations in countries with neighboring countries, Saudi Arabia Makah reported a saturation flow rate 2500 pcp/hln \[3\], Bester and Mayers (2007) reported a saturation flow rate of more than 2500 pcp/hln in South Africa. \[3\]
Furthermore, studies on the Saturation flow rates to other countries showed that the HCM rates substantially underestimate roadway capacities applicable in those regions.
In Sudan many of traffic constrains and Obstacles led to the failure on traffic performance, and decrease the ideal saturation flow rate from the standards to lower level, these constrains are not found in neighboring countries and not considered in traffic analysis studies and these constrains are common in development countries such as:

- **Pedestrians Behavior:** In addition to the lack of a traffic signal for pedestrians, there is abnormal behavior of pedestrians crossing the road during the green time of the vehicles, and this poses a high risk to the safety of pedestrians, in addition to the drivers have to stop during the green time which allowed them to pass and to allow pedestrians to cross the road. (Figures 4, 5, 6)

- **Drivers' behavior:** it is noticed that there is a strange behavior, the vehicle cross from the right hand side of the opposite direction during the red time and encounter with vehicles coming from the other direction. (Figure 7)

- **Local environment:** although the intersection of study in an urban area and represents the intersection of two main roads, but there is legal mode of transport not considered in Highway Capacity Manual HCM, as animal carts which effect the acceleration of vehicles and it is not compatible to be within traffic signal system. (Figures 8)

![Figure 4 Pedestrians crossing in med of intersection while green time to the opposite vehicle](image1)

![Figure 5 Pedestrians crossing and block the traffic while green time](image2)
Figure. 6 Pedestrians crossing in med of intersection while green time to the opposite vehicle.

Figure. 7 Drivers' behavior Driver Opposing directions on red time phase the vehicles in other direction.

Figure. 8 Animal Carts at signalized intersection with traffic stream.
Besides the general observation of varied modes of transportation and lack of road improvement, pedestrians random crossing, driving behavior, lack of traffic management for both road and driver elements.

In Khartoum road network, as demonstrated low acceleration patterns due to external factors of drivers behaviors and local environment, lower values of saturation flow rate in Khartoum state, Sudan which influence to heavily congested situations because of using parameters not compatible with the local environment.

VII. Conclusion and Recommendations

Based on analyses of saturation flow rate movements for signalized intersections in Khartoum, Sudan. The saturation flow rate for in Khartoum 1636 pcephl which is significantly lower than the value recommended by the HCM (2000). Capacity also falls sharply for a reduction in the number of lanes and lane width and lack of Traffic Management at both operational and strategic levels.

In spite of the technical factors to develop traffic to reduce congestion and safety, there are several external factors such as the behavior of pedestrian movement and Drivers’ behavior negatively affects traffic performance, so Traffic Awareness and Traffic Enforcement must be applied with the technical improvements to optimize the traffic performance in development countries.

Results are expected to assist in signal design and formulation of a Highway Capacity Manual for Sudan. Findings of the study demonstrate that the design parameters of the traffic system may vary significantly depending on the local characteristics. For traffic safety and efficiency these parameters should be assessed using local data, and due to local environments.

References

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The Impact of Rule of Law and Other Macro-Economic Variables on Performance of the Stock Markets

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Abstract- This research study investigated the impact of rule of law and other macro-economic variables on the performance of the stock markets. The independent variables for the study are rule of law, real interest rate, consumer price index inflation, gross capital formation, gdp per capita and trade. In the study, some of the advanced and emerging countries are selected. The data is examined annually from 2005 to 2015 in panel form. The measuring variable for the study which correlates the performance of stock markets with the economy is stock market return. To estimate the relationship Pearson correlation, regression analysis and descriptive statistics tests have been used. Regression analysis is performed in two models, one with rule of law and one without it. The results indicated that there is a significant relationship between real interest rate and the stock market return and a significant relationship between the stock market return and the inflation rate is also observed, this shows that whenever there is an increase in inflation and interest rates of an economy that will inevitably lead to the increase in the stock market performance of that economy. Rule of law makes an expressive impact on the research, a significance between rule of law and stock market return is seen which means that whenever the law and order is implemented the stock market performance tends to be increased. On the other hand, GDP, gross capital formation and trade shows insignificance with the stock market return. Most of the results are supporting the theories and literature.

Index Terms- Stock market performance, macro-economic variables, rule of law, panel data, fixed effect model, GDP per capita, gross capital formation, trade, pooled regression.

I. INTRODUCTION

Stock markets behavior can be in expectable, volatile and variative sometimes when they are related with the macro-economic variables. The demand and supply quotient makes it more interesting. Bhowmik (2013) estimated the volatility of stock market along with its measurement. The results showed that when there is a higher volatility of stock in the market there is a decline in the growth rate of the economy.

Stock markets directly impacts the variative nature of the economy; a change in the stock market could lead to a up and down change in the economy. Attari and Safdar (2013) shows this impact in their research that the stock prices have an upper hand on the growth of the economy and is considered as the excellent indicator and forecaster for the growth and development of the economy.

The macroeconomic variables are affecting the stock markets in a meaningful manner. Some researchers have defined this as a causal relationship between the macro economic variables and the stock exchanges. Fazal (2006) find out the variations in the stock market, which may be the cause of variability in macroeconomic variables.

A stock market is also an efficient capital market. Mandep (2009) assessed the validation of Efficient Market Hypothesis on Bombay stock exchange resulting the change in prices of the stocks related to the efficiency of the stocks. As an efficient capital market relates to share prices which changes rapidly to the arrival of new information and, therefore, the current prices of securities reproduce all information about the shares.

This study differs from the past researches in many ways. First, it is discussed within the coherent empirical framework on the impact of rule of law and other macroeconomic variables on stock market performance over the period of 2005 to 2015. Second, the use of a sample consisted of 24 developed and emerging markets with a pooled analysis framework which allows to know about if the heterogeneity of the markets affects the dynamics of the stock market’s performance. Third, the theories of arbitrage pricing and fishers effect to describe the relationship of real interest rate and inflation rate with stock market performance and fourth, the rule of law acts as a helping agent for the other macro-economic variables by making trade a significant variable for the study.

The main purpose of the study is to analyze the impact of inflation, real interest rate, rule of law and other macro-economic variables on the performance of the stock markets. This research paper is distributed into different sections. Section 2 shows a transitory overview of the literature of parallel studies conducted on stock market returns and macroeconomic variables with a theoretical and empirical framework. Section 3 shows the data and methodology for the research. Sections 4 and 5 provide an explanation of results and conclusion of the study respectively.

II. LITERATURE REVIEW

In the last 20 years, many researchers have analyzed the relationship of stock markets performance and macro-economic variables. Some have conducted empirical studies to examine this relationship between stock market performance and macro-economic variables. This section is divided in to two portions, one shows the theoretical inspirations of the research and other showing the empirical results of the past researches to support the research.

THEORETICAL FRAMEWORK
FISHER’S EFFECT THEORY OF INTEREST RATES

The Fisher’s effect theory of interest rates is substantial for explaining the inter relationship of inflation and interest rate in the research agenda. This effect states the relationship between inflation and interest rates which gives an impression that monetary policy should purely emphasize on supporting the expectations of inflation to keep real interest rate stable, strong and steady. This relays that the real interest rates fall as inflation rises or tends to, except the nominal rates which tends to increase at the same rate as inflation. This also results in performing savings and making investments. Cottrell (1994) also evaluated Fisher’s effect theory. The supposition about Fisher’s theory (1930) is that all the capital circulates within the economy and its usage in the production course copiously. As no stock of capital is found so at a required real rate there is a rise or fall in the expected rate of inflation which leads to deal in with the increasing or decreasing the nominal rate of interest with the help of arbitrages between future and present cumulative income. If there is a rise in expected inflation this results in increasing the money supply which means that the aggregate real income grows more rapidly than the anticipated real sum of money which needs to be compensated. Thus, fisher’s theory impacts both on the real interest rate as well as nominal interest rate.

ARBITRAGE PRICING THEORY

Arbitrage pricing theory is related to CAPM model which automatically involves the correlation of risk and return in an investment but both theories are not totally as same as it looks like because in arbitrage pricing theory macroeconomic variables independently performs a linear relationship between the returns of the portfolio and return of a single asset.

Salman (2013) test the CAPM model on KSE 30 index using the Sharpe Lintner (1965) approach. The evidence does not validate standard CAPM model. As the measurement of stock exchange is frequently related to stock return with the concept of CAPM model. Stock exchanges are connected to portfolio’s, so to measure its return or equity premium CAPM model theory is emboldened. In earlier studies, many works have been comprehended regarding to stock returns and macro-economic variables.

Husam and Turgut (2009) studied the effects of macroeconomic factors on stock return, an evidence from Istanbul stock exchange. The independent variables are interest rate, unanticipated inflation, risk premium and trade and stock return is the dependent variable. The APT model, CAPM, correlation and regression models are used. The results indicated that inflation has significant relation with stock return. Risk premium and interest rate have significant impact on various portfolios of stock return. On the contrary, findings these results have week illuminating authority.

EMPIRICAL FRAMEWORK

In the past, so many researchers have tried to explain the impact of macro-economic variables on the stock exchanges of different countries. Mahmoud (2015) investigated the impact of macroeconomic variables on the stock market, the case study is taken from Tunisia and Egypt. The data was collected from January 1988 to January 2014. The results indicated a causal relationship between the macroeconomic variables and the stock markets. The variables are appropriately correlated with the stock markets of the emerging countries.

Robert (2008) also conducted a study on effect of macroeconomic variables on stock market returns as a case study for four emerging economies (Brazil, Russia, India and China). The independent variables are trade and oil prices. Although the results are not showing signs of significance but it also indicated the less proficiency of the stock markets when related to these variables for the selected countries.

Attari and Safdar (2013) shows in their research, the analysis of relationship between macroeconomic volatility and the stock market volatility an empirical evidence from Pakistan. An EGARCH model is used. The results estimated that the macroeconomic variables have wide effect on the stock prices. Joseph (2013) investigated the impact of changes in selected macroeconomic variables on stock prices of the Stockholm Stock Exchange (OMXSS30). The results indicated that inflation and foreign currency depreciation have a significant negative effect on stock prices and the interest rate is negatively correlated to stock price change and is insignificant in the whole model. On the contrary, money supply is positively associated to stock prices even though is insignificant in study.

Early studies by Fama and Schwert (1977) reassured that the macroeconomic variables eventually influence stock returns. This relationship continues furtherly when Booth (1997) and Chan (2003) present that trade, inflation rate, interest rate, foreign exchange reserves, money supply and industrial production index are the main factors that affect the stock market prices. Gjerde and Saettem (1999) study the relation between stock returns and macroeconomic variables in Norway. The study shows positive relationship with the economic development and stock returns but on the other hand showed a negative relationship between stock returns and inflation.

Burton (2008) studied that interest rate measures the percentage reward a lender receives for deferring the consumption of resources until a future date. Thus, interest rate also plays a major role in financial enchantments and economic development. Interest rate always make an impact on stock exchanges because stock markets deal with the securities which are co related with the interest rates.

Muhammad Gazi (2009) investigated a study on relationship between interest rate and stock price an empirical evidence from developed and developing countries. Fifteen countries are taken for the study. Panel regressions methods are used and the results showed that for most of the countries interest rate has significant negative relationship with share price but for some countries, a slight change in interest rate has showed significant relationships with changes of share price. So, in long run this will eventually make these countries stock markets healthier.

Inflation acts as a discriminating variable when related to stock exchanges of any country. Ahmed (2015) conducted a study on inflation rate and stock returns: evidence from the Nigerian stock market. The results indicated that inflation has a negative and weak correlation with the stock returns in Nigerian stock market. It gradually makes impact when the stock prices varies.

Yogaswari, Nugroho and Astuti (2012) estimate the relationship between macroeconomic variables and stock returns.
in case of Indonesia. The research stated that the inflation, trade and interest rate have significant relationship with the stock exchange prices and inflation has positive effect while the interest rate volatility embraces negative impact on stock prices. Zhong qiang (2014) performed a study on the impact of inflation on stock market in China. The data for the period is from 2001 to 2010. Vector Auto Regression is used to specify the significance of the variables. The result indicated that inflation has a very weak correlation with the stock prices of the Chinese stock exchange.

Some studies showed that a well-developed financial structure of a country could lead it to success, whether it is under developed, developed or over developed. Aroni (2011) uses the regression method for the estimation of the outcome of macroeconomic variables at stock returns in Kenya. The data was collected from 2008-2010. The result showed that the interest rate and trade have negative relationship to stock prices. Whereas inflation showed positive effect on stock prices.

Bhattacharya et. al. (2001), analyzes the causal relationship between stock returns and macroeconomic variables in India and one of the variable is trade. The results shown that there is no causal relationship between the stock returns and variables.

In general, the effect of trade on stock prices can be either a positive or a negative relationship. Based on Doong et al (2005) work, we assume the negative relationship is majorly beneficial for the study but not in all cases exceptionally. Mansor and Dinniah (2009) examined the relationship between stock return and macroeconomic variables an evidence from six Asian pacific countries. The results showed that there is a long run relationship between variables. In short run, all countries show identical exchanges except Thailand and Hong.

Mgammal (2012) studied multiple variables (interest, trade and inflation rate) on stock prices. The study was conducted on United Arab Emirates (UAE) and Kingdom of Saudi Arabia (KSA) for the period of January 2008 to December 2009. The results showed that in short run, trade effect positively on stock market price index for United Arab Emirates while showing no significant relationship for Kingdom Saudi Arabia. The result also showed that in long run, trade influence negatively on stock market price index for United Arab Emirates.

Singh and Mehta (2011) performs a study on macroeconomic factors and stock return; an evidence from Taiwan. The techniques of multiple regression, mean, variance, and the Kolmogorov D-statistic normality test are used. The results showed that GDP and trade effects all portfolios return positively, while trade, inflation rate and money supply have negative impact on returns.

A study by Shawtari and Saleem (2015) explains the long-term relationship between macroeconomic variables and stock price. This study examines the long-term consistency between South Africa’s stock index and nominated macroeconomic variables using vector error-correction models (VECM). The results indicated that these variables are co integrated with the stock prices in the long run.

In the modern world, less effective governance might affect the firm’s capability to remain operating in the long run. Some of the African countries proceeded over the last decades in standings of fair and competitive elections, but governments are unnecessarily stable and inefficient (EIU, 2012). The rule of law must be recognized to ensure a long-term relationship with the stock market.

In North Africa authoritarianism was challenged later the 2011 Arab Mainspring and current takeovers. However, new governments in these countries are unnecessarily firm and may face trials in making effective and efficient political and economic institutions all over the north (Aon, 2013). So, the business firms should face uncertain legal and regulatory systems, new contract specifications, sovereign debt problems or political interference risks (Aon, 2013).

La Porta et al. (1997) shows effect of law and administration on the stock market return. The economies should provide legal investors to the stock market by legal enforcements and legal rights prosecutions. In this way, the finance from the investors increased which directly affects the economy and it helps in the development of the stock market.

“If an effect is assumed to be a realized value of a fixed variable, it is called a fixed effect.” (LaMotte, 1983). Fixed effect is mostly used in the past researches in the regression analysis. Mike and Timothy (2016) examined the impact of macroeconomic variables on stock returns of listed banks in the Nairobi Securities Exchange (NSE) from 2000 to 2015. The ordinary least squares (OLS) under fixed effects model was used. The observed results show that interest rate, trade and inflation have significant impact on bank stock return, while GDP had an insignificant impact on the returns.

Miseman and Ismail (2013) investigated the impact of macroeconomic forces on ASEAN stock market movements including Malaysia, Indonesia, Thailand, Singapore and the Philippines. The results stated a sturdy and significant effect of interest rate, broad money and inflation rate on the stock market movement, while domestic output is found to be unpredictably insignificant.

III. METHODOLOGY

This research is explanatory and quantitative in nature. The objective of this paper is to empirically examine the impacts of macroeconomic variables on the stock market returns. In this study, stock price index return is considered as the dependent variable. On the other hand, based on theoretical and empirical studies, six macro-economic variables namely Inflation (Inf), Real interest rate (Ir), Rule of law (Rule), Gross domestic product (Gdp), Trade (Trd) and Gross capital formation (Gross) are used as predictor variables. The study examines yearly data from the period of 2005 to 2015 collected from different sources. The data is cross sectional in nature and is taken from 24 emerging and developed countries. These countries are Australia, USA, UK, Russia, Canada, Pakistan, South Africa, South Korea, Japan, China, India, Indonesia, Malaysia, New Zealand, France, Germany, Brazil, Mexico, Switzerland, Singapore, Turkey, Spain, Philippines and Hungary. The statistical techniques used in this research are least square regression analysis under fixed effect, descriptive statistical measure and correlation matrix.

3.1 MODELLING FRAMEWORK

Following is the model of this study:

\[ YStret = \beta_0 + \beta_1 \text{inf} + \beta_2 \text{ir} + \beta_3 \text{trd} + \beta_4 \text{gdp} + \beta_5 \text{gross} + \beta_6 \text{rule} + \epsilon \]

The variables are defined as, “YStret” represents stock market index return, “inf” represents inflation (CPI), “ir” represents real interest rate, “trd” represents trade, “gdp” represents gross domestic product, “gross” represents gross capital formation and “rule” represents rule of law.
represents real interest rate, “trd” represents trade, “gdp” represents gross domestic product per capita, “gross” represents gross capital formation, “rule” represents rule of law and “ ε ” represents fixed error term.

IV. EMPIRICAL FINDINGS

Since the real agenda of this study is to analyze the impact and relationship between the macro-economic variables and the performance of stock markets, different techniques are selected to evaluate the resultant in the positive assurance of the literature and the problem.

1.1 DESCRIPTIVE STATISTICS

The panel regression model is used to analyze the data to find out the overtone among trade, inflation rate, rule of law, interest rate, gross capital formation and gdp with stock market index return. Table 1 represents the summary of information collected for this investigation:

<table>
<thead>
<tr>
<th></th>
<th>STRET</th>
<th>RULE</th>
<th>TRD</th>
<th>IR</th>
<th>INF</th>
<th>GROSS</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>12019.31</td>
<td>0.799828</td>
<td>78.15740</td>
<td>4.552015</td>
<td>3.880117</td>
<td>5.21E+11</td>
<td>2593045.</td>
</tr>
<tr>
<td>Median</td>
<td>6191.510</td>
<td>1.019463</td>
<td>56.04481</td>
<td>3.274352</td>
<td>2.997694</td>
<td>2.71E+11</td>
<td>54124.67</td>
</tr>
<tr>
<td>Maximum</td>
<td>69304.00</td>
<td>2.017012</td>
<td>439.6567</td>
<td>44.63500</td>
<td>20.28612</td>
<td>5.03E+12</td>
<td>44807497</td>
</tr>
<tr>
<td>Minimum</td>
<td>631.8900</td>
<td>-0.974740</td>
<td>22.10598</td>
<td>-12.28002</td>
<td>-1.346719</td>
<td>29869.85</td>
<td>9562.715</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>14427.25</td>
<td>0.956513</td>
<td>74.79540</td>
<td>7.032613</td>
<td>3.382200</td>
<td>8.76E+11</td>
<td>7757793.</td>
</tr>
<tr>
<td>Skewness</td>
<td>2.057778</td>
<td>-0.356825</td>
<td>3.084632</td>
<td>3.071241</td>
<td>1.374032</td>
<td>3.093152</td>
<td>3.407592</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>329.1598</td>
<td>27.70023</td>
<td>1484.206</td>
<td>1945.120</td>
<td>148.6694</td>
<td>1406.456</td>
<td>1795.761</td>
</tr>
<tr>
<td>Observations</td>
<td>257</td>
<td>257</td>
<td>257</td>
<td>257</td>
<td>257</td>
<td>257</td>
<td>257</td>
</tr>
</tbody>
</table>

4.2 CORRELATION MATRIX

The result is a table containing the correlation coefficients between each variable and the others. Table 2 shows the correlation of different variables with each other:

<table>
<thead>
<tr>
<th></th>
<th>STRET</th>
<th>TRD</th>
<th>RULE</th>
<th>GROSS</th>
<th>GDP</th>
<th>IR</th>
<th>INF</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRET</td>
<td>1.000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRD</td>
<td>-0.202471</td>
<td>1.000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RULE</td>
<td>-0.381834</td>
<td>0.195299</td>
<td>1.000000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROSS</td>
<td>-0.141358</td>
<td>-0.238526</td>
<td>0.013119</td>
<td>1.000000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>-0.178605</td>
<td>-0.027483</td>
<td>-0.186040</td>
<td>-0.071909</td>
<td>1.000000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IR</td>
<td>0.571126</td>
<td>-0.132242</td>
<td>-0.337162</td>
<td>-0.081109</td>
<td>-0.024412</td>
<td>1.000000</td>
<td></td>
</tr>
<tr>
<td>INF</td>
<td>0.180138</td>
<td>-0.160766</td>
<td>-0.471447</td>
<td>-0.216218</td>
<td>0.041559</td>
<td>0.233976</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

The Table 2 reveals Pair wise correlation. Positive and negative signs represent the direction of association and the nature of relationship is indicated by the value of correlation coefficient. As seen from the table 2 the correlations among the dependent and independent variables are being clearly stated. Stock market return is positively correlated with inflation, and interest rate. But on the other hand, the gross domestic product, rule of law, gross capital formation and trade are negatively correlated with stock market index return. This is due to the multi dependency of the variables with each other.

4.3 REGRESSION ANALYSIS

<table>
<thead>
<tr>
<th>Variables</th>
<th>MODEL 1 Coefficient</th>
<th>Probability</th>
<th>MODEL 2 Coefficient</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>15554.44</td>
<td>0</td>
<td>7092.491</td>
<td>0.0828</td>
</tr>
<tr>
<td>Trade</td>
<td>-2.866603</td>
<td>0.9223</td>
<td>14.81919</td>
<td>0.6191</td>
</tr>
<tr>
<td>Interest rate</td>
<td>-391.2817</td>
<td>0.0003</td>
<td>-355.7696</td>
<td>0.0008</td>
</tr>
<tr>
<td>Inflation</td>
<td>-594.8689</td>
<td>0.0005</td>
<td>-624.8954</td>
<td>0.0002</td>
</tr>
<tr>
<td>Gross capital formation</td>
<td>8.46E-10</td>
<td>0.3823</td>
<td>6.56E-10</td>
<td>0.4936</td>
</tr>
</tbody>
</table>
In table 3 a comparative analysis of the regression models is shown. The total number of observations are 264. Model 1 shows the regression analysis of the study between stock returns and macro-economic variables. The dependent variable is stock market index return and the independent variables are trade, inflation, gross domestic product, gross capital formation and real interest rate. The results showed that interest rate and inflation rate has negative significance with stock returns which means that when interest rate and inflation is declined the stock market index will rise. While gdp and gross capital formation shows positive relationship with stock return but are insignificant. On the other hand, trade is negatively insignificant with stock returns. The f statistic in the table also confirms that the model is statically significant overall. The Durbin Watson statistic shows less than 2 which means that there is positive serial correlation indicated in the model.

But in the model 2, the results showed that inflation and interest rate have negative relation with the stock returns and both are significant. While the variable with the most effective result is rule of law which has positive relation with stock returns and shows significance. This means that when the law and order is executed there is an increase in the stock market performance. Trade also shows positive relation with stock returns when rule of law is applied but in the end, it is insignificant. Same goes for gross domestic product and gross capital formation which shows positive relation but are insignificant. The f statistic in the table also confirms that the model is statically significant overall. The Durbin Watson statistic shows positive serial correlation in the model.

The correlations among the variables shows insignificance among them, but since there is multi dependency among the variables, the results are changed in the regression analysis where rule of law acts significantly and trade becomes effective when rule of law is used.

V. CONCLUSION

This study explains the impact of real interest rate, inflation, rule of law and other macroeconomic variables on stock returns. The focused variables are closely related to each other because if there is a rise in inflation in the economy this could automatically lead to rise in interest rates of that economy. When the economy rises, gdp and gross capital formation becomes variate resulting their interdependence with the economic performance. Same goes for rule of law and trade that trade becomes only effective when there is rule of law in the economy.

The results indicate that the real interest rate, inflation and rule of law along with other macroeconomic variables strongly affects the stock market returns. It is strongly noted that any variation in inflation, real interest rate and rule of law has strong positive influence on the performance of the stock market. Descriptive statistics, correlation matrix and regression analysis under fixed effect models are used to test the relationship between macro-economic variables and stock returns. The analysis shows that real interest rate, inflation rate has negative relationship with stock returns and both are significant in nature. Two regression models, one consisting rule of law as a focused variable and other without it are performed. The results show that rule of law has positive relationship with stock returns and is significant in nature. It also effects the relationship of trade openness and stock returns in a positive manner which means that when the law is abided in a country there is a positive increase in the stock market return which eventually led to an increase in the trade percentage of the economy. On the contrary, GDP per capita, gross capital formation and trade are showing positive insignificance with the stock market returns. As there is multi dependency among the variables the results are changed in the regression analysis, which shows the leniency of variables with each other.

APPENDIX

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COUNTRY</th>
<th>GDP</th>
<th>INFLATION</th>
<th>INTEREST RATE</th>
<th>STOCK</th>
<th>RULE LAW</th>
<th>GROSS CAPITAL</th>
<th>TRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>USA</td>
<td>44307.92058</td>
<td>3.392746845</td>
<td>2.878895959</td>
<td>6081.529785</td>
<td>1.526085973</td>
<td>3,040,749,800,000.00</td>
<td>25.50066345</td>
</tr>
<tr>
<td>2006</td>
<td>USA</td>
<td>46437.06712</td>
<td>3.225944101</td>
<td>4.739619623</td>
<td>6964.450195</td>
<td>1.575106382</td>
<td>3,232,996,400,000.00</td>
<td>26.87362225</td>
</tr>
<tr>
<td>2007</td>
<td>USA</td>
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**International Journal of Scientific and Research Publications, Volume 7, Issue 12, December 2017**

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A Study on Biosurfactant Production from Marine Bacteria

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Abstract- Biosurfactants are surface-active substances produced by microorganisms. They are amphiphiles and consist of a polar (hydrophilic) and non polar (hydrophobic) group. Due to their amphiphilic structure biosurfactants tend to increase the surface area of hydrophobic water-insoluble substances and this makes surfactant an excellent emulsifier, foaming and dispersing agents. They are environmental friendly, biodegradable, less toxic and non-hazardous. Because of their potential advantages, biosurfactants are widely used in many pharmaceutical and industrial applications. The present study was carried out on biosurfactant production by *Halobacterium salinarum* isolated from marine source. *Halobacteria* are microorganisms that require high salt concentrations to survive and reside naturally in habitats such as salt lakes and salt marshes. The water sample was collected from marina beach, Chennai and *Halobacterium salinarum* was isolated using a selective media (HS media) and identified by Gram staining technique and biochemical test. The biosurfactants were extracted and subjected to thin layer chromatography. Drop collapse assay and oil spreading assay to check their stability. Biosurfactant concentration was estimated by means of phenol sulphuric acid method and further characterized by FTIR analysis. The biosurfactant produced was then tested for its antimicrobial activity & its efficiency was tested by using in Avocado smoothie preparation, where the naturally available oil content was emulsified using the biosurfactant extracted from *Halobacterium*.

Index Terms- Biosurfactant; Drop collapse assay, Fourier Transform Infrared Spectroscopy, Halobacterium, Biosurfactant, Thin Layer chromatography.

I. INTRODUCTION

Halophilic bacteria produce wide range of products with different properties and applications. Biosurfactant are one such extracellular amphiphilic compounds produced by Halobacteria especially when grown on hydrophobic substrates. Biosurfactants are a structurally diverse group of surface-active substances produced by microorganisms (Desai and Banat 1997). All biosurfactants are amphiphiles and consist of a polar (hydrophilic) and a non polar (hydrophobic) group. They are used as emulsifiers, foaming and dispersing agents. In comparison to the chemically synthesized biosurfactants they are considered to be environmental friendly, biodegradable and non-hazardous. They are active at extreme temperatures, pH and salinity and can be produced from industrial wastes and by-products. Because of their potential advantages they are widely used in industrial and medicinal applications. Biosurfactants can also be produced from cheap raw materials like rapeseed oil, potato process effluents, oil refinery waste, cassava flour wastewater, curd whey and distillery waste, sunflower oil etc. (Muthusamy et al., 2008).

In recent years, much attention has been directed towards biosurfactants due to their broad range of functional properties and diverse synthetic capabilities of microbes. The most significant advantage of a microbial surfactant over chemical surfactant is its ecological acceptance (Desai J.D and Banat I.M., 1997). Biosurfactants can be efficiently used in handling industrial emulsions, control of oil spills, biodegradation and detoxification of industrial effluents and in bioremediation of contaminated soil. Due to their unique properties and application, identification of new biosurfactant producing microbes are in great demand. Nine different methods have been reported for screening biosurfactant producing microbes such as hemolytic assay, bacterial adhesion to hydrocarbons (BATH) assay, drop collapse assay, oil spreading assay, emulsification assay, surface tension measurement, titled glass slide test, blue agar plate and hydrocarbon overlay agar assay. These methods can have both advantages and disadvantages. This study was aimed at identifying a sensitive, reproducible and simple method for screening the biosurfactant producing bacteria. Screening method used in this study were Drop collapse assay, Oil spreading assay and Emulsification assay. Totally 6 different bacterial strains were screened and checked for their biosurfactant producing ability using the aforementioned three methods and it was observed that the drop collapse assay and oil spreading assay directly correlated to each other and were easy to perform without any specialized equipments. Apart from above mentioned screening methods, this study also analyzes the credibility of the use of hydrophobic substrates like crude oil for the isolation of biosurfactant producing bacteria from the environment. Thus the present study was carried out to determine the antimicrobial and emulsifying applications of biosurfactant extracted from *Halobacterium salinarum* isolated from sea water.

II. MATERIALS AND METHODS

2.1 Collection of Sample:

Sea water samples were collected from different locations in Marina beach, Chennai, Tamilnadu, India. The samples were collected in different sterile glass bottles, and immediately transported to laboratory for further analysis.

2.2 Enrichment of *Halobacterium* sp:

A selective media (HS media) was used as enrichment medium for isolation of Halobacterium. 20 ml of the each
collected sample were inoculated in 100ml of HS medium prepared in 500ml Erlenmeyer flasks, kept in a rotator shaker at 35°C or 38°C for 1-2 weeks and the growth was observed. On obtaining a confluent growth 10ml of the primarily enriched medium was withdrawn and transferred to a new flask and incubated under same conditions mentioned above.

2.3 Isolation of *Halobacterium* spp

The enriched culture was diluted and plated on HS media for viable count. The plates were incubated at 37°C for 5-7 days. After incubation colonies with different morphology were selected and subcultured further to obtain pure organisms.

2.4 Characterization and identification of isolates


2.5 Biochemical Characterization:

The discrete colonies from subculture plates were taken and series of biochemical tests were done for identification of bacterial species. The bacterial isolates were characterized by different biochemical reactions i.e. Oxidase, Catalase, Indole, MR, VP, Citrate, TSI, Fermentation of sugars etc., for the identification of bacterial species, standard methods were followed in description by Holt et al., 1994; Sherman N., Cappuccino J.G, 2005; Oyeleke S.B, Manga S.B, 2008; Kumar A, 2011; Adebayo Tayo B.C, 2012.

2.6 Screening for Biosurfactants:

2.6.1 Extraction of Biosurfactant: Rhamnolipids were purified by first separating the cells from supernatant by centrifugation at 6,800 rpm for 20 minutes. The supernatant was then acidified using 0.1 N hydrochloric acid to pH 2.0. The precipitated rhamnolipid was then collected by centrifugation at 12,100 rpm for 20 minutes. Rhamnolipids were extracted three times with chloroform-methanol (2:1) mixture. The organic phase was separated and the extraction was repeated twice. This was then evaporated leaving behind relatively pure rhamnolipids. The white residues of rhamnolipids obtained after drying were further dissolved in an appropriate volume of methanol and transferred to a previously weighed container (K.Santhiniet et al., 2014).

2.6.2 Thin layer chromatography: Silica gel plate was taken and the sample was spotted on the plate at a distance of about 2.5cm from one end of the edge using a capillary tube and allowed to dry. The solvent system- chloroform:methanol (2:1) was poured into a tank and allowed to stand with a cover plate on the top. This ensures that the atmosphere within the tank becomes saturated with the solvent. After equilibration the silica plate was kept vertically immersed in the tank and is kept closed. The solvent rises up the plate due to capillary action. Once the solvent reaches the top of the plate it is removed from the tank and is kept for drying. Once dried the plates were sprayed with an anthrone reagent (1.5ml Sulphuric acid, 1.5ml Phenol & 7ml Ethanol) and the appearance of brown spot indicates the presence of biosurfactant and was compared with the standard (S.K.Arora et al., 2015).

2.6.3 Drop collapse assay: 5µl of cell suspension or culture supernatant was added to the oil coated solid surface. The shape of the drop on the oil surface was inspected after a minute. If the liquid contains surfactants, the drops spread or even collapse because of the force or interfacial tension between the liquid drop and the hydrophobic surface is reduced. If the liquid does not contain surfactants then the polar water molecules are repelled from the hydrophobic surface and the drops remain stable (Jain et al., 1991).

2.6.4 Oil spreading assay: 10 µl of the crude oil is added to the surface of 40ml distilled water in a Petri dish to form a thin oil layer. 10 µl of culture or culture supernatant is then added, oil is displaced and a clearing zone is formed. If biosurfactant is present in the supernatant, the oil is displaced and a clearing zone is formed. (Morikawa M et al., 2000).

2.7 Estimation of Biosurfactant:

Phenol - Sulphuric acid method: Biosurfactant producing test samples were selected and inoculated in HS broth & incubated at 37°C on rotary shaker for 4-5 days. After incubation, broth was centrifuged at 10,000 rpm for 15 mins, the supernatant was collected, while pellet was discarded. 1ml of collected supernatant was mixed with 1ml of 5% Phenol then 5ml of concentrated Sulphuric acid was added in drop wise manner. Presence of biosurfactant in supernatant produces orange color from yellow color.

2.8 Characterization by Fourier Transform Infrared Spectroscopy (FTIR):

Fourier Transform Infrared Spectroscopic analysis (FTIR) was carried out using crude biosurfactant extract obtained from the acid precipitation of the cell free culture supernatant. IR Prestige- 21 Fourier Transform Infrared spectrophotometer (Samadzku, Japan) was used to determine the chemical nature of the biosurfactant by the KBr pellet method (Das et al., 2009a, b; Mukherjee et al., 2009).

2.9 Antimicrobial activity: The antibacterial and antifungal activity of the extracted biosurfactant was determined against 5 bacterial organisms namely *E. coli, Bacillus* spp, *Staphylococcus aureus, Streptococcus* spp and *Pseudomonas* spp and 2 fungal organisms namely *Candida albicans* and *Aspergillus niger* respectively. About 20ml of Muller Hinton agar (MHA) medium was prepared and sterilized for antibacterial activity while 20ml of Sabouraud Dextrose Agar (SDA) medium was prepared and sterilized for antifungal activity and poured onto the petriplates and was allowed to solidify. Once solidified the bacterial cultures and the fungal cultures were swabbed onto the agar medium using a sterile cotton swab. The wells were punctured using a sterile cork borer. The biosurfactant extracted from all the strains were dispensed in to the wells marked as H1, H2, H3, H4, H5, H6 and standard Rhamnose served as the control. The petriplates were then incubated at 37°C for 24 hours for bacteria and 37°C for 3-4 days for fungi and observed for the zone of inhibition. The diameter of the zone of inhibition was measured in mm.

2.10 Application: The biosurfactant produced was tested for its efficiency by using in Avocado smoothie preparation.
where the naturally available oil content was emulsified using the biosurfactant from *Halobacterium* spp. Avocado pulp was collected and the oil is separated and kept aside in an eppendorf tube. 10µl of extracted biosurfactant was added to the eppendorf and kept under observation for the emulsifying property of the added biosurfactant.

III. RESULTS AND DISCUSSION

### 3.1 Isolation of *Halobacterium* spp from Marine water sample:
Numerous pigmented colonies such as yellow, red, white spongy, white radial and dirty white colonies were isolated from the marine water sample and were numbered serially from H1-H6 for further identification (Fig 1). The shape, size, elevation, margin and color of the colony were observed in the culture plates with *Halobacterium salinarum* (HS) medium. Extremely halophilic species have been isolated from distinct saline regions of Marina beach.

![Figure 1: HS agar plate showing growth of *Halobacterium*](image)

### 3.2 Characterization of Isolated bacteria:

#### A) Colony Morphology:
The colony morphology of isolated *Halobacterium* strains were observed to be circular, smooth, rhizoid, filamentous, lobate, dry, irregular and entire. They were also motile and aerobic in nature.

#### B) Gram staining:
The isolated strains were further characterized by means of Gram staining technique wherein all the six strains (H1, H2, H3, H4, H5 and H6) were identified to be Gram negative rod and cocci (Fig 2).

![Figure 2: Shows Gram staining of *Halobacteium* strains](image)

#### C) Biochemical test:
The isolated pure cultures were subjected to various biochemical characterization test and the results were tabulated (Table 1). In the present study, the bacterial colonies isolated from marine water samples showed positive results for almost all the biochemical tests except a few. The results of the morphological and biochemical characteristic studies have confirmed the presence of *Halobacterium* sp.

<table>
<thead>
<tr>
<th>Biochemical Test</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>H6</th>
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<td>Positive</td>
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<td>Positive</td>
</tr>
<tr>
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<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
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</tr>
<tr>
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<tr>
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</tr>
</tbody>
</table>

Table 1: Biochemical test results of Isolated *Halobacterium* species (H1 –H6)

### 3.3 Screening of Biosurfactant:

#### 3.3.1 Extraction of Biosurfactant:
The bacterial cultures were inoculated in Mineral Salt medium and incubated for 48 hrs. After incubation period, cultures were centrifuged and the supernatant was collected and screened for biosurfactant activity (K. Santhini et al., 2014). The collected supernatant was mixed with Chloroform: Methanol in the ratio of 2:1. (Fig 3). The lower organic phase was found to contain biosurfactant exhibiting a oily nature (S.K. Arora et al., 2015).
3.3.2 Thin layer chromatography: The biosurfactant produced by all the six strains (H1 - H6) were subjected to TLC and compared with the standard biosurfactant Rhamnolipid. The Sediments obtained on extraction were spotted onto the TLC plate and the plates when sprayed with Phenol sulphuric acid reagent showed brown spots and the Rf value was found to be 0.65 the spot was concluded as a lipid moiety containing the compound of lipopeptide. (Anyanwu et al., 2011) cand this indicates the presence of biosurfactant in the sample (Fig 4)(S.K.Arora et al.,2015).

3.3.3 Drop collapse assay: The H1 - H6 samples showed dispersion and collapse of oil in water. Among the samples H2 & H6 showed immediate dispersion collapsing the oil sample. This assay relies on the destabilization of liquid droplets by surfactants. Therefore when drops of cell suspension or culture supernatant are placed on oil coated solid surface, Absence of biosurfactants in the liquid, the polar water molecules get repelled from the hydrophobic surface and the drops remain stable. If the liquid contains surfactants, the drops spread or even collapse because the force or interfacial tension between the liquid drop and the hydrophobic surface is reduced (Fig 5). The stability of drop is dependent on surfactant concentration and correlates with surface and interfacial tension (Jain et al., 2014).

3.3.4 Phenol-Sulphuric acid assay: Rhamnolipid undergoes dehydration in the presence of sulphuric acid to form derivatives of furfural that condenses with phenol to form a reddish orange coloured complex with an absorption maximum 490 nm (Abirami sivasubramni et al.,2015). The Presence of rhamnolipid biosurfactant was confirmed in all the samples, whereas H2 & H5 showed a colour change to greenish yellow indicating a mere presence of biosurfactant (Fig 6).

3.4 Antimicrobial activity: The antibacterial activity was determined against five bacterial organisms such as E. coli, Bacillus sps, Staphylococcus aureus, Streptococcus sps and Pseudomonas sps and antifungal activity was determined against two fungal organisms namely Candida albicans and Aspergillus niger for the test samples H1 - H6 (Table 2). Antimicrobial activity of purified biosurfactant showed broad spectrum of activity against the test organisms. The result showed that the highest activity of biosurfactant from H4 & H6 strain. H5 strain produced biosurfactant was active against Bacillus sp (0.85mm) followed by H6 strain biosurfactant against S.aureus and Escherichia coli (0.75mm). The least activity observed against A.niger ( 0.25mm).

<table>
<thead>
<tr>
<th>S.No</th>
<th>Organisms</th>
<th>H1</th>
<th>H2</th>
<th>H3</th>
<th>H4</th>
<th>H5</th>
<th>H6</th>
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<tr>
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<td>2</td>
<td>Bacillus sps</td>
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<td>0.6</td>
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<td>0.35</td>
<td>0.85</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
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<td>0</td>
<td>0.75</td>
<td>0</td>
<td>0.75</td>
<td>0</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>Streptococcus sps</th>
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<th>0.5</th>
<th>0</th>
<th>0.3</th>
<th>0.6</th>
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<tbody>
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<td>0.5</td>
<td>0.75</td>
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<tr>
<td>6</td>
<td>Candida albicans</td>
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<td>0.45</td>
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<td>7</td>
<td>Aspergillus niger</td>
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<td>0.25</td>
<td>0.3</td>
<td>0.4</td>
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</table>

Table 2: Antimicrobial activity of the isolated strains

3.5 Characterization of Biosurfactant by FTIR: The biosurfactant produced by *Halobacterium* spp (H4 & H6) was classified as a lipopeptide. The most important peaks of FTIR analysis of the biosurfactant revealed that, the peak at 491 cm\(^{-1}\) is due to C–I (Carbon–Iodine) bond, 3429 and 2360 cm\(^{-1}\) denoted as the N–H group. The transmittance around at 1400 cm\(^{-1}\) referred to the aliphatic chain of the C–H group. An intense stretching peak 1159, 1537 and 1626 cm\(^{-1}\) indicates the presence of RNO2 groups. The availability of all these functional groups firmly substantiated that the biosurfactant is a peptide nature (Donio et al., 2013a). The above information from the respective wave numbers confirmed the lipopeptide nature of the biosurfactant. (Fig 7 & 8).

**Figure 7:** Shows FTIR results of the biosurfactant produced by *Halobacterium* sp H4 strain

**Figure 8:** Shows FTIR results of the biosurfactant produced by *Halobacterium* sp H6 strain.
3.6 Application: Avocado smoothie ingredients are prepared and its squeezed oil is added in avocado smoothie and also extracted biosurfactant is added in it, to confirm that it’s an emulsifier and can be used in food. In control separate upper layer is formed in eppendorf tube while adding squeezed oil in avocado smoothie (Fig 9).

Test samples (H4& H6): In two separate fresh eppendorfs, Avocado squeezed oil and extracted biosurfactant from H4& H6 strains were taken and mixed well. After the addition of biosurfactant to the eppendorf the oil was emulsified and got mixed well in the preparation resembling as one single layer (Fig 10). The biosurfactant used in food industries helps in proper emulsification of the oil and increases the absorption of the essential oils in the system.
IV. CONCLUSION

Biosurfactants have wide applications in various industries such as agriculture, food production, chemistry, cosmetics and pharmaceutics. Many properties of microbial surface active compounds such as emulsification/de-emulsification, dispersion, foaming, wetting and coating make them useful in physico-chemical and biological remediation technologies of both organic and metal contaminants. Biosurfactants were found to increase the bioavailability of hydrocarbon resulting in enhanced growth and degradation of contaminants by hydrocarbon-degrading bacteria present in polluted soil. The production of biosurfactants using the microbial sources have received much attention these days when compared to synthetic sources because of low toxic and non-hazardous nature but only limited works were carried out so mass production of biosurfactants from *Halobacterium* spp have to be taken from pilot study level to industrial level. Not much work has been reported on the biosurfactant production from *Halobacterium* spp due to the difficulty in isolation procedure. Yet the present study was one such attempt to explore the potential utility of *Halobacterium* for the goodness of mankind.

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Characteristics of Fuzzy Domination Number In Fuzzy Digraphs

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Abstract- The purpose of this paper is to introduce the concept of fuzzy in-dominating set ,fuzzy out-dominating set ,fuzzy characteristic function of fuzzy digraph .The theorems based on fuzzy kernel ,fuzzy absorbant ,fuzzy characteristic function are proved.

Index Terms- The fuzzy digraph- in-degree and out-degree in a fuzzy digraph-the fuzzy independence number the fuzzy out-dominating set- in-dominating set- the fuzzy characteristic function.

I. INTRODUCTION


Recently, G.Nirmala ,M.Vijaya [9] & G.Nirmala,K.Dhanbal [10] in their studies discussed the various concepts on related with fuzzy graph along with their properties.Proceeding in the same chain, the domination number of the fuzzy digraph, the fuzzy kernel of the fuzzy digraph and the fuzzy absorbant of the fuzzy digraph are discussed in this paper. We also introduce some new concepts as fuzzy out-dominating set of the digraph, fuzzy in-dominating set of the fuzzy digraph, fuzzy characteristic function of the fuzzy digraph.

PRELIMINARIES1.1

Definition 1.1

A fuzzy digraph GD=(σD,μD) is a pair of function σD :V→[0,1] and μD : V×V→[0,1] where μD(u,v)≤ σD (u) and σD (v) for u,v ε V, σD a fuzzy set of V,(V× V , μD ) a fuzzy relation on V and μD is a set of fuzzy directed edges are called fuzzy arcs.

Let GD=(σD,μD) be a fuzzy digraph .If σD(u)≥0, for u in V, then u is called a vertex of GD .If μD(u,v) = 0 for u in V, then u is called an empty vertex of GD .If μD(u,v) = 0, then (u,v) is called an empty arc of GD .

Definition 1.2

Let GD= (σD1,μD1) and GD= (σD2,μD2) be two fuzzy digraphs of V . Then GD= (σD2,μD2) called a fuzzy sub-digraph of GD= (σD1,μD1) if σD2(u) ≤ σD1(u)for all u in V and μD2(u,v) ≤ μD1(u,v) for all u,v in V, then write GD2 ≤ GD1.

Definition 1.3

An fuzzy arc μ(u,v) is said to be directed from σ(u) to σ(v) in which case σ(u) is said to be a predecessor of σ(v), σ(v) is a successor of σ(u). In this case also use the notational equivalence μ(u,v)=σ(u)→σ(v).

Definition 1.4

For any real number α,0<α ≤ 1, A fuzzy directed α walk Wα from a vertex σD(xj) to σD(xj+1) is an alternating sequence of vertices and edges, beginning with σD(xj) and ending with σD(xj+1) , such that σD(xj)≥ α, 0 ≤ j ≤ n, and μD(xj)≥ α, 0 ≤ j ≤ n each arc is oriented from the vertex preceding it to the vertex following it. No arc in a fuzzy directed walk Wα appears more than once, but a vertex may appear more than once, as in the case of fuzzy undirected graphs.

Definition 1.5

In a fuzzy directed walk Wα, the starting and ending vertex are the same then the fuzzy directed walk Wα is called fuzzy closed directed walk Wα, otherwise it is called a fuzzy open directed walk.

Definition 1.6

A fuzzy semi-walk in a fuzzy digraph is a walk in the corresponding fuzzy undirected graph, but is not a fuzzy directed walk. fuzzy walk in a digraph can mean either a fuzzy directed walk or a fuzzy undirected walk.

Definition 1.7

For any real number α,0<α ≤ 1, a directed α-path Pα in a fuzzy digraph GD = (σD,μD) is a sequence of distinct nodes x0, x1, x2, ..., xn such that σD(xj)≥ α, 0 ≤ j ≤ n, and
\[ \mu_D(x_{i-1}, x_i) \geq \alpha, \ 0 \leq i \leq n, \ n \geq 0, \] is called the length of \( \rho_\alpha \). In this case, write \( \rho_\alpha = (x_0, x_1, x_2, \ldots, x_n) \) and \( \rho_\alpha \) is called a \((x_0, x_n)\)-\( \alpha \) path.

**Definition 1.8**

If the directed \( \alpha \)-Path \( \rho_\alpha \) has length \( n > 0 \), the strength of \( \rho_\alpha \) is defined as \( \{ \bigwedge_{i=1}^{n} \mu_D(x_{i-1}, x_i) \} \). If the directed \( \alpha \)-Path \( \rho_\alpha \) has length 0, it is convenient to define its strength to be \( \sigma_D(x_0) \).

**Definition 1.9**

A directed \( \alpha \)-cycle if \( x_0 = x_n \) and \( n \geq 3 \).

**Definition 1.10**

A fuzzy digraph \( G_D \) is said to be strongly connected if there is at least one fuzzy directed path from every vertex to every other vertex.

**Definition 1.11**

A fuzzy digraph \( G_D \) is said to be weakly connected if its corresponding fuzzy undirected graph is connected but \( G_D \) is not fuzzy strongly connected.

**Definition 1.12**

In a fuzzy digraph \( G_D \) a fuzzy closed directed walk which traverses every arcs of \( G_D \) exactly once is called a fuzzy directed Euler line. A fuzzy digraph containing a fuzzy directed Euler line is called a fuzzy Euler digraph.

**Definition 1.13**

A fuzzy digraph \( G_D \) is said to be fuzzy unicursal if it contains an fuzzy open Euler walk.

**Definition 1.14**

Let \( G(\sigma_D, \mu_D) \) be fuzzy digraph on \( G*(V,A) \). The vertex \( v_i \), which edge \( e_k \) is incident out of, is called the initial vertex of \( e_k \). The vertex \( v_j \), which \( e_k \) is incident into, is called the terminal vertex of \( e_k \).

**Definition 1.15**

Let \( G(\sigma_D, \mu_D) \) be fuzzy digraph on \( G*(V,A) \). The outset of a vertex \( u \) is the set \( O(u) = \{ v : (u,v) \in A \} \). And the inset \( I(u) = \{ w : (w,u) \in A \} \). Also \( O[u] = O(u) \cup \{ u \} \) and \( I[u] = I(u) \cup \{ u \} \).

**Definition 1.16**

The in-degree of any vertex \( u \) in the fuzzy digraph \( G_D \) is the sum of membership of all those arcs which are incident into the vertex \( u \). That is the in-degree of the vertex \( \text{in}(u) = |I(u)| \).

**Definition 1.17**

The out-degree of any vertex \( u \) in the fuzzy digraph \( G_D \) is the sum of membership of all those arcs which are incident out of the vertex \( u \). That is the out degree of a vertex is \( \text{od}(u) = |O(u)| \).

**Definition 1.18**

A fuzzy digraph is said to be fuzzy balanced digraph or fuzzy isograph if for every vertex \( \sigma(v) \) the in-degree equals the out-degree.

**Definition 1.19**

A fuzzy balanced digraph is said to be fuzzy regular digraph if every vertex has the same in-degree and out-degree as every other vertex.

**Definition 1.20**

Two vertices in a fuzzy digraphs \( G_D \) are said to be fuzzy independent if there is no strong arc between them.

**Definition 1.21**

A subset \( S \subseteq V \) is said to be fuzzy independent set of \( G_D(\sigma_D, \mu_D) \) on \( G*(V,A) \) if every two vertices of \( S \) are fuzzy independent.

**Definition 1.22**

The fuzzy independence number \( \beta_{0}(G_D) \) is the maximum cardinality of an independent set in \( G_D \).

**Definition 1.23**

A set \( S \subseteq V \) is called fuzzy absorbant if for every \( v \in V - S \), there exist a \( u \in S \) which is a successor of \( v \). That is \( v \rightarrow u \) is an arc in \( \mu_D \).

II. FUZZY DOMINATION IN FUZZY DIGRAPHS

**Definition 2.1**

A subset \( S \subseteq V \) is a fuzzy out dominating set of \( G_D \). If every vertex \( v \in V - S \), there exists \( u \in S \) such that \( \mu_D(u,v) = \sigma_D(u) \land \sigma_D(v) \).

**Definition 2.2**

The fuzzy out domination number of a fuzzy digraph \( G_D \) is the minimum cardinality taken over all fuzzy out dominating sets in \( G_D \), and it is denoted by \( \gamma_{od}(G_D) \).

The fuzzy out dominating set \( S = \{ a, d, g \} \)

The fuzzy out dominating number \( \gamma_{od}(G_D) = 0.7 \)
Definition 2.3 A subset $S \subseteq V$ is a fuzzy in dominating set of $G_D$. If every vertex $v \in V - S$, there exists $u$ in $S$ such that $\mu_D(v, u) = \sigma_D(v) \land \sigma_D(u)$.

Definition 2.4

The fuzzy in - domination number of a fuzzy digraph $G_D$ is the minimum cardinality taken over all fuzzy in dominating sets in $G_D$. The fuzzy in-dominating number is denoted by $\gamma_{in}(G_D)$.

The fuzzy in-dominating set $S = \{a, d, g\}$
The fuzzy in-dominating number $\gamma_{in}(G_D) = 0.6$

Definition 2.5

Let $G_D = (\sigma_D, \mu_D)$ be a fuzzy digraph on $G(V, A)$. A set $S \subseteq V$ is a fuzzy kernel in fuzzy digraph if it is both fuzzy independent and fuzzy absorbent in fuzzy digraph.

Definition 2.6

Let $G_D = (\sigma_D, \mu_D)$ be a fuzzy digraph on $G(V, A)$ and $S$ be the fuzzy kernel of the fuzzy digraph, then its characteristic function is defined by $\phi_{DS}(u) = 1$ if $u \in S$.

Theorem 2.1

A fuzzy digraph $G_D = (\sigma_D, \mu_D)$ is fuzzy regular and fuzzy Eulerian if and only if $G_D$ is fuzzy strongly connected and for each of its vertices $u, v$, $od(u) = in(u)$ that is $|O(u)| = 1|u|$.

Proof:

Necessity Let $G_D$ be a fuzzy Euler, fuzzy regular digraph. Therefore, it contains a fuzzy Euler walk, say $W_\alpha$. In traversing $W_\alpha$, every time a vertex $u$ is encountered we pass along an arc incident towards $u$ and then an edge incident away from $u$. This is true for all the vertices of $W_\alpha$, including the initial vertex of $W_\alpha$, say $u$, because we began $W_\alpha$ by traversing an arc incident away from initial vertex of $W_\alpha$, and ended $W_\alpha$ by traversing an arc incident towards $u$.

Sufficiency Let for every vertex $u$ in $G_D$, $in(u) = od(u)$. For any arbitrary vertex $u$ in $G_D$, we identify a fuzzy walk, starting at $u$ and traversing the arc of $G_D$ at most once each. This traversing is continued till it is impossible to traverse further. Since every vertex has the same number of edges incident towards it as away from it, we can leave any vertex that we enter along the walk and the traversal then stops at $u$. Let the walk traversed so far be denoted by $W_\alpha$. If $W_\alpha$ includes all arcs of $\mu_D$, then the result follows. If not, we remove from $G_D$ all the arcs of $W_\alpha$ and consider the remainder of $\mu_D$. By assumption, each vertex in the remaining fuzzy digraph, say $G_D_1$, is such that the number of arcs directed towards it equals the number of arcs directed away from it. Further, $W_\alpha$ and $G_D_1$ have a vertex, say $v$ in common, since $G_D$ is strongly connected. Starting at $v$, repeat the process of tracing a walk in $G_D_1$. If this walk does not contain all the arcs of $G_D_1$, the process is repeated until a fuzzy closed walk that traverses each of the arcs of $G_D$ exactly once is obtained. Hence $G_D$ is fuzzy Euler graph.

Theorem 2.2

A necessary and sufficient condition for a set $S$ to be a fuzzy kernel of a fuzzy digraph $G_D = (\sigma_D, \mu_D)$ is that its characteristic function $\phi_{DS}(u)$ satisfy the condition: $\phi_{DS}(u) = 1$ - $\max\{\phi_{DS}(v), v \in O(u)\}$. If $u \notin S$, then $\phi_{DS}(u) = 0$. But since $S$ is a fuzzy kernel, $S$ is fuzzy absorbent, and therefore there must be a vertex $v \in S$ which is a successor of $u$, that is $v \in O(u)$. This means that $\phi_{DS}(v) = 1$ and $\max\{\phi_{DS}(v), v \in O(u)\} = 1$. Thus $\phi_{DS}(u) = 0 = 1 - \max\{\phi_{DS}(v), v \in O(u)\}$. Similarly, if $u \notin S$, then $\phi_{DS}(u) = 0$. But since $S$ is a fuzzy kernel, $S$ is fuzzy absorbent, and therefore there must be a vertex $v \in S$ which is a successor of $u$, that is $v \in O(u)$. This means that $\phi_{DS}(v) = 1$ and $\max\{\phi_{DS}(v), v \in O(u)\} = 1$. Thus $\phi_{DS}(u) = 0 = 1 - \max\{\phi_{DS}(v), v \in O(u)\}$. Conversely, assume that $\phi_{DS}(u) = 1 - \max\{\phi_{DS}(v), v \in O(u)\}$ holds for some set $S \subseteq V$, its characteristic function $\phi_{DS}$ and every vertex $u \in S$. To show that $S$ is kernel of $G_D$, that is, $S$ is both fuzzy independent and fuzzy absorbent. Let $\phi_{DS}(u) = 1$ and $\phi_{DS}(v) = 0$ for every $v \in O(u)$. But this implies that no vertex $v \in O(u)$ is in $S$, that $S$ is fuzzy independent.

Similarly, consider any vertex $v \in S$. We know that $\phi_{DS}(v) = 0$ and that $0 = 1 - \max\{\phi_{DS}(u), u \in O(v)\}$. But this
implies that \( \max \{ \phi_{DS}(u): u \in O(v) \} = 1 \), which means that for at least one vertex \( u \in O(v) \), \( \phi_{DS}(u) = 1 \). Therefore, \( u \in S \) and there is at least one vertex in \( S \) which is a successor of \( v \). Thus, \( S \) is fuzzy absorbant. Since \( S \) is both fuzzy independent and fuzzy absorbant, it is a fuzzy kernel.

III. CONCLUSION

In this paper we define the concepts of fuzzy digraph, fuzzy out-dominating set, fuzzy in-dominating set, fuzzy characteristic function, further we proved the theorems based on fuzzy regular digraph, fuzzy characteristic function.

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Image Compression Algorithm and JPEG Standard

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Summary. The interest in digital image processing is growing at an enormous place in last decades. As a result, different data compression techniques has been proposed which are concerned in minimization of the information used for representation of image.

In this paper we provide an overview, needs of data compression techniques in image processing, focusing on JPEG image compression technique.

Keywords: Data compression, Karhunen-Loeve Transformation, Discrete Cosine Transform (DCT), Huffman coding, Quantization, JPEG Standard

I. INTRODUCTION

Large amounts of data are used to represent an image. The amount of storage media needed for storage is enormous. One approach to decreasing the amount of storage is to work with compressed image data. In data compression, we remove correlated data to by using appropriate compression transformation, without losing the ability to reconstruct the image. The more correlated data, the more data items can be removed.

There are many compression standards, JPEG, JPEG-LS and JPEG-2000. Nowadays, JPEG is widely used in many application areas. JPEG-LS is also called lossless compression so exactly what you see is what you compress in that case there is no irrelevant information added.

Fig. 1 JPEG Image Compression Technique

This chapter begins with discussion of image compression techniques and its types. Then introduced the concept of data compression, followed by quantization and entropy coding which is used to compress the data. Later we talk about JPEG Standard along with example. Finally, a conclusion section ends the chapter.

II. DATA COMPRESSION
In data compression less number of data is used to represent the original data taking account of the information contained on it. If we do look at the Fig. 1, encoder receives the target image and then it converts the image into bitstream. On the other part, the decoder is used to convert the bitstream back to the image I. If the quantity of bitstream is lesser than original image then this process Image Compression Coding.

(a) Original image 4718592 bytes                (b) Compressed image 695755 bytes

Fig. 2 Examples of image compression technique using JPEG standard

The compression ratio is 695755/4718592, about 0.14744, which is about x7 still being extremely conservative. We can see the images are slightly, parts of information are lost during compression. The decoder cannot rebuild image perfectly as before and this kind of compression technique is called non-reversible or lossy coding. But, in reversible coding, we can perfectly rebuild the original image without any distortion and the ratio of compression is much lower.

Since, there is distortion between the images i.e original image and decoded image. We need to evaluate the coding efficiency. The common evaluation tools, which are used to calculate the coding efficiency are Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR) which are defined as follows:

\[
MSE = \sqrt{\frac{\sum_{x=0}^{W-1} \sum_{y=0}^{H-1} (f(x, y) - f'(x, y))^2}{WH}}
\]  

(1)

\[
PSNR = 20\log_{10} \frac{255}{\text{MSE}}
\]  

(2)

Eq. (1), \( f(x, y) \) and \( f'(x, y) \) represents the original image and decoded image, respectively. The image size is \( W \times H \). In Eq. (2),
The image coding algorithm consists of reducing correlation exists between pixels, quantization and entropy coding.

(a) Source Encoder: Source encoder aimed at decorrelating input signal by transforming its representation. where set of data values is sparse, thus compacting the information content of the signal into the smaller number of coefficients.
b) **Quantizer**: A quantizer aims at reducing the number of bits needed to store transformed coefficients by reducing the precision of those values. Quantization performs on each individual coefficient i.e. Scalar Quantization (SQ) or Vector Quantization (VQ).

c) **Entropy Coding**: Entropy encoding aims to remove redundancy by removing repeated bit patterns. The most common entropy coders are the Huffman Coding, Arithmetic Coding, Run Length Encoding (RLE) and Lempel-Ziv (LZ) algorithm.

The constitution of image coding algorithm model is in **Fig. 3** which will be discussed in following chapters.

![Fig. 3 Constitution of image coding algorithm](image)

### III. KARHUNEN-LOEVE TRANSFORMATION AND DISCRETE COSINE TRANSFORM

#### A. Karhunen-Loeve Transformation

Images have high correlation, for an image with size $K_1 \times K_2$, we divide it into several small blocks with size $N_1 \times N_2$ and deal with each blocks with transformation. Which helps to reduce its pixel correlation. In JPEG standard, we do not use KLT because the transform is computationally expensive.

#### B. Discrete Cosine Transform

Problems like computation power, storage , cost goes more if we use KLT in orthogonal transform of KLT, to deal with the problems and also to preserve optimal property of KLT for image. we have Discrete Cosine Transform (DCT), which is defined as

$$F(u, v) = \frac{1}{4} C(u) C(v) \sum_{x=0}^{7} \sum_{y=0}^{7} f(x, y) \cos \left( \frac{\pi(2x+1)u}{16} \right) \cos \left( \frac{\pi(2y+1)v}{16} \right)$$

for $u = 0, ..., 7$ and $v = 0, ..., 7$

where $C(k) = \begin{cases} 1/\sqrt{2} & \text{for } k = 0 \\ 1 & \text{otherwise} \end{cases}$

(3)
Fig. 4 The $8 \times 8$ DCT basis $\omega_{x,y} (u,v)$

And inverse DCT is defined as:

$$f(x, y) = \frac{1}{4} \sum_{u=0}^{7} \sum_{v=0}^{7} C(u)C(v) F(u, v) \cos \left[ \frac{\pi (2u + 1)}{16} \right] \cos \left[ \frac{\pi (2v + 1)}{16} \right]$$

for $x = 0, \ldots, 7$ and $y = 0, \ldots, 7$

(4)

The $F(u,v)$ is called DCT coefficient, and basis of DCT is:

$$\omega_{x,y} (u,v) = \frac{C(u)C(v)}{4} \cos \left[ \frac{\pi (2x + 1)}{16} \right] \cos \left[ \frac{\pi (2y + 1)}{16} \right]$$

(5)

Thus can rewrite by Eq. (5):
The 8 × 8 two dimensional DCT basis is represented in Fig. 4.

IV. QUANTIZATION

In Fig. 4 we represent the transformed 8 × 8 block that consists of 64 DCT coefficients. The first coefficient which is denoted by \( F(0,0) \) is the DC component and the rest are AC component. The DC component denoted by \( F(0,0) \) is the sum of 64 pixels which is multiplied by the scaling factor \( \frac{1}{10} C(0)C(0) = \frac{1}{8} \) as shown in Eq. (3) for \( F(u,v) \).

![Quantization matrix](image)

Fig. 5 Quantization matrix

The next step is to quantize transformed coefficients. Each DCT coefficients \( F(u,v) \) is uniformly quantized and can be obtained by dividing it by the corresponding quantize step-size parameter \( Q(u,v) \) and then rounded to the nearest integer as below:

\[
F_q(u,v) = \text{Round} \left( \frac{F(u,v)}{Q(u,v)} \right)
\]

JPEG standard does not define fixed quantization matrix. It is of the user to select a quantization matrix. Fig. 5 shows quantization matrices of JPEG standard.

In JPEG compression quantization process removes high frequencies present in original image. We do so cause our eyes is much sensitive to lower spatial frequencies. Bigger the values in quantization table, bigger error introduced by lossy process resulting smaller visual quality.
V. JPEG STANDARD

Joint Photographic Experts Group (JPEG) has built up a worldwide standard for universally useful, shading, still-picture compression. There are numerous compression standards such as JPEG, JPEG-LS and JPEG-2000. JPEG-LS is also called loss less compression so exactly what you see is what you compress in that case there is no irrelevant information added. The block diagram of Baseline JPEG Transformation is shown in Fig. 1.

A. Zig-Zag Reordering

We obtain new 88 blocks after DCT and quantization, which is our frequency domain value for the original blocks. In order to encode the value we need to reorder values into one dimensional form. The DCT coefficient is encoded by difference coding and AC terms are scanned in Zig-Zag manner and we do it to get a vector sorted on basis of the spatial frequency. Fig. 6 shows Zig-zag reordering process.

![Zig-Zag reordering matrix](image)

Fig. 6 Zig-Zag reordering matrix

B. Zero Run Length Coding

The quantized AC coefficients for the most part contains continuous zeros. Therefore, an advantage can be acquired by utilizing a run-length method, where upper four bits of code image demonstrate the quantity of back to back zeros previously the following coefficient, and lower four bits show the quantity of huge bits in the following coefficient.

The following code symbol are significant bits of the coefficient, where length is determined by the lower four bits of the code. The inverse run-length coder takes the current code symbol and appends to the output array the number of zeros which is corresponding to the four bits used for the run-length code. Coefficients are placed in the output array has the number of bits determined by the lower four bits of the run-length code and a value determined by the number of trailing bits.
C. Difference Coding

DC coefficients are highly correlated with each other in the blocks. DC coefficients contain more energy so they have much larger value than AC coefficients. This is why we have to reduce the correlation before doing encoding. JPEG standard encodes the resulting difference between the DC coefficients. The difference value between adjacent DC values can be computed by the following equation:

\[ \text{Diff}_i = \text{DC}_i - \text{DC}_{i-1} \]  

(8)

The initial DC value is set to zero, then difference is Huffman encoded together with the encoding of AC coefficients. Difference coding process are shown in Fig. 7.

---

D. Huffman coding

During data transmission, data need to be encoded and is converted into binary format with values 0 and 1. If all the character data is converted to binary format of same length irrespective of their priority, length of the entire code will be large. So, huffman encoding follows a rule of assigning short length code for most frequently used words and longer length code for less frequently used words. Thus the length of entire code gets reduced.

---

E. Decompression

In decompression, the compression phase is reversed in the opposite order to get the image. In first step, we restore the Huffman tables from the image and then decompressing the Huffman tokens in the image. Then, DCT values for each block will be the first things needed to decompress a block. The other 63 values of each blocks are decompress by JPEG, filling the appropriate number and last step is combined of decoding the zigzag order and then recreating...
the 8 × 8 blocks. The inverse DCT (IDCT) takes each value present in the spatial domain and examines the each contributions of the 64 frequency make to that pixel.

VI. CONCLUSIONS

We discussed about the basic concepts of image compression along with the overview of JPEG standard. Although, there is much more details we did not mentioned, the important parts are discussed in this paper. The JPEG standard has become on of the the most popular image format and widely used in many applications; it still has some properties which needs further improvement.

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Overview of biogas production from different feedstocks

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Abstract- Renewable energy could replace the conventional sources of energy such as fossil fuel and oil, serving as an alternative source of energy. Non-renewable energy sources have been found to pose various environmental problems such as greenhouse gas emissions as they tend to deplete at faster rates. Biological processes such as fermentation and anaerobic digestion have given rise to the production of biofuels such as biogas and bioethanol. Biogas production is environmentally friendly and simple to produce although some drawbacks have limited its full exploitation in the past decades such as the physical and chemical treatment techniques required in the process. The most important parameter to consider in the application of anaerobic digestion is the type of feedstock as almost any organic material can be processed under this process. An incipient gain in the shift for a renewable source of energy is that the feedstock is often a by-product, a residue or waste product of other processes. Feedstocks include waste paper, grass clippings, leftover food, sewage, and animal waste which are obtainable without the need for competition of arable land. In general, some of these energy crops have been found to also contain the major constituents required of them such as sugar, starch, and oils. However, the measure of how digestible a particular feedstock is determined the yield of bioenergy it can produce. Thus the greater the digestibility of the feedstock, the higher the gas yield. Data available in this review include the amount of each potential source of raw material serving as feedstock for bioenergy production. This review, therefore, highlights the various types of feedstock that have been used in the few decades to produce bioenergy.

Index Terms- Biofuel, Biogas, Bioethanol, Feedstock, Renewable energy.

I. INTRODUCTION

The over-reliance on renewable forms of energy such as coal, increase in fuel prices, and the emission of greenhouse gases has braved researchers in the past few decades to find alternative methods to obtain a sustainable form of energy [1]. Biological processes such as fermentation and anaerobic digestion have given rise to the production of biofuels such as biogas and bioethanol. Thus the most important parameter to consider in the application of anaerobic digestion is the type of feedstock, as almost any organic material can be processed under this process. Feedstock has been defined to include substrates than can be converted to methane by anaerobic digestion [2]. This could range from biodegradable waste water to complex high-solid waste. Toxic compounds could also be degraded anaerobically according to the same study. According to Sawatdeenarunat, et al. [3], renewable energy such as biogas can be produced from different types of organic materials (feedstock) such as industrial wastewater, agricultural waste, food waste, and sewage sludge. Biogas is a renewable fuel that largely consists of 60-70% methane, 20-30% carbon dioxide and other trace gases such as hydrogen sulfide. The gas produced, can be used to generate electricity and also in the production of combined heat and power generation using appropriate technologies [4]. Plant residues which are rich in lignocellulose signify the most favorable renewable organic feedstock for bioenergy production such as biogas production without the competition for arable land [3, 5].

A major challenge in the utilization of lignocellulosic feedstock in the fermentative process is the transformation of the complex polysaccharides into simple sugars which can then be assimilated by a large consortium of microorganisms [6]. Pretreatment of lignocellulosic biomass to remove lignin, however, alters the physical and chemical structures of lignocellulosic feedstock significantly thereby improving the cellulose activity for higher yield of sugars [7]. The lignin portion of the feedstock protecting the structure of the cell wall of lignocelluloses tends to resist the direct accessibility of cellulose to microorganisms during the bioconversion of feedstock to bioenergy [8]. In this case, the need for pretreatment is essential as technique targets the disruption or removal of lignin and hemicellulose present in the biomass making cellulose porous and accessible to the microorganisms for further digestion to yield energy [1]. These, together with the low nutrient content (nitrogen, phosphorous, trace elements, etc.) makes lignocellulosic materials a poor nutrient source for degrading microorganisms [5]. In other to counterbalance these nutrient losses, some micronutrients required by microorganisms for anaerobic digestion have been employed by researchers to supplement the carbon to nitrogen ratio as commonly employed in mono-digestion [9].

Also, fermentation and distillation have been used for thousands of years to produce bioethanol from sugar but was until the mid-18\textsuperscript{th} century that the process was fully explained [10]. Sugarcane bagasse, among several feedstocks investigated worldwide, is considered in Brazil for the use as a raw-material for cellulosic bioethanol production [11, 12]. However, the use of this feedstock for second generation ethanol is hypothetically remarkable as it is readily made from the first generation plants [11, 13]. Drawbacks such as
process instability, process failure, poor methane yield, the larger retention times, and reactor failures have limited the full exploitation for the production of bioenergy from feedstocks [9].

This paper, however, highlights the various types of feedstock that have been used in the few decades to produce bioenergy.

II. FEEDSTOCK FOR BIOGAS PRODUCTION

Biodegradable feedstocks are known for biogas production and could be solid, slurries, and in both dilute and concentrated liquid forms [14]. This feedstock includes agricultural wastes and crop residues, animal wastes, aquatic waste, forest residues and municipal solid wastes [15, 16].

Agricultural: animal and crop residues

Several agricultural crops and activities produce residues that can be used as a feedstock for biogas production such as biogas. There is an abundance of biomass in the form of agricultural waste and crop residue which can be used as feedstock for anaerobic digestion [17, 18]. Bioenergy production has been achieved in the past decades from various agricultural feedstocks such as straw, sugarcane bagasse, corn silage, wood chips, weeds, tobacco waste, crop stubbles, fruit and vegetable processing wastes, and oil cakes [17]. A significant amount of waste is also produced by animals as the activity of animal breed has gained an increasing recognition [19]. Cattle dung has been used as one of the solid waste feedstock for most parts of rural India as about 354 million tonnes of dung is available per year [17]. Countries like the Philippines and Taiwan predominantly used pig manure as feedstock for the bioenergy production [20]. Generally, mostly used animal wastes include cow dung, pig waste, poultry manure, horse dung, camel dung, elephant dung, fishery waste and slaughter house wastes. Studies have found that poultry wastes are rich in organic nitrogen and relatively lower carbon source [21].

Aquatic plants as feedstock for bioenergy production

Feedstocks such as water hyacinth, micro and macro algae, sea weeds are suitable for bioenergy production [22]. These feedstocks have easily hydrolysable sugars, contain low lignin content, and they do not compete with land resources used in arable food crop cultivation [23]. Methane production has been found in the co-digestion of alga sludge and waste paper. In this study, the maximum methane production rate of 1607 ± 17ml/day of algae sludge at a combined 5 gVS/l day loading rate with 60 % VS of paper added in alga sludge feedstock [22]. Both water hyacinth and micro algae are mostly used as feed material because of their higher gas yield [20].

III. Biogas production

The anaerobic digestion process to produce biogas offers a range of benefits such as the lowering of fossil fuel usage, mineral fertilizer replacement (from the digestate), renewable energy production and in wastewater treatment [24]. The hydrolysis process which is the rate-determining step of the overall process converts a wide range of solid organic materials (polymeric) as feedstocks into sugars, fatty acids and amino acids [25]. Fermentation of these materials produces volatile fatty acids. Acidogenesis forms hydrogen, carbon dioxide and acetate from VFAs. The methanogenesis produces biogas, a mixture of methane, carbon dioxide, and numerous trace elements such as hydrogen sulfide, ammonia, carbon monoxide [26]. The hydrolysis process of anaerobic digestion is often the rate-limiting step when the fibrous material is used as the feedstock because of the recalcitrant presence of lignin [27]. In this case, substrate pretreatment could be an alternative to improve the AD process by increasing the accessible surface area, modifying the crystalline structure or partially depolymerizing cellulose, solubilizing hemicellulose and lignin or modifying lignin structure. Table 1 presents the feedstock type and the biogas yield per dry matter estimated.
Table 1: Different feedstocks with biogas yield according to Maurya, et al. [28].

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>% dry matter</th>
<th>Biogas yield (m³/wet tonne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose grown crops</td>
<td>30</td>
<td>50-220</td>
</tr>
<tr>
<td>Sewage sludge</td>
<td>10</td>
<td>9-16</td>
</tr>
<tr>
<td>Animal slurry and manure</td>
<td>15</td>
<td>12-23</td>
</tr>
<tr>
<td>Food and drink</td>
<td>18</td>
<td>20-14</td>
</tr>
</tbody>
</table>

Lignocellulosic feedstocks for biogas production

The availability of lignocellulosic materials is abundant worldwide as these materials have been found to be estimated to account for approximately 50% of the biomass in the world [29]. Lignocellulosic feedstock consists largely of three different forms of polymeric units, namely, cellulose, hemicellulose, and lignin, and are observed to be cross-linked to each other [30]. The cellulose is vastly crystalline, resists depolymerization, shows insolubility in water, rigid and heart, making it not easily to be broken [1, 31]. In regards to the structure of the cellulose, efficient alteration of cellulose has been hindered. The structural component of a lignocellulosic biomass such as that of the crystallinity of cellulose has affected the rate of enzymatic hydrolysis [32]. Pretreatment methods thus aid to disrupt the inter- and intra- hydrogen bonding of the cellulose chain even though it is not completely broken as it was found in the case of hydrothermal pretreatment according to Fan, et al. [32]. Various pretreatment that feedstocks for biogas production have undergone is presented in Table 2. Renewable energy from biomass is one of the most efficient and effective options for the various other alternative sources of energy [33]. It is however available as a domestic resource in the rural areas which are not subject to world fluctuations. Rao, et al. [33] proposed that biomass is a potentially reliable energy resource because of its availability as a sewage sludge, animal manure, industrial waste and agricultural waste. Feedstock has been defined to include any substrate that can be converted to methane by anaerobic bacteria [2]. This ranges from readily degradable wastewater to complex high-solid waste and that it is required of this given solid waste or wastewater to contain a substantial amount of organic matter which is finally converted mainly to methane and CO₂. Steffen, et al. [2] categorize the sources of substrates for anaerobic digestion as energy crops, agricultural wastes, industrial wastewater and municipal biowaste. Applying different feedstock improvement solutions to feedstock investigated such as nutrient addition, co-digestion and biomass pretreatment have been demonstrated as effective means of enhancing the methane yield of the feedstock thereby improving the overall anaerobic digestion process [9].

Table 2: Different pretreatment methods versus feedstock applied in literature

<table>
<thead>
<tr>
<th>Pretreatment Methods</th>
<th>Feedstocks</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermochemical</td>
<td>Water hyacinth</td>
<td>[34]</td>
</tr>
<tr>
<td>Ultrasonic</td>
<td>Activated sludge</td>
<td>[35]</td>
</tr>
<tr>
<td>Acidic</td>
<td>Newspaper</td>
<td>[36]</td>
</tr>
<tr>
<td>Steam</td>
<td>Softwood</td>
<td>[37]</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Sugarcane bagasse</td>
<td>[38]</td>
</tr>
<tr>
<td>Lime</td>
<td>Switch grass and corn stover</td>
<td>[39]</td>
</tr>
<tr>
<td>Liquid hot water</td>
<td>Wheat straw</td>
<td>[40]</td>
</tr>
<tr>
<td>Liquid hot water</td>
<td>Corn fibre</td>
<td>[41]</td>
</tr>
<tr>
<td>Liquid hot water</td>
<td>Sugarcane bagasse</td>
<td>[42]</td>
</tr>
<tr>
<td>Biological</td>
<td>Olive mill wastewater</td>
<td>[43]</td>
</tr>
</tbody>
</table>
Influence of the operating parameters for biogas production

A biogas plant can be measured by studying and monitoring the variation in parameters like temperature, loading rate, hydraulic retention time and pH, as a sharp change in these could adversely affect the biogas production process. Some of the influence of these parameters on feedstock from literature is presented in Table 3.

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Parameter of interest</th>
<th>Parameter range</th>
<th>Results</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water hyacinth</td>
<td>Solid to water content</td>
<td>Six different solid concentrations from 5g/L to 30g/L</td>
<td>Maximum yield of biogas obtained at 25g/L</td>
<td>[44]</td>
</tr>
<tr>
<td>Water hyacinth</td>
<td>Solid to water content</td>
<td>Substrates with five different solid concentrations 3,5,7, 9,11% of total solids experimented</td>
<td>7% of total solids produced the best yield</td>
<td>[45]</td>
</tr>
<tr>
<td>Food waste</td>
<td>Temperature</td>
<td>Temperature from 30 to 55˚C</td>
<td>Highest gas production and COD removed rate was achieved at 50˚C</td>
<td>[46]</td>
</tr>
<tr>
<td>Algae sludge and waste paper</td>
<td>Organic loading rate</td>
<td>From 4 gVs/lday to 5 gVs/lday</td>
<td>Maximum methane production rate of 1607 ± 17ml</td>
<td>[22]</td>
</tr>
<tr>
<td>Cow dung</td>
<td>pH</td>
<td>pH of 4, 7, and 9 investigated</td>
<td>Best biogas at pH of 7, followed by 9 and 4</td>
<td>[47]</td>
</tr>
<tr>
<td>Waste water and bagasse</td>
<td>Carbon-Nitrogen ratio</td>
<td>C:N ratios of 6.62, 9.27, 13.19, 19.56, 24.53, 31.76, and 64.58 were investigated</td>
<td>Highest methane yield at C: N of 25.53</td>
<td>[48]</td>
</tr>
</tbody>
</table>

Influence of Carbon-Nitrogen (C/N) Ratio on feedstock characterization

The relationship between the amount of carbon and nitrogen existing in a particular feedstock is represented by its C/N ratio [49]. However, maintaining a proper structure of feedstock for effective plant operation so that the C: N ratio in feed remains within the desired range is essential. It has been found that during anaerobic digestion, microorganisms make use of carbon 25-30 times faster than nitrogen and thus microbes require about 20 to 30:1 ratio of C: N [50]. Ward, et al. [16] predicted the optimum C/N ratios in an anaerobic digester to be 20-30 and that a high C/N ratio gives an indication of rapid consumption of nitrogen by methanogens resulting in lower gas production. A C/N ratio of 26:1 has also been reported to achieve the maximum biogas yield with various agricultural feedstocks [51]. Kızılkaya and Bayraklı [52] observed that C/N ratios can often be considerably lower than what is observed by Ward, et al. [16], for example, sewage sludge with a C/N ratio of approximately 9:1 has also been reported. A condition for good composting is thus a C/N ratio of 25:1 to 40:1 and that anaerobic microbe when given a steady diet at 30:1 ratio decomposes organic materials very quickly. The carbon to nitrogen ratio of some feedstock used for biogas production is shown in Table 4.
Table 4: Feedstocks and their C/N ratios from literature

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>C: N ratio</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pomegranate waste</td>
<td>80</td>
<td>[53]</td>
</tr>
<tr>
<td>Poultry manure</td>
<td>11.54</td>
<td>[53]</td>
</tr>
<tr>
<td>Cow dung manure</td>
<td>22.71</td>
<td>[53]</td>
</tr>
<tr>
<td>Sugarcane bagasse</td>
<td>131.8</td>
<td>[54]</td>
</tr>
<tr>
<td>Food waste</td>
<td>13.6</td>
<td>[55]</td>
</tr>
<tr>
<td>Corn stalk</td>
<td>60</td>
<td>[15]</td>
</tr>
<tr>
<td>Slaughter house waste</td>
<td>2-4</td>
<td>[15]</td>
</tr>
<tr>
<td>Sawdust</td>
<td>200-511</td>
<td>[20]</td>
</tr>
</tbody>
</table>

IV. CONCLUSION

Currently, the use of non-renewable energy outweighs that of the renewable energy making the globe not environmentally and economically secured. Investing in a world completely made of renewable energy which is affordable and clean is the right candidate for sustainable development. By so doing, our natural environment is not only kept clean but also protected from possible emissions. Biogas production has been found to be derived directly from plants, or indirectly from agricultural, commercial, domestic, and or industrial wastes. This paper has sought to address some types of feedstock used in the past few decades, their biogas yield, and pretreatment techniques applied. Production of bioenergy such as biogas from feedstocks with qualities such as less energy input, low cost of pretreatment, affordability, the reach of newly emerging feedstocks without the competition for arable land and the need to be environmentally friendly is the surest way for the future and thus warranted to all researchers.

ACKNOWLEDGMENT

The authors are thankful to all the affiliate Universities listed in this paper for the use of their Library resources during the research findings.

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The Status and Causes of Secondary School Students’ Dropouts: The Case of East Gojjam Administrative Zone, Ethiopia

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Abstract- Persistent high dropout rates of secondary school students generate huge social and private costs. Thus, this study was intended to identify the status and causes of secondary school students’ dropouts in East Gojjam administrative zone. To achieve this objective descriptive survey research design with mixed approach was employed. From 18 woredas of the zone, six woredas were purposively selected to conduct the study. From these six woredas, six secondary schools were selected using simple random sampling techniques. 175 teachers were selected through systematic random sampling technique to fill questionnaire and 168 of them were properly filled and returned the questionnaires. Qualitative data also collected through interview from 5 principals, 5 supervisors and 5 district education experts. 18 dropout returnee students and 30 Parent-Student-Teacher Association (PSTA) members were also participated in focus group discussions. Documents of schools and zone education department were consulted to examine the trends and status of dropout rates. The obtained quantitative data was analyzed using one-sample t-test and qualitative data was analyzed through word narration thematically. Hence, the study revealed that the trends of students’ dropout rates in secondary schools of the study area showed a declining tendency and the highest dropout rates were existed in grade nine. The study also identified that the magnitude of dropout rates of students vary from year to year and among grade levels. The result of the study pointed out that several student-related, parents-related and school-related factors were contributed to secondary school students’ dropout in the zone. It is suggested that teachers, principals and school administrations should work with students and their families to minimize early departure of pupils’ from secondary schools.

Index Terms- Dropout, Trends, Causes, Secondary school

I. INTRODUCTION

Education plays indispensable role for all economic, political, social development and a principal means of improving the welfare of society at large. It also accelerates economic growth by maximizing labor productivity, promotes citizens innovative capacity of technologies and facilitates the diffusion and transmission of new knowledge and technologies. Hence, high levels of literacy and numeracy are pre-requisites for creating competitive work force and a nation of effective parents and active citizens. (UNESCO, 1998; Hanushek and Wobmann, 2008). Education is also a basic right in itself. Expanding access to quality education for rural people is thus of crucial importance in the realization of human rights (MOE, 2002).

Despite direct and indirect link between education and labor market returns, the education system of most African countries characterized by high rates of dropout, which result in educational inefficiency and wastage of scarce resources (Habtamu, 2002). Thus, high students drop out figures might be a strong indicator of the future shortages of skilled labor force (De Sousa & Tesfa, 1999). Besides, dropping out is a serious problem because it denies fundamental human right of individual student to education by early departure of a student from school without completion of a given grade level (MOE, 2002).

The problem of dropping out should be the concern of every member of society since it has negative consequences both at individual and societal level. For society, drop out resulted in wastage of scarce resources (teachers who have already employed) and student time (time taken to attend school) (Koskei, Tonui, and Simiyu, 2015). Dropout has also adverse effect on nation progress by jeopardizing human capital formation needed for economic development. As to Azzam (2007) major social costs of drop out of school include reduced political participation, increased demand for social services, increased crime rates and poor levels of health.

Individual students also suffer negatively from dropping out of school. On average, youth who are dropping out are more likely to experience future unemployment, engage in crime, underemployment, and lower earnings (Thurton, Collins, and Daugherty, 2006).

Conceiving the negative consequences of drop out for society and individuals, facilitating school completion for all students must be a priority for educators, administrators, researchers and policy makers. In this regard, Bongani (2014) asserted that the ongoing neglect of such an important topic to developing countries renders the problem a near permanent stumbling block on the road to the elimination of poverty.

Addressing drop out has been high on the agenda of the Ethiopian government for several years believing that preventing drop out and encouraging successful completion of secondary school can enhance economic growth and social development. It can ensure that students graduate with at least the minimum qualifications needed for economic labor market and for further education & training. Thus, ministry of education planned to reduce drop out and repetition rates of general secondary education and expand general secondary school in view of its universalization by 2020 in line with the middle income country vision (MOE, 2010b).

www.ijsrp.org
However, high dropping out of students from schools has been one of the main challenges of the education system of Ethiopia in general, and secondary school in particular. For instance, the MOE data of 2010 showed that more than 17% of school age students of general secondary education were dropped out from the schools. The trend analysis for drop out showed a decline tendency from 2003 to 2005. It might be the government measures such as increase budget allocation to education, construct new schools, recruit and train teachers and the like to reduce drop out (FDRE, 2004). Nevertheless, dropout rates began again started to show an increasing trends from 2006 to 2009 (MOE & UNICEF, 2012). MOE 2010 data also showed that dropout trend of general secondary school students of Amhara region, had also high rates of drop out, nearly the national average (16.6%). Supporting this, UNESCO (2015) revealed that one of critical problems of the Ethiopia’s education sector is a high dropout rate almost at all levels.

Several factors were mentioned associated with students’ drop out in Ethiopia. Previous studies conducted on primary schools and female students drop out (Zehle, 2009; Maeregu & Tadesse,2015; Habtamu, 2002 and MOE and UNICEF, 2012) revealed that several personal, school and family related factors contributed to students’ dropout. Some of the factors mentioned comprise ill-health, mal nutrition, low students interest to education, low employment opportunities to graduates, teachers’ methods of instruction, range of costs associated with schooling like uniform, travel, equipment and students’ opportunity costs.

II. OBJECTIVE OF THE STUDY

The main objective of this study is investigating the status and causes of secondary school students’ dropouts in East Gojjam administrative zone. Therefore, the study specifically addresses the following issues:

- To examine the magnitude of secondary school students drop out rate in the zone.
- To point out major factors that make secondary school students drop out in the zone.

III. METHODS

1.1. Participants

The participants of the present study comprised of 175 teachers, who were selected from districts of East Gojjam Zone Secondary schools using systematic random sampling technique to fill questionnaire. 5 principals, 5 supervisors and 5 woreda education experts of sample woredas/schools of secondary schools was selected using purposively and interviewed. 18 dropout returnee students and 30 Parent-Student-Teacher Association (PSTA) members were also participated in focus group discussions.

1.2. Instruments

In the study both close- ended and open-ended questionnaires having five- likert scale (where 1 stands for very low, 5 very high) were developed based on the review of related literatures and utilized to collect data from participants. Interview, focus group discussion and document analysis were also employed as a supplementary data collection tools.

1.3. Reliability of the instrument

Before being used for the actual purpose, the questionnaires were piloted on 30 respondents, who were out of the sample area, to check its reliability using Chrombach alpha and obtained 0.89 alpha coefficients, which was considered as reliable and suitable for data collection. Concerning this, Andy (2006) contended that the values of Cronbach’s alpha greater than 0.8 is good.

1.4. Data Analysis Procedures

In the study both quantitative and qualitative data were used and analyzed accordingly. Quantitative data was cleaned, coded and entered in the computer for analysis using the Statistical Package for Social Sciences (SPSS) version 20.0. Therefore, descriptive statistics (mean, standard deviation, and percentage) and one sample t-test were computed. The data that was obtained from open ended questionnaires, interview, focus group discussion (FGD) and document analysis were analyzed qualitatively using word description and narration thematically.

IV. RESULTS

1.5. The Status and Trends of Students Dropout Rates

<table>
<thead>
<tr>
<th>Year</th>
<th>Grade 9</th>
<th>Grade 10</th>
<th>Grade 11</th>
<th>Grade 12</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>%</td>
<td>Total</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>dropout</td>
<td></td>
<td>dropout</td>
<td></td>
<td>dropout</td>
</tr>
<tr>
<td>2005 E.C.</td>
<td>859</td>
<td>13.11</td>
<td>211</td>
<td>6.16</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>10.22</td>
<td></td>
<td>33</td>
<td></td>
<td>2.31</td>
</tr>
<tr>
<td>2006 E.C.</td>
<td>3709</td>
<td>12.19</td>
<td>1209</td>
<td>4.90</td>
<td>628</td>
</tr>
<tr>
<td></td>
<td>8.61</td>
<td></td>
<td>262</td>
<td></td>
<td>3.92</td>
</tr>
<tr>
<td>2007 E.C.</td>
<td>2641</td>
<td>8.7</td>
<td>667</td>
<td>2.92</td>
<td>656</td>
</tr>
<tr>
<td></td>
<td>6.69</td>
<td></td>
<td>177</td>
<td></td>
<td>2.65</td>
</tr>
</tbody>
</table>

Source: adopted from East Gojjam Zone Education Department Annual Reports

Data was obtained after reviewing East Gojjam zone education department annual reports. As shown in the table 2, the magnitude of dropout rate was 9.50%, 8.41% and 5.94% for 2005-2007E.C. academic years respectively. Hence, this data indicated that there was a decreasing trend of dropout rate of secondary school students of East Gojjam Zone. From this, it can be concluded that the trends of students’ dropout rate in secondary schools of the study area show a decreasing tendency. Concerning grade level there was a high dropout rate in grades nine and eleven students than grades ten and twelve students. Moreover, highest rates of dropout were registered in grade nine
than the rest grade levels (grade 10, 11 and 12) from 2005-2007E.C academic years in the study area.

The qualitative data obtained from focus group discussion is in line with the above findings. One participant in the discussion expressed his views about early departure of students in the secondary schools in the following ways.

“Some students experienced problems with their transition to secondary school. This is due to the deterioration of school performance during their primary school achievement. Students were become desperate when they transferred to secondary school due to their poor background in their primary school attainment. This negative experience decreased students’ commitment to school and contributed to their early school leaving”.

1.6. Major Factors that Contribute to Student Dropout

<table>
<thead>
<tr>
<th>No</th>
<th>Parents Related Factors</th>
<th>Mean</th>
<th>Mean Difference</th>
<th>t</th>
<th>Sig. (2-tailed)</th>
<th>Std.error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Parent illness</td>
<td>2.52</td>
<td>-0.476</td>
<td>-5.215</td>
<td>.000</td>
<td>.091</td>
</tr>
<tr>
<td>13</td>
<td>Parent death</td>
<td>2.25</td>
<td>-0.750</td>
<td>-9.078</td>
<td>.000</td>
<td>.083</td>
</tr>
<tr>
<td>14</td>
<td>Family breakdown/divorce</td>
<td>2.30</td>
<td>-0.702</td>
<td>-8.647</td>
<td>.000</td>
<td>.081</td>
</tr>
<tr>
<td>15</td>
<td>Parents need child labor</td>
<td>2.55</td>
<td>-0.446</td>
<td>-4.521</td>
<td>.000</td>
<td>.099</td>
</tr>
<tr>
<td>16</td>
<td>Parents lack of perceived benefits from education</td>
<td>3.23</td>
<td>.226</td>
<td>2.352</td>
<td>.020</td>
<td>.096</td>
</tr>
<tr>
<td>17</td>
<td>Low level of parental education</td>
<td>3.38</td>
<td>.375</td>
<td>3.856</td>
<td>.000</td>
<td>.097</td>
</tr>
</tbody>
</table>

N=168   df=167   P<0.05
Source: SPSS output of collected data

The study identified that pupils related factors that significantly contributed to secondary school students dropout were students low expectation on future success (M=3.80, t=8.676, P<0.05), regular absenteeism from school(M=3.44, t=4.788, P<0.05), and low interest towards education(M=3.42, t=3.860, P<0.05).

Consistent with the present study findings, previous study of Shadreck (2013) affirmed that lack of interest, even with high rates of return from educational investment, also appears to be a strong factor influencing a student's decision to drop out from school. Shadreck further asserted that less motivated students with low expectations concerning rewards from graduation and the job market play considerable role in one's decision to quit school.

Similarly, a study conducted by Haileselassie (2011) in the model primary schools of Central Tigray zone revealed consistent result with the present study that pupils’ low expectation on future success and regular absenteeism from school were among the major contributing factors of students' high dropout rate.

Consistently, one respondent during interview replied as follows:

Some students have less interest towards education. They go to school with the pressure of external forces. For instance completing a certain grade is compulsory to obtain driving license. Engaging in commercial activities or becoming a driver has better income than being employed in government offices. On the other hand, private occupations do not demand completing secondary schools at this time. That is why students drop out from this level not to disburse opportunity costs secondary education has.
students from low-income families have a dropout rate of 10 percent than students from high-income families.

One interviewed expert also give emphasis to parent’s lack of perceived benefits from education as follows:

Parent’s need of child labor is among the major parent related factors of students drop out. Since majority of the zone populations have engaged in agriculture, parents need their child labor during harvesting and other farming activities. This may lead students’ missed many school days and finally depart from the system.

Table 4: School Related Factors of Students Dropout

<table>
<thead>
<tr>
<th>No</th>
<th>School Related Factors</th>
<th>Mean</th>
<th>Mean difference</th>
<th>t</th>
<th>Sig. (2-tailed)</th>
<th>Std. error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Poor school management</td>
<td>3.30</td>
<td>.298</td>
<td>3.197</td>
<td>.002</td>
<td>.093</td>
</tr>
<tr>
<td>20</td>
<td>The large size of students in the class</td>
<td>3.04</td>
<td>.036</td>
<td>.298</td>
<td>.766</td>
<td>.120</td>
</tr>
<tr>
<td>21</td>
<td>Sexual harassment of female students in the school</td>
<td>2.80</td>
<td>-.196</td>
<td>-1.873</td>
<td>.063</td>
<td>.105</td>
</tr>
<tr>
<td>22</td>
<td>Shortage of school facilities (desk, chairs, toilets)</td>
<td>2.43</td>
<td>-.571</td>
<td>-.5688</td>
<td>.000</td>
<td>.100</td>
</tr>
<tr>
<td>23</td>
<td>Lack of qualified teachers in the school</td>
<td>1.99</td>
<td>-1.012</td>
<td>-11.810</td>
<td>.000</td>
<td>.086</td>
</tr>
<tr>
<td>24</td>
<td>Unavailability of enough teachers in the school</td>
<td>2.04</td>
<td>-.964</td>
<td>-10.387</td>
<td>.000</td>
<td>.093</td>
</tr>
<tr>
<td>25</td>
<td>Lack of encouragement given by teachers to pupils</td>
<td>2.46</td>
<td>-.542</td>
<td>-5.7888</td>
<td>.000</td>
<td>.094</td>
</tr>
<tr>
<td>26</td>
<td>Lack of support to students who have academic difficulties</td>
<td>3.28</td>
<td>.181</td>
<td>2.021</td>
<td>.000</td>
<td>.097</td>
</tr>
<tr>
<td>27</td>
<td>Inappropriate evaluation of pupils performance</td>
<td>2.82</td>
<td>-.185</td>
<td>-2.1260</td>
<td>.035</td>
<td>.087</td>
</tr>
<tr>
<td>28</td>
<td>School distance from pupils home</td>
<td>2.77</td>
<td>-.226</td>
<td>-2.3619</td>
<td>.019</td>
<td>.096</td>
</tr>
<tr>
<td>29</td>
<td>Unattractive instructional techniques(methods)</td>
<td>3.47</td>
<td>.530</td>
<td>6.096</td>
<td>.000</td>
<td>.088</td>
</tr>
<tr>
<td>30</td>
<td>Irrelevancy of the curriculum to the students</td>
<td>2.67</td>
<td>-.333</td>
<td>-3.6558</td>
<td>.000</td>
<td>.091</td>
</tr>
<tr>
<td>31</td>
<td>Shortage of students’ textbook</td>
<td>2.64</td>
<td>-.363</td>
<td>-3.4723</td>
<td>.001</td>
<td>.105</td>
</tr>
</tbody>
</table>

N=168     df=167     P<0.05

Source: SPSS output of collected data

School related factors of students drop out of school were disclosed in the study. Therefore, poor school management (M=3.30, t= 3.197, P<0.05), lack of additional support students faced academic difficulties (M=3.28, t= 2.012, P<0.05) and less attractive teacher’s instructional methods (M=3.47, t= 6.096, P<0.05) became the major significant school related factor of students drop out in the study area.

Similarly, one interviewee expressed his view as follows:

Unless low achieving students obtained additional support, their frustration increases. They may like to cease their schooling not to repeat the same grade level. Besides, students are suspended for minor infractions in schools. For instance less attractive instructional strategies are being used by teachers without regard to individual student learning styles may lead students to quit from schools.

V. CONCLUSION

From the trend analysis results the study concluded that the magnitudes of dropout rates of students vary from year to year and among grade levels. It was found that students’ dropout rates in secondary schools showed a declining tendency and there were highest dropout rates in grade nine. On the other hand, there was no single major factor that contributes to students high dropout rates in the zone. Rather, several pupil-related (low expectation on future success, regular absenteeism from school and low interest towards education), parent-related (lack of perceived benefits from education, low level of parental education and inability to afford expenses of school supplies) and school related factors (poor school management, lack of additional support of students and less attractive teacher’s instructional methods) were identified as significant factors that induce students to early depart from schools and therefore there is need to take measures by teachers, principals and parent teacher association members to curb the problem.

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VI. RECOMMENDATIONS

It is believed that if parents are informed, concerned, and involved with their child’s education, students stay in school and perform successfully. Thus, parents should actively involve and engage in their child’s education in schools to increase students’ progression rates. Schools should provide support for students who are having difficulty succeeding academically and create self-help mechanisms for economically poor learners and improve teachers methods of instruction.

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Effective Utilization of Condenser Heat of a Refrigerator in a Heating Chamber

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Abstract- This paper presents our research to utilize the otherwise waste heat of a domestic refrigerator. Through this investigation we want to suggest a method to improve the efficiency of the current system.

As purchasing power rises, so does the sales of products like refrigerators and air conditioners. With growing income in both rural and urban households the demand for consumer products will multiply. A recent study suggests that the sales of refrigerators increase by 15% every year. Further, a significant amount of energy is spent on cooking and heating purposes across the world and this amount would also increase in the future. This increase in the energy consumption and the growing levels of pollution are the main motivational factors for us. With our system we aim to conserve energy and create an efficient and a simple system which would tackle these issues.

Index Terms- Domestic Refrigerator, Heating chamber, Efficiency, Waste heat, Recovery

I. INTRODUCTION

All over the world there is a growing consciousness among the consumers and governments alike to employ energy saving measures and reduce the carbon footprint. Our project is a step in this regard. Through this research we would like to present a cost-effective system which could be used both as a refrigerator and a heating chamber or an oven thus improving the efficiency and effectiveness of the existing system. The low cost of this product is possible because of the low investment and effort needed to modify the existing system. We are confident that if this system is incorporated at a OEM level then this impact would also be almost negligible.

The commonly used domestic refrigeration system is based on the vapour compression cycle. The four main parts of the system include the compressor, condenser coils, evaporator and the expansion valve.

Heat rejection in case of a domestic refrigeration system occurs to the ambient air. With growing environmental concerns, the need to utilize energy efficiently is constantly increasing. Waste heat is produced by both the equipment and the thermal processes occurring in the system. We tried to build a waste heat recovery unit in which this waste heat is used for some purpose like for heating water. Therefore, instead of rejecting the heat to the environment which would be nothing but a waste, we try to use that heat in a heating chamber and in a sense, make the refrigeration system more efficient. According to us, this model holds huge potential and further refinements of the model could make mass market adoption easier.

Coming to the units of refrigeration, the amount of heat removed by the refrigeration system is called as the refrigeration ton. It is based on the cooling effect of 1 ton of ice at 32°F melting in 24 hours. The standard refrigeration ton is defined as the transfer of 288,000 BTU’s in 24 hours.

II. PROCESS DESCRIPTION

In the improved refrigeration system, we have primarily focused on the effective utilization of heat. Our main focus has been to use the heat from the condenser coils in a productive way. A description of the components of our system is given below:

i) Compressor: The main aim of the compressor is to take the vapour from the evaporator and increase its temperature and pressure so that it could be easily condensed into liquid form. We have not tampered with the OEM setup.

ii) Heating chamber with coils: The air cooled condensing coils of the system are arranged inside a chamber which would be used as a heat box. Further, a certain length of the condensing coil is outside the heating chamber. The heating chamber is constructed using polyurethane foam because of its high insulation capacity. Also, the chamber is lined with aluminium foil to better distribute the heat inside the chamber.

iii) Expansion Valve: Expansion valve serves the purpose of reducing the pressure of the liquid refrigerant so that the liquid refrigerant could easily vaporize at low temperature inside the evaporator.

iv) Evaporator: This is the part of the refrigeration system that is doing the actual cooling. The evaporator is the heat exchanger made up of several turns of copper or aluminium tubing. The refrigerant in the evaporator, absorbs the heat from the substance which needs to be cooled and is evaporated and fed into the compressor and the cycle continues.
III. EXPERIMENT

Since in the refrigerator, the condensing coils are present on the walls of the refrigerator, some amount of heat must be going inside the refrigeration chamber. This would be putting an extra load on the compressor. Thus, the first step in performing the experiment was to get an idea about the amount of heat going inside the refrigeration chamber.

To measure the temperature of the walls, we used a surface temperature measurement device having a least count of 0.1 °C.

**Observations:**
Ambient Temperature of the surrounding was 27°C
The k factor of the PU foam is 0.025W/mK.
Dimensions of foam are: 0.7*0.695*0.027 m³
To calculate the amount of heat going inside the refrigerating compartment **Fourier’s Law of heat conduction** was used.
Mathematically, it can be represented by the equation:

\[ Q = -k \cdot A \frac{dT}{dx} \]
‘Q’ is the heat flow rate by conduction \((\text{W} \cdot \text{m}^{-2})\)

‘k’ is the thermal conductivity of body material \((\text{W} \cdot \text{m}^{-1} \cdot \text{K}^{-1})\)

‘A’ is the cross-sectional area normal to direction of heat flow \((\text{m}^2)\)

‘dT/dx’ is the temperature gradient \((\text{K} \cdot \text{m}^{-1})\).

The ‘-ve’ sign of equation is to take care of decreasing temperature along with the direction of increasing thickness or the direction of the heat flow.

First, we calculated the temperature at the inside and outside of the two walls of the refrigerator and the compressor.

The following calculations were made:

\[
\text{I. Area of the foam} \\
A = \text{Length} \times \text{Breadth} \\
A = 0.695 \times 0.7 \\
\text{Area} = 0.4865 \, \text{m}^2.
\]

\[
\text{II. Heat going inside on right side} \\
Q_2 = \frac{kA(t_2-t_1)}{L} \\
Q_2 = \frac{0.025 \times 0.4865(36.9+1.95)}{0.027} \\
Q_2 = 17.500 \, \text{W/m}^2
\]

Total Heat going into the refrigerating compartment

\[Q = Q_1 + Q_2\]

\[Q = 32.343 \, \text{W/m}^2\]

Dimensions of the heating chamber:

Length: 0.35m    Breadth: 0.35m    Height: 0.25m

Thickness of each wall: 0.025m      Volume of the cavity: 0.018m³

Ambient Temperature of the room: 30.2°C.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Left wall(inside) (^°\text{C})</th>
<th>Left wall(outside) (^°\text{C})</th>
<th>Top (^°\text{C})</th>
<th>Right wall(inside) (^°\text{C})</th>
<th>Right wall(outside) (^°\text{C})</th>
<th>Compressor (^°\text{C})</th>
<th>Temperature (^°\text{C})</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>3.2</td>
<td>35.2</td>
<td>27.3</td>
<td>-1.3</td>
<td>37.5</td>
<td>59.1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>2.0</td>
<td>35.9</td>
<td>26.5</td>
<td>-2.6</td>
<td>36.3</td>
<td>59.4</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>2.6</td>
<td>35.55</td>
<td>26.9</td>
<td>-1.95</td>
<td>36.9</td>
<td>59.25</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 1:** Observations for heat going inside the refrigerator

<table>
<thead>
<tr>
<th>S. No</th>
<th>Time(minutes)</th>
<th>Temperature(°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>26.2</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>30.2</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>34.2</td>
</tr>
<tr>
<td>4</td>
<td>30</td>
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<td>40</td>
<td>42.3</td>
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<tr>
<td>6</td>
<td>50</td>
<td>46.8</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>49.9</td>
</tr>
<tr>
<td>8</td>
<td>65</td>
<td>51.6</td>
</tr>
</tbody>
</table>

**TABLE 2:** Observation for heat gained by the water
Heat absorbed by 200mL of water in the heating chamber:

**Calculations:**

Heat absorbed by water, \( Q = mc_p \Delta T \)

Where, 
- \( m = \text{mass of water in grams} = 200 \)g
- \( c_p = \text{specific heat of water} = 4.179 \text{J/g}^\circ \text{C} \)
- \( \Delta T = \text{temperature difference} = (51.6 - 26.2) = 25.4 \)°C

\( \therefore Q = 200 \times 4.179 \times 25.4 \) J

\( Q = 21229.3 \) J or 5.443 W in 65 minutes

**IV. CONCLUSION**

With this paper we tried to take a look at a possible method of increasing the efficiency of the present refrigerator. An estimate of the amount of energy that could be recovered from the improved system is presented. More calculations and study are necessary to make a system which could be implemented easily on the refrigerators available in the domestic market. Going further, the system could be improved by installing a water chamber in which the condenser coils are placed. This would ensure that heated water is easily available. Such a system would be suitable for cold countries.

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Emulation tool for research purposes in smart grids


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Abstract- In this work the implementation of a real-time emulator operating under the principle of Power Hardware in the Loop (PHIL) is presented. The system developed is a great tool for the study of electrical anomalies such as harmonics in smart grids. The general structure of the emulator, control scheme, sensors, instrumentation and amplification stages are described, which provides flexibility in terms of power ranges, topologies and control techniques. The algorithms of control and execution of the simulation models in real time are implemented in the platform dSPACE DS1103. The results of the real-time emulation with purely sinusoidal voltages and with harmonic content are presented, which show excellent performance and versatility to analyze study cases with diverse loads; besides, smart grids with different topologies and non-linear loads.

Index Terms- Power Hardware in the Loop, Real Time System, Smart grids, Power Amplification Stage.

I. INTRODUCTION

Tests for the study and analysis of electrical systems are diverse due to the multiple areas of knowledge that are involved in modern electric power systems. An alternative to analyze them is to build the system on real hardware, but it is usually expensive and requires long time to implement and perform the tests. Another option is to use simulation software, but it has the disadvantage that if the system is not properly modeled, it moves away from its real behavior. On the other hand, the simulation using Hardware in the Loop (HIL) is used for the development and testing of embedded systems in real time and constitutes an effective platform to include real behavior of hardware under test (HuT) interacting with models of simulation of complex systems [1]. For its part, PHIL systems are an extension of HIL, particularly in the field of electric power systems, because it allows real-time emulation in which the HuT can be subjected to higher voltage and current levels. This provides almost real test conditions, with a robust, flexible and reliable system [2]. Nowadays, different commercial platforms oriented to the analysis of power systems under the PHIL principle are commercialized. OPAL-RT platforms provides a real-time emulator with stability in simulations due to control and protection of HuT, with field of application in power systems [3]. National Instruments with its PXI units introduces a robust and high-performance platform for manufacturing, military, aerospace, machine monitoring, automotive and industrial testing applications [4]. The NOVACOR platform of RTDS Technologies allows to achieve powerful, accurate, accessible and scalable real-time simulations for control systems [5]. In the literature there are reported works in different areas where the PHIL technique is applied with commercial platforms. In [6], the optimized construction of models are developed for a crystalline photovoltaic panel that is analyzed with a real-time simulator to improve the accuracy of the dynamic model. Also in [7] a simulated energy network through a voltage source converter (VSC) is under test, to analyze stability in the control system, besides a method is proposed to improve some cases of instability. In [8] the implementation of a control for a micro grid is presented. The mentioned platforms allow to have a closed loop system with stability and control in the PHIL simulations, although some disadvantages are the high cost and the closed architecture. In this work the design and implementation of the power, instrumentation and control stages of an electric system emulator under the PHIL principle is carried out. The real-time processing and control algorithms are based on the DS1103 platform and the instrumentation and control stages are carried out, achieving a robust, precise, stable, flexible and low-cost emulator to analyze electrical systems under the PHIL principle.

II. PRINCIPLE OF PHIL OPERATION

Figure 1 shows some of the elements of a micro power grid, it can be seen that it is integrated by elements of distributed generation such as: photovoltaic panels and wind turbines; also some common loads as motors, inverters, linear and non-linear loads are presented. In order to construct a micro grid, it is necessary to have different elements that comprise it, such as measuring equipment, control and processing of information. This is a complex task that requires a great amount of time for its execution. However, the PHIL concept allows to mitigate aspects such as: the lack of infrastructure and execution time without losing accuracy and reproducibility. Figure 2 shows the PHIL concept, which can be divided into the virtual part and the experimental part. The experimental part corresponds to the HuT, which in this case is the photovoltaic system. The virtual part consists of the simulation model executed in real time of the micro grid, without considering the photovoltaic system. The connection between the virtual and experimental stage is made through sensors and actuators; the last one employs usually an amplification stage. In this sense, a power inverter is operated in closed loop to simulate the voltage applied to the HuT, which corresponds to the output voltage of the virtual simulation.
III. IMPLEMENTED SYSTEM UNDER PHIL PRINCIPLE

The implemented system in this work is conformed of a single phase inverter that is controlled with the platform DS1103 using the unipolar PWM switching technique and considering dead times. The control is done with the Simulink / Matlab software and loaded on the DS1103. Also, the single-phase inverter module consists of 6 IGBT's with the flexibility to handle half bridge topologies, single-phase and three-phase complete bridge, it has a variety of protections against severe operating conditions, such as short circuit, overvoltage, overcurrent and overheating. In addition, the converter is powered by a four-quadrant power supply. The inverter output is connected to an LC filter to obtain an AC filtered voltage, which is applied in real time to an external resistor (in this case the HuT). A transformer is used as a voltage sensor for voltage measurement; and the current measurement uses a current probe, fluke i200s, both sensors are connected to ADC inputs of the DS1103 platform. The mentioned key elements of the implemented PHIL system are shown in Figure 3.

Fig. 1. General scheme of a micro grid.

Fig. 2. Micro grid implemented with PHIL.
IV. HUT VOLTAGE CONTROLLER

The voltage controller is one of the most importance part of the PHIL, it allows accuracy in the system performance, since the virtual voltage and the voltage applied to the HUT can have difference in open loop operation such as drop voltage, delays and harmonic distortions. The reference signal of the controller is the block “Sine Wave”, which allows generating purely sinusoidal or non-linear references with the presence of up to five harmonics. The gains $G_{ma1}$ and $G_{transo}$ are used to calibrate the current and voltage sensors respectively. The designed controller is a controller by feedback states, being the voltage in the capacitor and the current in the filter inductor the feedback signals. The gains $G_{ma2}$, $G_{ma3}$, $G_{ma4}$ and $G_{ma6}$ correspond to the controller's gains, which are tuned with Matlab software. The output of controller "A" is sent to the subsystem “INVERTER CONTROL” as shown in Figure 4. The subsystem contains the blocks needed to generate PWM signals with unipolar switching. These signals are sent to the amplification element providing a voltage to the HUT with equal amplitude, phase and waveform that the generate by the voltage control reference.

Fig. 4. Simulation model made in Simulink for voltage control of the HUT.

Using the ControlDesk software, the monitoring of the input and output signals of the DS1103 platform is carried out, in addition, it allows to control some parameters in real time of the simulation model. The signals of the simulation model and measured signals can be displayed graphically as it is shown in Figure 5. The bottom of the Figure 5 shows the variables to be displayed, as well as its magnitude. In order to have diverse conditions in the simulation, the values of the simulation model parameters are changed using the interface. It can be seen in the figure 5 that the controller’s gains and sensor gains are modified individually, while the harmonic components of the reference signals are deployed in matrix form, it allows to modify the magnitude and frequency of each harmonic component. The options "STOP", "PAUSE" and "RUN" are added to control the execution in real time.
V. RESULTS

Three case studies are presented, these allow observing the performance of the emulator with pure sinewave and harmonic reference voltages. The period of time in the simulation is 5e-5 s. A single-phase full-bridge inverter is used, which is powered by a DC voltage of 50V, also a LC filter is used at the output of inverter, where the inductor L is 2mH and the capacitor C is 15 μF; the cutoff filter is 919 Hz. In this study case an external resistance of 56 Ω is used as the HuT.

Figures 6 and 7 show the voltage applied to the HuT with and without control. The reference signal is purely sinusoidal with a frequency of 60 Hz and a peak amplitude of 40 V. It can be clearly seen in Figure 6 that the voltage applied to the HuT and the reference voltage are different in magnitude, phase and waveform, which is due to the attenuation applied by the filter, dead times and variations in the CD voltage source. In Figure 7 the same case study is shown, but now with the control system operating. It can be seen the excellent performance of the controller since practically the reference and the voltage applied to the HuT are practically the same in magnitude, phase and frequency, which makes it possible for the emulator to be used with great accuracy in PHIL systems with linear loads.
The second study case consists in voltage with odd harmonics, the same parameters are used as the previous study case. The output results is similar to a square wave. The magnitude of the voltages is given with respect to the magnitude of the fundamental component (40 Vpeak and a frequency of 60 Hz). The harmonic magnitudes corresponds to: \( V_1 = 1 \), \( V_3 = 1/3 \) and \( V_5 = 1/5 \). Figures 8 and 9 show the results without control and with control, respectively. It can be seen that without control the voltage applied in HUT vary greatly, nevertheless, Figure 8 clearly shows the controller's performance and the excellent response to changes in the reference signal.

Fig. 8. PHIL simulation applying voltage with odd harmonics without control stage.

Fig. 9. PHIL Simulation applying voltage with odd harmonics with control stage.
The third case study consist in five harmonics, it results in a waveform similar to a sawtooth with a negative slope. The magnitudes of the fundamental and the harmonics in per unit are shown below: \( V_1=1, V_2=1/2, V_3=1/3, V_4=1/4, V_5=1/5 \). Figures 10 and 11 show the voltage in HuT and the reference without control and control respectively. It can be seen that the voltage applied to the HuT with control works properly with even and odd harmonics, also it shows great accuracy. This shows that the emulator is capable of working in PHIL systems that contain non-linear elements.

![Fig. 10. PHIL simulation applying voltage with harmonics from 1 to 5 without control stage.](image1)

![Fig. 11. PHIL simulation applying voltage with harmonics from 1 to 5 with control stage.](image2)

VI. CONCLUSION

In this work the implementation and operation of an electrical systems emulator under the PHIL principle was presented. The general structure of the emulator and the different its elements are described, as well as its performance under different case studies. The results allow to determine that the emulator works with great accuracy with voltages of pure sinusoidal references and with the presence of harmonics, which makes it suitable to emulate PHIL systems that have linear and non-linear loads with the control developed. Another aspect to highlight is the flexibility to handle HuT of different powers. Also, since the system is an open architecture, it can be used with different elements.

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Determinants of brand loyalty: A case study of Asian Mobile Phone Users

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Abstract- The study intellectualizes to define the aspects that have impact on the brand loyalty of mobile phones brand in market of Asia. A Questionnaire has been designed in a layout of 7 point Likert scale for the purpose of data collection. Respondents varied between strongly agree and strongly disagree. Sample size of the study has been taken up to 250 respondents including customers having mobile phones of different brands using more than past 2 to 3 years in market of Pakistan. The study investigated that the customers are loyal to their brand attitudinally plus behaviorally. Brand loyalty is positively affected by the Brand trust of customers. Further it has been found that the satisfied customers are the loyal ones. In Pakistan customer preferred the price comparison among brand which influence their loyalty with their brand.


I. INTRODUCTION

The term Brand loyalty researchers and managers have been using in order to explain variety of terms and conceptions associated to consumer buying behavior in marketing (Chaudhuri & Holbrook, 2001). In fact, brand loyalty has been observed as the most important concepts of relationship management in literature of marketing, where the consumer possess an important psychosomatic connection to the brand product consumed (Bennett, Härtel, & McColl-Kennedy, 2005). Researchers have always tried to study the interactive variables that are basis of the customer–brand connection (Chaudhuri & Holbrook, 2001). These variables convey to brand loyalty concept. (Jacoby & Kyner, 1973) has defined brand loyalty as a phenomenon (Fournier & Yao, 1997) of repeated and affectionate purchasing behavior of a customer towards a brand with a long time frame.

Brand loyalty is a vast term and has various dimension (J. L. Aaker, 1997). Khan (2010) (Khan, 2010) identified the two prime dimensions of the term brand loyalty which are based on case studies; examined in the research. The dimensions or elements of the brand loyalty identified by him are “attitudinal loyalty” and “behavioral loyalty”. Khan further explained the differences in aspects of loyalty between the two aspects of loyalty; emotionally loyal and attitudinally loyal consumers. Brand loyalty is multidimensional concept, it comprises mainly three dimensions; emotional tendency of customer towards brand, evaluative tendency and third one is behavioral tendency of a customer towards its brand (Sheth, Newman, & Gross, 1991). Researchers hypothesized that all the dimensions exist within each circumstance where the brand loyalty of customer towards its brand exists. Brand Loyalty in previous studies have been hypothesized by two main types, the behavioral and the attitudinal types (Khan, 2010). Brand loyalty had an unlikely practice research in the practice and the concept has sometimes identified as a multifaceted combination of the attitudinal loyalty and behavioral loyalty (Bennett & Rundle-Thiele, 2002). Brand loyalty magnanimities a puzzle. Most of the people think that it is an attitude based conception which is influenced by management of customer relationships (Uncles, Dowling, Hammond, & Manaresi, 1998).

Brand loyalty has been defined by American Marketing Association (AMA) has defined the concept of brand loyalty as a state of affairs where a customer generally purchase the manufacturer originated product or service on repeated basis over a time span rather than purchasing the same products or services from different suppliers. It is the percentage of degree to which a customer steadily buy same brand products. Brand loyalty has been examined by Aaker, and explained that brand loyalty is the name of a situation that how likely a consumer will switch to other brands, more specifically how many possibility is there for a customer to get switched to other brand, particularly when there are changes in the price, product’s features or a significant change in the marketing or distribution strategy of brand (D. A. Aaker & Equity, 1991).

Brand loyalty is explained as a limit or a level of customer’s truthfulness to a specific product, articulated via his purchases and repeat purchases, regardless of the promotion or advertisement pressure produced by the competitor brands. When customers turn into loyal to brand they mark repeated purchases over a time period. Brand loyalty is the result of buyer’s behavior and got affected by a being's priorities (Bandyopadhyay & Martell, 2007). Customers who are loyal steadily buy products and services from their favored brand, irrespective of their suitability or prices. Different strategies of marketing are being used by organizations often to encourage loyal consumers, be it is through loyalty program, trials and incentives (Subhani; & Osman, 2011).
A customer’s perception which affect the judgment of customer regarding the choice of product ultimately leads to the loyalty to the products and services of a specific brand. Brand loyalty is one of the basic component which form the basis of competitive edge for a company against its competitors (Reichheld, 1996).

A company can increase its growth and economic performance by developing the brand loyalty for its brand among its customers. So the strategy of marketing should be framed in a way that would be helpful in developing the brand loyalty of brands as well as these strategies must be good enough to retain the existing customers in market (Kim, Park, & Jeong, 2004).

There are many research articles stating that loyalty is distributed into two dimensions; attitudinal loyalty and behavioral loyalty. Mostly think that Attitudinal loyalty is predecessor of behavioral loyalty (Bandyopadhyay & Martell, 2007; Carpenter, 2008; East, Gendall, Hammond, & Lomax, 2005; Jacoby, 1971; Pritchard, Havitz, & Howard, 1999; Russell-Bennett, McColl-Kennedy, & Coote, 2007). But some are not agree to this fact like (Labeaga, Lado, & Martos, 2007) argued that brand image might increase behavioral loyalty meaningfully. (Reynolds & Beatty, 1999) has investigated that customer satisfaction has a direct effect on behavioral loyalty. (Day, 1976) mentioned that behavioral loyalty happens due to casual, custom or other factors, but not necessary caused through attitudinal loyalty. (Chaudhuri & Holbrook, 2001) believed that the relationship of attitudinal and behavioral loyalty has to be inter-related not a cause and an effect relationship.

Factors like perceived quality of product, customer satisfaction, trust of customer in brand, switching cost of the consumer and commitment of consumer influence the brand loyalty of the consumers (Afsar, 2010). (Abbasi, Akhter, Ali, & Hasan, 2010) has found that organizations operating in Asia should give prime focus to customer satisfaction in order to earn long term loyalty of consumers. In Asia customer are loyal to their brands (Aamir, Ikram, & Zaman, 2010); (Osman & Subhani, 2010); (Ahmad, 2011), but this loyalty is attitudinal or behavioral it is not studied yet. This study has main focus on exploring these two dimensions of brand loyalty in Pakistan specifically among brands offering mobile phones.

II. LITERATURE REVIEW

Marketing strategies used by the brands have already moved their concentration to the relationships and creation of value which has been directly link with the brand loyalty (Maheshwari, Lodorfos, & Jacobsen, 2014). Marketing literature has taken brand loyalty primarily on academic level (Kabiraj & Shanmugan, 2011). At that time brand loyalty existed only on the behavioral level (Ramesh Kumar & Advani, 2005); (Iglesias, Singh, & Batista-Foguet, 2011) has suggested that the factors, purchase sequence , purchase probability (Kabiraj & Shanmugan, 2011) and purchasing frequency of customer, that were being used for the measurement of the brand loyalty. Brand loyalty always been associated with the positive perceptions of customers regarding the brand (Ishak & Ghani, 2014).

What is meant by the term brand? Brand consists of the logo, the ‘pictorial representation of the company or organization’, ‘the signature of the company’ (Keller, 1998). In Accordance to the American Marketing Association

“A brand is the name, term, sign, symbol or design or a combination of them intended to identify the goods and services of one seller or group of sellers and to differentiate them from those of competitors”.

“Now a days a brand also represents any personality or a signature designed to gather the hearts of customers and to keep them committed” (D. A. Aaker, 2012).

Loyalty

Loyalty is the name of influenced response to a brand or product showed over a time period (Baldinger & Rubinson, 1996). Loyalty can be defined as the buying pattern of a customer which may be a person, a household or an organization (Mellens, Dekimpe, & Steenkamp, 1996). Therefore loyalty has been explained as the steady repurchase of a brand which results from positive attitude of customers headed for a specified brand or the products of that brand (Bloemer & Kasper, 1995).

Dimensions of the Brand loyalty (Pride et al., 2006)

[Diagram of Brand Loyalty]

Attitudinal Loyalty

Behavioral Loyalty

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The term brand loyalty is the customer’s inclination for purchasing a specific brand of a product class (Jacoby & Chestnut, 1978). It can be said that a brand loyalty exists when the customer’s perceived features about the product has been fulfilled by that brand offers. This fulfilled perception of consumer leads to repeat purchase behavior of consumer that results in brand loyalty for that product. Jacoby et al, define the term brand loyalty as the prejudiced, behavioral response of a customer. This behavior should be expressed over a time span by an individual, with a consistent comparison with one or more than one brands in same products or services sector (Jacoby & Chestnut, 1978). Brand loyalty has a relation with consumer’s preferences and attachment with the brand (D. A. Aaker & Equity, 1991). (Cunningham, 1956) suggested that because of long usage of a particular product and development of trust for brand, customer become loyal to the brand. (Cunningham, 1956) specified three definitions of the brand loyalty which consists of; consumer’s loss and gain over a specific timeframe. (Olson & Jacoby, 1971) designed factor analysis study to theorize the conception of a brand loyalty of a specific brand. Further it has found by the academicians that brand loyalty has a relation with the; percentage of customer’s buying dedicated to the most bought brand (Shankar, Smith, & Rangaswamy, 2003).

Dimensions of brand Loyalty

In 1976 (Day, 1976) suggested that the brand loyalty should be taken as an amalgamated perception. According to this view brand loyalty must comprises of both attitudinal element as well as behavioral element (Pride et al., 2006).

**Behavioral loyalty:** The behavioral loyalty is the attitude of brand loyalty which is mainly concerned with the measures of repeated purchasing behavior, percentage of purchases and rate of recurrence of purchases. The admiration of these measures has varied over time and among researchers as both types have some strengths as well as some weaknesses (Mellens et al., 1996).

Behavioral measures of a person’s perception regarding the brand explains the brand loyalty by measuring the actual purchases made by the customer over a time period. (Dekimpe, Steenkamp, Mellens, & Abeele, 1997).

Some merits of behavioral loyalty for an organization are;

1. Behavioral loyalty is based on actual purchases which have direct relation with performance.
2. Behavioral loyalty is not supplementary as it is based on customer’s behavior over a time period.
3. There is comparatively ease in data collection in case of behavioral loyalty rather than attitudinal data.

while it has some limitations as, this type of loyalty do not make any difference between brand loyalty and repeated purchases, so it might include forged loyalty (Mellens et al., 1996).

**Attitudinal loyalty**

Dick & Basu, (1994) reasined that the buyer’s attitudes should also be considered in addition to behavioral dimensions of brand loyalty (Dick & Basu, 1994). Factors like intentions of re-buying, positive feedback, and brand commitment are the dimensions of attitudinal loyalty (Pride et al., 2006).

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Behavioural Measures</strong></td>
<td>1. Based on actual behaviour</td>
</tr>
<tr>
<td></td>
<td>3. Easy to collect data</td>
</tr>
<tr>
<td><strong>Attitudinal Measures</strong></td>
<td>1. Repeat buying separated from brand loyalty.</td>
</tr>
<tr>
<td></td>
<td>2. less sensitive to short-run fluctuations.</td>
</tr>
<tr>
<td></td>
<td>3. Easier to pick right decision unit.</td>
</tr>
</tbody>
</table>

(Pride et al., 2006)
Measurement of both the behavioral and attitudinal loyalty dimensions helps the manager to understand the concept of brand loyalty (Bandyopadhyay & Martell, 2007). It is much easier for the manager to discover the reasons behind the customer’s buying behavior, and help them in recognizing the strength and weakness of their brand (Ioannou & Rusu, 2012). Attitudinal loyalty is based on an emotional and psychological affiliation that a buyer may advance towards a brand (Bowen and Chen, 2001). The cognitive, affective and conative are the three dimensions of attitudes of customers (Dick & Basu, 1994).

(Khan, 2010) conducted a research study with an objective to discover the elements that explicate the development of behavioral dimension of loyalty. Literature on loyalty has been studied by Khan (Khan, 2010). Key aspects have been acknowledged which are significant in increasing loyalty (both attitudinal as well as emotional). There has been a research study conducted by Khan with a purpose to identify the factors that distinguish customer into two categories; emotionally (behaviorally) loyal customers and attitudinal loyal customers. In order to achieve this objective variables of both categories of loyalty have been identified through primary research and previous literature. Variables or determinants of attitudinally loyal and behaviorally loyal customers have been identified by the research study (Olson & Jacoby, 1971). It has been found that customer who are behaviorally loyal have higher perception regarding quality of product and services (Ong, 2008). While attitudinal loyal customer always make a comparison with the products of competitors. (Khan, 2010) (Ladhari, Souiden, & Ladhari, 2011). It has been found in the study conducted by Khan that a behaviorally loyal customer would take 5 years to become loyal with the brand while an attitudinal loyal customer would take only 3 years to become loyal. Further it has been examined that behaviorally loyal customer is eager to make payment 20% more for a product as compared to the competitors on contrast attitudinal loyal customer are not willing to extra penny. The last significant feature that had been revealed is connected to cultural differences. Further cultural difference has been studied and it has been found that the people who belong to the Asian culture are more likely to be behaviorally loyal as they take into consideration the brand image. While European people do not pay attention to brand image and are less likely to become loyal (Khan, 2010).

Aaker hypothesizes brand loyalty is a pyramid having five levels. The bottommost level of this pyramid shows the non-loyal customers who have indifferent behavior towards the brand; who supposed brands are being not important where the brand name has very little or no impact on their purchase decision. On the 2nd level of pyramid of loyalty those customer are lying who are satisfied or dissatisfied with the product. The next pyramid level are the satisfied buyers who might switch and have low switching cost; there is less risk associated with the change in product or brand. Next level consumers are brand friendly. While the fifth level of loyalty pyramid contain that customer who are committed to the brand. They feel proud of themselves being associated with the brand further they recommend the brand to others (D. A. Aaker, 2012).

The Brand Builder model explain the method of studying the phenomenon of brand loyalty construct. These methods contain both attitudinal and behavioral elements of brand loyalty. This has been formulated on the basis of some presumptions; that every brand could be explained behaviorally. A variety of questions or survey can be used at the place of purchase or in the markets to observe the behaviors and attitudes of customers towards a specific brand (Mellens et al., 1996).

(Unces et al., 1998) little evidences have been found that the construct of brand loyalty gradually declines for last decades and the brand loyalty pattern for the organizations who lead the market share is stable. (Dekimpe et al., 1997) states that buying choices of customer is based on brand loyalty might become simple and habitual in its nature. Which is a result of satisfaction related to the brand. A strong base of the loyal customers always beneficial for a firm because it causes a reduction in the advertising cost of business. Further loyalty can be capitalized on different strategies such as brand expansion strategy and market penetration (Solomon, 2014). (Dick & Basu, 1994) argued that loyalty should not be limited up to only repurchase behavior. This brings a new door open for the large number of variables which can be used for studying the brand loyalty (Ladhari et al., 2011). Literature further suggested that brand management phenomenon do not change the whole structure of market (Meyer-Waarden & Benavent, 2006).

Significance of Brand Loyalty

Brand loyalty is a vital objective and a significant outcome of an effective promotion programs, sales creativities and product growth exertions. Every successful brand has loyal customers at their nucleus. These loyal customers consider the brands in a better way, make purchases more frequently and suggest the brand to other people. Loyal customers are the basic base of marketing strategy of an organization; base of profitable outcome as well as a sound platform of brand development and upgrading. Loyal customer are direction for brands, if a brand loses its sight on customer it may lose its direction and may suffer loss in shape of market share decline.

Theoretical Framework

This study has suggested a model for the determination of dimensions of brand loyalty for mobile phones among customers. Further explaining the lengths of attitudinal loyalty as well as behaviorally loyalty for brands of mobile phones. Literature has suggested that there is an effect of satisfaction (Russell-Bennett et al., 2007), as well as perceived value of brand is also associated with the brand loyalty (Yi & Jeon, 2003), there is an association between price of product and loyalty level of customers of that brand (Krishnamurthi & Raj, 1991). Chaudhuri and Holbrook (2001) has found that the brand trust has also an affect on the loyalty of customer regarding that brand; the authors inspected two facets of brand loyalty; purchasing loyalty and attitudinal loyalty. These aspects of loyalty have taken as relating variables in the associations of impacts from trust in brand as well as brand affect to brand performance (Chaudhuri & Holbrook, 2001).

Literature discussed the attitudinal and the behavioral dimensions of loyalty (Day, 1976; Dick & Basu, 1994; Mellens et al., 1996). Attitudinal loyalty is an attitudinal predilection entailing faithfulness to a specific brand and aim of customer to buy again the
brand (Mellens et al., 1996). The faithfulness aspect shows the affective constituent of a customer's attitude and the intention constitute shows the cognitive or evaluative element of a customer's attitude (Gautam, 2015). Contrastingly, behavioral research in loyalty is only concerned with actions which are observable; actual purchasing behaviors (Devece, Garcia-Agreda, & Ribeiro-Navarrete, 2015). Therefore, behavioral loyalty is being explained as purchasers' replication of buying pattern for a specific brand; that is also discovered by the arrays of continued support and real expenditure behaviors” (East et al., 2005).

Bennett & Rundle-Thiele (2002) have studied the attitudinal loyalty and their study shows the results suggesting that the attitude headed for the deed of purchasing a brand can be used to explain or envisage purchasing behavior (Bennett & Rundle-Thiele, 2002). Fader & Schmittlein (1993) proposed a demonstrating framework in order to study customer behavioral loyalty as evidenced by two aspects of loyalty: the first one is the hard-core loyalty, when a customer’s wholly repeat purchase of one product substitute, and the 2nd one is strengthening loyalty, when customers might be get switched among product substitutes (Fader & Schmittlein, 1993). An association between quality and behavioral loyalty has been perceived in which the coefficients are not only highly significant but also are of high value (Liang & Wen-Hung, 2004).

Hypothesis no. 1: Satisfied customer are loyal ones; hence there is a positive relationship between the satisfaction and brand loyalty

Literature always states that more the customer is satisfied with the brand products and services the more he is loyal with the brand (Bowen & Chen, 2001; Fornell, 1992; Lam, Shankar, Erramilli, & Murthy, 2004; Wallin Andreassen & Lindestad, 1998). In this study, the association in the customer satisfaction level and brand loyalty of mobile phones is going to be examined. For this following hypothesis is designed.
H1. Customer satisfaction has a positive effect on brand loyalty.
H0. Customer satisfaction has no effect on brand loyalty.

Hypothesis no. 2: Brand loyalty increases when perceived value of brand is fulfilled

Customer become aware of the brand due to promotions and marketing efforts of an organization done for its brand (Jacoby, Olson, & Haddock, 1971). Brand offer a set of features which are associated with the product of that brand. As a result of these promotions a customer perceived specific features and quality aspects regarding that brand (Severi & Ling, 2013). When once these perception become reality customer intend to buy the products from the same brand and this commitment with the brand leads to the brand loyalty (Lam et al., 2004).

In this research study a hypothesis is designed to find out whether the loyalty for mobile phones brands increases if value of brand perceived by the customer is fulfilled or it has no impact on brand loyalty.
H2. Perceived value has a positive effect on brand loyalty.
H0. Perceived value has no effect on brand loyalty.

Hypothesis no. 3: Customer remain loyal irrespective of price of products

Price always a deciding factor in purchase decision of customers (Grabowski & Vernon, 1992; Krishnamurthi & Raj, 1991). But if a customer is loyal with the brand the rising prices will not affect the buying pattern of the customer. In the market of Pakistan where competition among the mobile phones brand is fierce, price must have an impact on buying patterns of customers. In order to find this out following hypothesis is designed.
H3. Price has effect on brand loyalty
H0. Price has no effect on brand loyalty

Hypothesis no. 4: Satisfied customer has trust in brand

The results obtained from literature suggested the key role of brand trust in building brand loyalty. Trust in brand is a variable that creates consumers’ commitment, especially in circumstances of high involvement of brand and customers; the effect of brand trust is stronger as compared to overall satisfaction in brand loyalty (Selnes, 1993).

Hence to study the effect of trust in brand over satisfaction and then ultimately on brand loyalty a hypothesis is designed.
H4. Trust has a positive effect on brand loyalty.
H0. Trust has no effect on brand loyalty.

Hypothesis no. 5: Customer of mobile phones brands are attitudinally loyal with brand

The Brand Builder model provides a way of studying the brand loyalty concept which entails the both aspects of loyalty; attitudinal and behavior components (Boyle, 2007). To find out the loyalty dimensions of customers of mobile phones in the market of Pakistan following hypothesis has been designed.
H5. User of mobile phones are attitudinally loyal
H0: User of mobile phones are not attitudinally loyal

Hypothesis no. 6: Customer of mobile phones brands are behaviorally loyal with brand

It is based on the assumptions that all brands can be described behaviorally, that a series of survey questions can be employed in place of probability of purchase, and that consumer behaviors and attitudes towards brands can be linked (Baldinger & Rubinson, 2015).
(Khan, 2010) conducted a research study with an objective to explore the elements that explain the development of behavioral loyalty. These study results are further carried in current research which have a purpose to find out whether customers of mobile phones are attitudinally loyal or behaviorally.

H6: User of mobile phones are behaviorally loyal

H0: User of mobile phones are not behaviorally loyal

Hypothesized Research Model

![Hypothesized Research Model Diagram]

Sample and Procedure

We focus on the mobile phones users of all brands. There are many brands of mobile phones available in market. Further the all demographics of customers have been taken in this research.

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>45.2</td>
</tr>
<tr>
<td>Female</td>
<td>54.8</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>16-25 years</td>
<td>60.8</td>
</tr>
<tr>
<td>26-45 years</td>
<td>37.2</td>
</tr>
<tr>
<td>Level of Education</td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>3.6</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>9.6</td>
</tr>
<tr>
<td>Masters</td>
<td>86.8</td>
</tr>
<tr>
<td>Income level</td>
<td></td>
</tr>
<tr>
<td>10-20 lac</td>
<td>74.8</td>
</tr>
<tr>
<td>20-30 lac</td>
<td>12.0</td>
</tr>
<tr>
<td>40-50 lac</td>
<td>1.6</td>
</tr>
<tr>
<td>60-70 lac</td>
<td>2.0</td>
</tr>
<tr>
<td>more than 70 lac</td>
<td>9.6</td>
</tr>
<tr>
<td>% of mobile phones from this brand</td>
<td></td>
</tr>
<tr>
<td>0-15%</td>
<td>11.6</td>
</tr>
<tr>
<td>16-30%</td>
<td>9.2</td>
</tr>
<tr>
<td>31-45%</td>
<td>2.0</td>
</tr>
<tr>
<td>46-60%</td>
<td>8.4</td>
</tr>
<tr>
<td>61-75%</td>
<td>25.6</td>
</tr>
<tr>
<td>76-90%</td>
<td>28.0</td>
</tr>
</tbody>
</table>
Data collection: data is collected with the help of questionnaire which has been adopted from the research of (Khan, 2010). We distributed 300 questionnaires and out of them 270 responses were obtained. After missing value analysis, the final sample consists of 250 responses. The demographics of the respondents are given in Table 1.

Measurement
For the measurement of variables we use items; for satisfaction we used 3 items, for perceived value we used 3 items. To measure the variable of brand trust we used 3 items, for price we used 3 items. For measuring the attitudinal loyalty we used 4 items and for behaviorally loyalty we used 4 items.

Data Analysis
Data has been analyzed in three steps
a. The reliability of data has been analyzed
b. The regression analysis is run to check the dependence of brand loyalty on the hypothesized variables
c. Then the data has been analyzed descriptively to check the percentages of loyalty dimensions; attitudinal or behavioral

Measurement Reliability
The seven construct showed high internal consistency and reliability with Cronbach alpha value .674 while Cronbach Alpha.

Regression analysis
To analyze the effect of different constructs on brand loyalty regression analysis is done and following results have been found out.

Hypothesis no. 1: Satisfied customer are loyal ones; hence there is a positive relationship between the satisfaction and brand loyalty
H1. Customer satisfaction has a positive effect on brand loyalty.
H0. Customer satisfaction has no effect on brand loyalty.

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>13.674</td>
<td>1</td>
<td>13.674</td>
<td>24.754</td>
</tr>
<tr>
<td>2</td>
<td>Residual</td>
<td>136.990</td>
<td>248</td>
<td>.552</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150.664</td>
<td>249</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Having satisfaction independent variable and brand loyalty dependent variable regression analysis shows with the Significance value of .000 and with df 1. It means the satisfied customer of mobile phones in Pakistan are loyal ones. Hence H1 is accepted.

Hypothesis no. 2: Brand loyalty increases when perceived value of brand is fulfilled
Having perceived value of brand independent variable and brand loyalty dependent variable regression analysis shows with the Significance value of .000 and with df 1. It means the customer with fulfilled perceptions of mobile phones in Pakistan are loyal ones. Hence H2 is accepted.

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>16.432</td>
<td>1</td>
<td>16.432</td>
<td>30.359</td>
</tr>
<tr>
<td>2</td>
<td>Residual</td>
<td>134.231</td>
<td>248</td>
<td>.541</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150.664</td>
<td>249</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hypothesis no. 2a: Perceived value of brand has positive impact on customer satisfaction

Having perceived value of brand independent variable and customer satisfaction dependent variable regression analysis shows with the Significance value of .000 and with df 1. It means the customer with fulfilled perceptions of mobile phones in Pakistan are loyal ones. Hence H2a is accepted.

H2a. Perceived value has a positive effect on customer satisfaction.
H0. Perceived value has no effect on customer satisfaction.

<table>
<thead>
<tr>
<th>Table 4: Effect of perceived value on customer satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Hypothesis no. 3: Customer remain loyal irrespective of price of products

Having price of brand independent variable and brand loyalty dependent variable regression analysis shows with the Significance value of .000 and with df 1. It means the customer consider price of mobile phones in Pakistan. Hence H0 is accepted.

H3. Price has effect on brand loyalty
H0. Price has no effect on brand loyalty

<table>
<thead>
<tr>
<th>Table 5: Customer remain loyal irrespective of price of product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Hypothesis no. 4: customer who has trust in brand are brand loyal

Having trust in brand independent variable and brand loyalty dependent variable regression analysis shows with the Significance value of .000 and with df 1. It means the customer with fulfilled perceptions of mobile phones in Pakistan are loyal ones. Hence H4 is accepted.

H4. Brand Trust has a positive effect on brand loyalty.
H0. Brand Trust has no effect on brand loyalty.

<table>
<thead>
<tr>
<th>Table 5: customer who has trust in brand are brand loyal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Hypothesis no. 4a: customer who has trust in brand are more satisfied

Having trust in brand independent variable and customer satisfaction dependent variable regression analysis shows with the Significance value of .000 and with df 1. It means the customer with fulfilled perceptions of mobile phones in Pakistan are satisfied ones. Hence H4 is accepted.

H4a. Brand Trust has a positive effect on customer satisfaction.
H0. Brand Trust has no effect on customer satisfaction.

<table>
<thead>
<tr>
<th>Table 6: Effect of Brand trust on customer satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Regression</td>
</tr>
<tr>
<td>Residual</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Hypothesis no. 5: Customer of mobile phones brands are attitudinally loyal with brand

The descriptive statistics shows that only 39.5 % customer are agree with the fact that they are attitudinally loyal with their brands. While 17% are agree and 12% disagree with this.

Hypothesis no. 6: Customer of mobile phones brands are behaviorally loyal with brand
Further the descriptive statistics of behavioral dimension of loyalty shows that 35% people agree that they are behaviorally loyal while 10 % strongly disagree, 14% are strongly agree to this fact.

Findings
This study has the objective to study the brand loyalty dimensions among the user of mobile phones in market of Asia specifically in Pakistan. The results of the study shows that the customers are loyal to their brands if their perceptions regarding services of the brand are fulfilled. Further it has been found that if customer is satisfied with the services and products of brand he remain loyal otherwise he will switch to other brand. Study also found that loyal customer have trust in brand of mobile phones they are using. Literature always showed that price is irrelevant factor for loyal customers, but in this study it has been found that price is considered by the customers. So mobile phones brand should have look on the market prices also if they want to keep their customer loyal. Two dimensions of brand loyalty have been discussed in the literature review. This research has studied the new paradigm of these dimension; either customer of mobile phones in the market of Pakistan are loyal with mobile phones brand attitudinally or behaviorally. Results show mix calculations; customers are equally loyal to brand attitudinally as well as behaviorally.

Managerial Implication
This study is helpful for the managers of mobile devices brands. They can observe the behavior and loyalty pattern of their consumers and this will help them to improve their loyalty development program.

Limitations of the study
Although this study works on new paradigm of brand loyalty of mobile devices in Pakistan, but there are certain limitations of this study
1. The population of the study is limited as compared to the number of users of mobile devices in Pakistan
2. The study I mainly focusing on the two determinants of brand loyalty; attitudinal loyalty and behavioral loyalty. According to literature the determinants of loyalty are many.
3. The study is just explaining the effect of determinants of loyalty not their pattern.

Recommendations for further research
This study can be used as a base and researcher can further explain the moderating and mediating effects of aforementioned determinants of brand loyalty. Further it can be used to study the effect of a specific brand loyalty program in Pakistan.

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Teacher Performance Based on Stress and Organizational Commitment

Nur Laily, Dewi Urip Wahyuni

A lecturer in Sekolah Tinggi Ilmu Ekonomi Indonesia Surabaya

Abstract- The biggest responsibility of current teachers in this globalization era is to increase their knowledge so that they could give high contribution to better students’ characters. One of the best ways is to really comprehend rigidly the curriculum goals for preferable and optimum classroom settings.

Education curriculum in surabaya, in particular, has changed since 2012 in which the government used to kurikulum tingkat satuan pendidikan (KTSP). Since 2013 then the government changed it into curriculum 2013 (K-13) which has been implemented for two years particularly for the first and second levels at secondary and high schools. Many teachers have been trained in order to support the policy through workshops at local or national levels. But in 2015 the government changed the curriculum again to refer back to previous KTSP model. These changes bring about difficulties for teachers who have already stucked to apply previous teaching materials and text books, meanwhile the government did not provide complete guidances yet. While the process was going on, at the same time, the teacher had to give appraisal about the student’s attitudes and behaviors daily as the alternative assessments.

This study is intended to analyze the influence of stress work to organizational commitment, job satisfaction and teacher’s performance at senior high schools in north surabaya in which job satisfaction and teacher’s performance are as dependent variables while stress work and organizational commitment as independent variables.

The population of this research was 425 private senior high school teachers from north surabaya. The sample used in this research was 200 private senior high school teachers collected by using cluster random sampling technique. The instrument used was questionnaires that were then processed by applying the structure equation modelling (SEM) and the analysis of moment structure (AMOS2.0).

The results of this research indicate that there were influences between stress work and job satisfaction, organizational commitment and job satisfaction, stress work and teacher’s performance, and organizational commitment on teacher’s performance and there were negative influences between work stress and organizational commitment. The research is also expected to be useful and meaningful for the next researchers and for the social science developments especially of organizational behaviors.

Index Terms- Stress work and organizational commitment, job satisfaction and teacher’s performance

I. INTRODUCTION

Education serves as a way or means in advancing the nation's cultural civilization. Education is expected to provide the widest opportunity for all citizens in obtaining the right for education in accordance with the hierarchically levels. Profession as teachers has an important role in educating students to be able to become a national asset of character particularly as the assets of the next generation.

The teacher's role is very important to the intelligence of learners that changes the character of the learners better. This has to do with the learning system or curriculum change since 1994 turned into the 2004 curriculum (Competency-Based Curriculum), later it turned into a Unit Level of Curriculum (SBC) and transformed into the curriculum in 2013 (K-13). The latest raises new polemics that dress the minister then to replace the curriculum anyway. In 2012 the Government and minister of Mohammad Nuh applied learning systems to the curriculum of 2013 (K-13) and started running already 2 years and its implementation is for class X and XI. The 2013 curriculum is expected no change in the learning system because of its improvement from the previous curriculum. By 2015 the new minister of Anis Bawesdan, the curriculum is changed and returned to the Unit Level Curriculum (SBC) or curriculum 2006. The curriculum changes create confusion and stress for teachers formerly SBC which is not 100% comprehensible turns into the curriculum in 2013 and even though it is still unrealized well, it is finally replaced using the old curriculum of SBC. The curriculum of SBC uses national standards and teachers are given the freedom to create their own curriculum based on their respective territory but still sticks to the goals that have been agreed upon by the Government. At SBC, teachers are still confused especially on how to create the Plan of Learning Programme (RPP), how to make a minimum completeness criteria (KKM), item analysis, and how to report on the development of student learning. In fact, many teachers do a copy-paste of the document from other schools so that it will be transmitted from one school to another school. According to Handoko (2010: 200) stress is a condition that affects the emotional tension, the thought process and the person's condition. According to Anwar Khan et al. (2012) saying that Teachers' stress in particularly means a situation where the teachers are exposed to Certain unwanted environmental factors, which either exists within the educational institution (internal factors) or exists outside the educational institution (external factors). These factors hamper the normal routine life of teachers by negatively affecting their performance at work.
Organizational commitment to a teacher is indispensable in carrying out its duties as a teacher. Although the teachers are very heavy task in implementing the learning of the students, a teacher must remain committed to the profession. Mc Sehane et al. (2003:32) explain the strong organizational behavior commitment can make someone to achieve their importance and the aim organizational with maximal.

Job satisfaction is closely linked to individual achievement. If a person is satisfied with the performance of work will increase and vice versa if someone feels dissatisfaction at work will lead to decreased achievement. According Luthans (2006: 243) job satisfaction is an emotional state that is happy or positive emotions derived from the assessment of a person's job or work experience.

Teacher performance is the result of the performance of teachers to become professional teachers According to the Law no.14 th 2005 that the professional is the work done by someone and become a source of income and a life that requires expertise, or skills that meet certain quality of standards or norms and require a professional education. A teacher with his expertise, can be expected to change the character of the students to become qualified learners.

At the present globalization, education is required to be better especially on teachers to constantly improve their ability so that teachers can contribute to learners to be better. The purpose of this study is to determine the effect of work stress and organizational commitment to job satisfaction and teacher's performance.

II. THEORETICAL REVIEW

Work Stress
Each person must experience stress at work. Work stress is always experienced by every individual in carrying out the duties as an employee because they feel dissatisfied with their workplace or also due to the leadership which cannot protect his men, causing employee turnover or caused by the curriculum changing. Prolonged stress will lower morale and performance of employees. According to Luthans (2006: 243), job satisfaction is an emotional state that is happy or positive emotions derived from the assessment of a person's job or work experience. According to Robbins (2006: 794), there are three categories of stress in the workplace, namely: environmental factors, organizational factors and individual factors. Environmental factors are related to the relationship of a person in the organization that is in a relationship with superiors, subordinates or colleagues. If a person is not able to establish relationships that are not good, it will give rise to feelings of depression, organizational factors which are related to the role of individuals within the organization and the individual factors relating to the profession and the excessive workload and pressure of time given to complete.

Organizational commitment
Organizational commitment is defined as a situation where an employee favoring certain organizations as well as the goals and desires to retain membership in the organization. Thus, the involvement of high employment means favoring certain work of an individual, while the high organizational commitment means an impartial organization that recruits individuals. (Robbins, 2008). Organizational commitment is a person's attitude towards the institution organization to achieve a goal and has high organizational commitment to the institution. According to Allen and Meyer in Luthans (2006: 249) there are three dimensions in organizational commitment, the affective 1.Commitment is the employee's emotional attachment, identification and involvement in the organization, 2. Commitment of continuation is a commitment based on the advantages and disadvantages associated with the release employees of the organization, 3. Normative commitment is feeling obliged to remain in the organization because it must be so, such action is the right thing to do.

Job satisfaction
Job satisfaction refers to an individual's general attitude towards work, Robbins (2002: 179). Further he said that the general attitude can be classified to two things: the negative attitudes that will raise a worker if they are not satisfied with their jobs. Conversely, if a person is satisfied with the jobs then he/she will bring a positive attitude. It is also in line with what is proposed by Locke (in Bhuiyan, 1996) who states that job satisfaction is a positive or negative attitude resulting from the assessment of workers against job or experience obtained. Job satisfaction is an attitude that individuals have about Reviews their jobs. It results from their perception of Reviews about their job, based on factors of the work environment, such as the supervisor's style, policies and procedures, work group affiliation, working condition, and fringe benefits (Gibson et al., 1997: 75).

Job satisfaction for teachers is an expectation that teachers can perform teaching duties. A teacher will be satisfied if the job satisfaction of teachers are met with the achievements of learners and success in teaching. Job satisfaction of teachers will have an impact on performance. According to Hughes (2012: 312), it is also associated with feelings of job satisfaction or a person's attitude about the work itself, salary, promotion or education, supervision, co-workers and workload.

Teacher Performance
A performance by Bernardin and Russel (1995: 379), is a record of gains resulting from the function of a particular job or activity during a specific time period. So the performance with regard to the work is achieved by employees in a certain period. In this case the performance is related to the quantity and quality of work produced. Bowin and Harvey (1996:140) said Performance may be defined as the accomplishment of an employee or manager assigned duties and the outcomes produced on a job function or activity during specified time period”.

Teacher performance or achievement is the result of the work of teachers in performing their duties as teachers which are associated with the increased human resources through the education sector that is expected to become professional teachers in the field. Related to the principles it requires for training and coaching continuously to develop their knowledge. According to the Ministry of National Education in 2008, the teacher's performance appraisal program includes planning learning
activities, the implementation of learning activities and learning evaluation.

The relationship between Work stress and organizational commitment

Work stress emerges as a mismatch between the individual and the work environment, the higher the job stress experienced by a person, the lower the organizational commitment has. Velnampy and Aravintan (2013) argue that work stress has a negative and significant relationship with organizational commitment. Role conflict and ambiguous role as a shaper of stress have an influence on the decrease of organizational commitment, which means there is a negative and significant relationship between job stress with organizational commitment (Pool, 2000).

The research hypothesis as follows:

H1 = There is a negative affects between work stress and organizational commitment

The Relationship between Work Stress and Job Satisfaction

Stress and job satisfaction have a reciprocal relationship. Several studies are already conducted by researchers who study the relationship between stress and job satisfaction. Both are inter-connected as has been proposed by Robbins (2003), that one of the effects of psychological stress can decrease employee satisfaction. Robbins (2003) also believes stress can lead to dissatisfaction. Stress is associated with work-related cause dissatisfaction with the job and that's the psychological effect of the simplest and most obvious effect of stress. Furthermore Robbins (2003) suggests that the effects of stress on a much more immediate gratification. Work-related tension tends to reduce the general job satisfaction. Although low to moderate levels may improve performance, the employees feel that stress is not fun.

Then the research hypothesis is:

H2: Work Stress has an affects to Job Satisfaction

The Relationship between Job Satisfaction and Teachers Performance

Staff job satisfaction can affect patient outcomes. All service providers showed better services when they are satisfied with their jobs and when they feel committed to the organization (McNeese-Smith, 1996). Al-Ahmadi (2009) conducted a study of 923 nurses at a hospital in Riyadh, Saudi Arabia on the relationship between employee performance and job satisfaction and commitment of employees on organisational. Performance is also positively associated with organizational commitment, confirming the discovery by researchers earlier that organizational commitment is a strong determinant of the performance of the employee (Al-Meer, 1995 in Al-Ahmadi, 2009).

Then the research hypothesis is:

H4: Organizational Commitment has an affect teachers performance

The Relationship between Work Stress and Teacher’s Performance.

Higgins (Umar, 2000: 259) argues that there is a direct relationship between job stress and employee performance, a large number of studies have investigated the effect of work stress with the performance presented in the model of stress - performance (inverted U relationship) that the law of Yerkes Podson (Mas'ud, 2002 : 20). The inverted U pattern suggests the influence of stress level (low - high) and performance (low - high). If there is no stress, challenge, and work is also no tendency to performance decreases. If the stress even become too large, the performance will start to decline because of stress interference with the implementation of the work. Employees lose the ability to control it. The most extreme result is performance becomes zero, the employee becomes no longer strong enough to work, desperate, out or refuse work to avoid stress.

Then the research hypothesis is:

H5: work stress has an affects to teachers performance

The Relationships of Organizational Commitment and job satisfaction

Employee commitment is an important factor to improve organizational performance. Organizational commitment is the identification and involvement of someone who is relatively strong against the organization. Employees who have a strong commitment to the organization is an asset in achieving the goals of the organization, so as to provide maximum benefit to the organization. Employees are encouraged to have commitment needed to resolve the problems of internal organization such as reduced cost of operations and conflicts within the organization. A strong commitment allows each employee to strive to meet the challenges and pressures that exist. Success in meeting these challenges will foster a sense of pride towards the organization and it raises employee satisfaction (Toegijono, 2007). Research conducted Kadir (2003) examines the effect of organizational commitment on job satisfaction and turnover intentions auditor in public accounting firm in Java. The research results proved that the organizational commitment significantly associated with job satisfaction.

Then the research hypothesis is:

H6: Organizational Commitment has an affects to job satisfaction

Methodology Research
This research is a descriptive that aims to describe the performance of teachers. The population in this study are all high school teachers in North Surabaya Private Schools totaling 425 people. The samples included 200 teachers with the criteria, teachers who teach the curriculum in 2013. Methods of sampling use purposive random sampling technique. Data collection methods are surveys and questionnaires. Data analysis technique is using Structural Equation Modelling (SEM) by using the program of Analysis of Moment Structure (AMOS) version 2.0.

Table 1
Dimensional Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Indicator</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Stress (X)</td>
<td>X1.1 = Environmental Factors</td>
<td>Robbins (2006: 794)</td>
</tr>
<tr>
<td></td>
<td>X1.2 = Organizational Factors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X1.3 = Individual Factors</td>
<td></td>
</tr>
<tr>
<td>Organizational</td>
<td>X2.1 = Affective</td>
<td>Allen and</td>
</tr>
</tbody>
</table>

Conceptual framework

![Conceptual framework diagram]

III. ANALYSIS AND DISCUSSION

Description of Respondents

The number of samples in this study is 200 respondents in North Surabaya high school teachers with the following characteristics: 43% male and 57% female, the age is 30th of most respondents - 40th by 46%. The respondents education are S1 and S2 by 61% = 39%. The working periods of respondents are between 10-20 = 35%. Conformance Test Model (Goodness -of-fit test)

Testing the model in SEM aims to look at the suitability of the model. According to Kline (1998) that the model can be resumed if the results of the overall model test or F-test at α = 5% are outside the boundaries of more than 1.96 in two-way test, means that the indicator showed no relationship among the variables of oxygen. Chi-square test showing a value close to zero indicates a low difference between expectations and observations, in addition, the probability level should be greater than 0.05 when the chi-square is close to zero. Indicators The Comparative Fit Index (CFI) of this research is greater than 0.80. Value Root Mean Square Error of Approximation (RMSEA) is smaller than 0.06 or smaller. If the model has been fit, the parameter estimates have been tested. If the model does not fit, it can be repaired. CMIN / DF is relatively less than 2.0 TLI (Trucker Lewis Index) * with a value of showing very good fit. Results of testing the suitability of the initial model in this study are presented in Table 2.
Table 2. The Results of Model Testing

<table>
<thead>
<tr>
<th>Goodness of fit Indexes</th>
<th>Cut off Value</th>
<th>Analysis Results</th>
<th>Model Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square Kecil (&lt; 272.836)</td>
<td>123.768</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Probability ≥ 0.05</td>
<td>0.272</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>RMSEA ≤ 0.08</td>
<td>0.028</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>GFI ≥ 0.90</td>
<td>0.884</td>
<td>Marginal</td>
<td></td>
</tr>
<tr>
<td>AGFI ≥ 0.90</td>
<td>0.846</td>
<td>Marginal</td>
<td></td>
</tr>
<tr>
<td>CMIN/DF ≤ 2.00</td>
<td>1.076</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>TLI ≥ 0.95</td>
<td>0.985</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>CFI ≥ 0.95</td>
<td>0.987</td>
<td>Good</td>
<td></td>
</tr>
</tbody>
</table>

Source: Processed data

Based on Table 2, it can be seen that there are six (6) criteria which can be said to be good and two (2) models are marginal but still within the boundary area so that the model can be acceptable to all. The data of the work stress (independent variable) and dependent variable (organizational commitment, job satisfaction, Teachers Performance) are valid because all the loading factors P = 0.0000 smaller than α 0.05. The critical Ratio (CR) from four variables are reliable because the value from each variables are above the cut-off value of 0.7.

Table 3. LANE Coefficients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Lane Coefficient</th>
<th>C.R.</th>
<th>Prob.</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>work stress (X) → organizational commitment (Y₁)</td>
<td>0.600</td>
<td>1.949</td>
<td>0.051</td>
<td>Not significant</td>
</tr>
<tr>
<td>work stress (X) → Job satisfaction (Y₂)</td>
<td>0.848</td>
<td>2.333</td>
<td>0.020</td>
<td>Significant</td>
</tr>
<tr>
<td>work stress (X) → Teachers Performance (Y₃)</td>
<td>0.217</td>
<td>2.574</td>
<td>0.010</td>
<td>Significant</td>
</tr>
<tr>
<td>organizational commitment (Y₁) → Teachers Performance (Y₃)</td>
<td>0.326</td>
<td>0.320</td>
<td>0.019</td>
<td>Significant</td>
</tr>
<tr>
<td>organizational commitment (Y₁) → Job satisfaction (Y₃)</td>
<td>0.795</td>
<td>2.255</td>
<td>0.024</td>
<td>Significant</td>
</tr>
<tr>
<td>organizational commitment (Y₁) → Job satisfaction (Y₂)</td>
<td>0.345</td>
<td>2.523</td>
<td>0.012</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Source: Processed data

Results of Coefficient Line

1. Work stress is not significant to organizational commitment to the path coefficient of 0.600 and probability = 0.051

2. Work stress is significantly to job satisfaction and the path coefficient is 0.848 and probability = 0.020

3. Work stress is significantly to the teachers performance by the path coefficient of 0.795 and probability = 0.010.

4. Organizational Commitment is significantly to the teachers performance with path coefficients and probability of 0.326 = 0.019

5. Organizational Commitment is significantly to job satisfaction with 0.345 path coefficients and probability = 0.024

6. job satisfaction is significantly to the teachers performance with path coefficients and probability 0.217 = 0.012.
Conceptual framework

H1 = 0.600
H2 = 0.848
H6 = 0.345
H5 = 0.795
H4 = 0.326

IV. DISCUSSION

The first hypothesis in this study is that the work stress has no effect on organizational commitment. The result using AMOS software in Table 3 shows that the probability level of 0.051 with the path coefficient is positive at 0.600 with CR value of 1.949 for the probability value is less than 0.05, the first hypothesis is rejected. Work stress on teachers is due to curriculum changes do not alter the commitment of the teachers at the school institution where teachers work in private high school of North Surabaya. Education in Indonesia is always changing the educational curriculum according to the development of education and knowledge of the world. The curriculum that has changed is the curriculum of 1994 turned into the curriculum of 2004 (competency-based curriculum) then turns into curriculum units Level Curriculum (SBC) and transformed into the curriculum of 2013 (K-13). Work stress of the North Surabaya Private high school teachers as curriculum changes only occur momentarily and teachers remain committed to the institution. The results of this study do not support Fontana in (Rulestari and Eriyanto, 2013: 22), namely Increased job stress causes a decrease in organizational commitment and vice versa higher organizational commitment, employees will feel comfortable in the work so as to reduce work stress. This study does not support the research of Wibowo, Putro. (2014) who says that work stress negatively affect commitments by -0.133 and t-statistics of 11.7.

The second hypothesis suggests that work stress has a significant effect on job satisfaction. The calculation results in Table 3 indicate that the probability level of 0.020 by the path coefficient is positive at 0.848 with a value of CR for 2333, because the probability value is less than 0.05, the second hypothesis is received. Meaning that the higher the work stress is needed to support teachers performance. These results suggest that stress work and job satisfaction happen because teachers feel the pressure of work or work stress are due to changes in the curriculum that has given better results in learners so as to provide satisfaction for teachers. Job satisfaction of teachers can be fulfilled with the increased achievements of learners. This is consistent with the theory of Hughes (2012: 312) associated with feelings of job satisfaction or a person's attitude about the work itself, salary, promotion or education, supervision, co-workers and workload. This study supports the research of Suhanto, Edi (2009) who says that work stress effects on job satisfaction by demonstrating the value of -5.796 CR which is greater than 1.96 with a probability of 0.001 less than 0.05.

The third hypothesis in this study is that no effect of job satisfaction on teachers performance. Results of the analysis in Table 3 shows the probability level of 0.010 by the path coefficient is positive at 0.217 to the value of CR for 2574, because the probability value is less than 0.05, the sixth hypothesis is accepted. This suggests that the higher the job satisfaction of the teachers performance will be better / higher as well. Teachers assess that job satisfaction is required to support the performance. At the high school level, education environment relations which influence job satisfaction and performance occurs because the teachers feel that there is a match between the expected and the reality of works. The work itself which is a part of capability yields high performance. The results are consistent with the opinion of Robbins (2006) that, job satisfaction affects the productivity of labor and McCue and Gianakis (1997) that there is a relationship only between job satisfaction and performance of employees of financial management in government offices of Ohio. The results of this study are consistent with the theory Robbins and Judge (2008: 113) that there is a correlation between job satisfaction and performance which is quite strong. This study supports the research of Koesmono (2005) that affect the performance of job satisfaction with a regression coefficient of 0.004 P = 0.000 <0.05 and Khan, et al. (2012) job satisfaction as independence variables was significant influence on employee performance 0.238 P = 0.001 <0.050.

The fourth hypothesis in this study is that no effect of organizational commitment on teachers performance. The results of calculations using the software AMOS in Table 3 shows that organizational commitment on teachers performance is no effect with a probability level of 0.019 marked by positive path
The sixth hypothesis in this study is that organizational commitment will motivate a teacher to maximize his performance, since there is a sense of effort to perform his work maximally. Kreitner and Kinicki (2010: 163) say organizational commitment reflects the extent to which an individual identifies with organization and is committed to its goal. In turn, higher commitment can facilitate higher productivity. The output of this research supports the research conducted by Khan, et al. (2010) stating that organizational commitment were positive influence to employee job performance of 0.218 P = 0.000 <0.050.

The fifth hypothesis in this study is that no effect of work stress on teachers’ performance. The calculation results in Table 3 indicate the probability level of 0.024 by the path coefficient is positive at 0.795 with a value of CR for 2255, because the probability value is less than 0.05, the third hypothesis is accepted. In this study, the higher the stress of the work of teachers, especially with the changes in the curriculum and teacher workload increasing the performance of teachers become better / higher. This is evidenced by many learners who are accepted at state universities, military education of Police Academy, the Armed Forces Academy and others. The results support the research of Noviansyah and Zubaidah (2011) who says that there are job stress and partial work motivation that effect on employee performance of PT Plantation Minangga Ogan Balfour with P = 0.00 and the influence of the performance is of 0.91.

The sixth hypothesis in this study is that the influence of organizational commitment on job satisfaction with a probability level of 0.012 by the path coefficient is positive at 0.345 to the value of CR for 2523, because the probability value is less than 0.05 then the fifth hypothesis is received. This shows that the higher organizational commitment, the job satisfaction of teachers will be better / higher as well. The high school environment and organizational commitment of North Surabaya are to encourage teachers to always engage with learning activities, changes in the curriculum of K-13 SBC becomes a challenge for teachers. This involvement gives feeling of being able to control the situation because during the course of the learning process, teachers learn to understand how he/she has a role in the changes that occur in the institution. The involvement of teachers in the implementation of the curriculum changes of 2013 as a commitment that gives a sense of satisfaction will the result performance. The results support the theory of Luthans (1998: 125) Although early research Seemed to support a positive relationship between job satisfaction with organizational commitment. The results support the study by Exam and Alwi (2005) who show significant influence of organizational commitment and job satisfaction with a regression coefficient of 0.111 P = 0.022 <0.05.

V. CONCLUSION

1. Work stress has no affect the organizational commitment. The hypothesis one that states the work stress has an negative affects an organizational commitment is unproven and rejected. Work stress on teachers due to curriculum changes do not alter the commitment of the teachers at the school institution where teachers work in private high school of North Surabaya. Work stress of high school teachers for curriculum changes only occur momentarily and teachers remain committed to the institution.

2. Work stress effects on job satisfaction. The second hypothesis which states work stress effect on job satisfaction is proven. These results suggest that work stress and job satisfaction happens because teachers feel the pressure of work or work stress are due to changes in the curriculum that has given better results in learners so as to provide satisfaction for teachers.

3. Job satisfaction directly affect teacher performance. Which means that the hypothesis third stating job satisfaction affects teachers performance is proven and true. Job satisfaction is one of the important aspects that need to be considered in efforts to increase to the teachers performance. The private school teachers in Surabaya feel that there is a match between the expected and the reality of works. The work itself which is a part of capability yields high performance.

4. Organizational Commitment is affect teachers performance. The fourth hypothesis stating organizational commitment influencing on teachers performance is proven. In this study, the higher of the organizational commitment so that teachers performance will also increase.

5. Work stress influences on teachers performance. The fifth hypothesis which states work stress effects on teachers performance is proven. In this study, the higher the stress work of the teachers, especially with the changes in the curriculum and teacher workload increasing the teachers performance become better / higher.

6. The effect of organizational commitment on job satisfaction. Hypothesis sixth organizational commitment effect on job satisfaction is proven. The involvement of teachers in the implementation of curriculum change is a form of organizational commitment that gives a sense of satisfaction will result of teachers performance.

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The Role of Corporate Social Responsibility in Mediating the Effects of Foreign Operation on Tax Aggressiveness

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Abstract - This study aims to identify the role of corporate social responsibility in mediating the effects of foreign operation on tax aggressiveness. The sample used in this study was taken from Indonesian Stock Exchange during 2012-2016 period based on predetermined criteria set by the writer. The number of final samples was 33 corporations or 165 firm years. The analysis using Warp PLS 6 finds that CSR significantly mediates the effects of foreign operation on tax aggressiveness. Corporations with high foreign operation tends to have low CSR and low tax aggressiveness, meaning that these corporations are not performing tax aggressiveness. This finding indicates trade-off between CSR and tax. Mediation in this study is categorized as inconsistent mediation because although the mediated effect has different (opposite) sign from the direct effect, the mediated effect shows significant correlation. The contribution of this study is to provide empirical evidence on trade-off between CSR and tax. When CSR implementation is low, the corporation tends to have low tax aggressiveness indicating the corporation does not perform tax aggressiveness. The findings of this study are also expected to provide contribution for policy makers on CSR to explicitly state the sanctions for corporations that are not performing CSR activities and really implement the sanctions. The further researches in the future should be able to add some variables as the factors that strengthen the correlation between CSR and tax aggressiveness because the finding of this study still varies. Among these factors are culture and managerial characteristics of the nation where the research samples taken.

Index Terms - Corporate Social Responsibility, Foreign Operation, Tax Aggressiveness

I. INTRODUCTION

Tax is one source of national income used to fund national expenditure. It contributes the highest proportion on national income in Indonesian State Budget (APBN). However, the realization of tax collection is always below the target. The Ministry of Finance states the realization of tax collection in 2016 was IDR 1.283.6 trillion or about 83.4% of tax collection target in Revised State Budget (APBNP) 2016 (ekonomi.akurat.co.id).

Indonesia includes in lower middle income country with average tax ratio 19%-26% of Gross Domestic Product (GDP). The Bureau of Budgetary Analysis and Implementation Secretary General of DPR-RJ stated based on the data released by Government Procurement of Goods and Service Agency (LKPP), tax ratio in Indonesia increased during 2002-2012 period from 11.5% to 13.3% in 2009. The tax ratio plummeted to 11.1% in 2009 and consistently improved to 11.9% in 2011-2012 period. IMF explains that Indonesia’s actual tax income relative to PDB is the lowest among G-20 countries and emerging market countries. Sri Mulyani, Minister of Finance Republic of Indonesia explains that Indonesian tax ratio is still below 11% in 2016, the lowest tax ratio in the world (http://wartaekonomi.co.id).

The unexplored tax potentiality becomes the opportunity for Indonesian Government because there are many problems concerning with poverty, education, health, national defense and security, environment, transportation, infrastructure and public facilities need to be solved by Indonesian Government. Tax income plays vital role in solving these social problems (Wahyudi, 2015).

Therefore, the participation of corporations in implementing its responsibility to pay taxes correctly is needed. One of the factors causing low actual tax income to ratio to GDP in Indonesia is probably caused by most of the taxpayers disobediently ignore their responsibility to pay taxes. One form of disobedience made by the taxpayers is there are corporations that avoid taxes and perform aggressive tax planning.

Rego (2003) defines tax avoidance as the utilization of tax planning method to legally reduce the amount of income tax that should be paid. Meanwhile, Desai and Dharmapala (2006) perceive tax avoidance as a form of abusing tax shelter facility. Tax avoidance is actually a legal action carried by a corporation because the provisions of tax avoidance itself have been regulated in laws. Tax avoidance is different from tax evasion, an illegal way to reduce the amount of taxes paid by a corporation. Aggressive taxation is commonly carried out by domestic and multinational corporations. The definition of tax aggressiveness operated in this study refers to the definition proposed by Frank et al. (2009), namely an action to reduce taxable income by applying certain methods that are categorized (or not categorized) as tax evasion. Tax evasion is the obstacles in tax collection process that reduces national cash income. Hence, the term tax aggressiveness is a term that is widely defined and can be used in substitutive with tax avoidance/evasion and tax management.

Several tax avoidance and tax evasion cases in Indonesia were done by famous corporations. PT. Toyota Motor Manufacturing was accused of using transactions among its national and international affiliated companies known as transfer pricing. Transfer pricing is developed as tax planning carried out by corporations using a simple method, namely by transferring excessive income gained in a country to other countries with lower taxation rate. The transfer of taxable income is carried out...
through unreasonable price manipulation. The transfer pricing scandal was revealed when the Directorate General of Taxation assessed the Annual Tax Return (Surat Pemberitahuan Pajak Tahunan/SPT) of the corporation in 2005 with taxation rate IDR 1.07 trillion (https://investigasi.tempo.co). Other corporation performing tax evasion was Asian Agri Group. The Directorate General of Taxation investigated the scandal by assessing the financial report of 14 subsidiary companies of Asian Agri Group. The investigation revealed that tax evasion practice carried out by Asian Agri Group is conducted in sophisticated, systematic, and structured ways. They even employed a special unit to manage the tax evasion process (Kamaludin, 2014). Another case was PT. Bumi Resources Tbk. and its subsidiaries which were accused of conducting tax evasion. The investigation carried out by The Audit Board Republic of Indonesia revealed the deficit in Coal Sale Income (Dana Hasil Penjualan Batubara/DHPB) as much as US$ 143,189 million in 2003-2008. The amount had not been adjusted with financial statements of the company as much as US$ 608.178 million. The investigation also revealed deficit on royalty payment for 2003-2008 period as much as US$ 477.299 million.

Tax evasion phenomenon also occurs and is practiced by large international companies. In the last few years, world taxation is spiced up with stories of investigations carried out by taxation authorities on multinational companies such as Apple, Starbucks, Google, and Amazon. Taxation authorities doing investigations finds the tax evasion structure of multinational companies has made these companies pay unfair amount of taxes (Febriyanto, 2013). Based on these issues, tax evasion may be caused by taxation regulations applied in each country.

Corporations implementing aggressive taxation are considered as multinational companies practicing international business by opening branch offices/distributors and exporting their products. The development of information technology and international transaction enhances the ways of tax evasion practiced by multinational companies. Corporations with greater extensive international operational have a greater opportunity to evade income taxes than corporations with domestic business operation. For example, a multinational company has the opportunity to evade income taxes applied in one of its business locations with lower tax rate by transferring its income from locations with higher tax rate to locations with lower tax rate by exploiting different taxation regulations applied in different countries and taking advantages of tax subsidy agreement made with government of the country (U.S. Department of Treasury, 1999).

Tax avoidance activity has two effects on Effective Tax Rate (ETR). First, tax avoidance may cause Book-Tax Differences (BTD). BTD is temporary and permanent differences between accounting-based income and tax-based income. The transactions that may affect taxes are: overseas sales, tax-free income, tax credits, and deferring revenue admission for taxes. These transactions may reduce the ETR of a company. Second, multinational corporations often utilize foreign operation they practiced to avoid income taxes (Mills, 1998). In his research on tax avoidance practiced by multinational companies in the US, Rego (2003) found that multinational companies with extensive foreign operation have lower ETR, indicating that these companies minimized tax avoidance. This finding negates previous study carried out by Stickney and McGee (1982). In their study, Stickney and McGee (1982) showed that extent foreign operation variable has no significance in defining ETR, meaning that extent foreign operation does not affect ETR. Mills et al. (1998) utilized dummy variable to identify the effect of extent foreign operation. Their study found significant positive correlation between ETR and foreign operation variable. This finding indicates that companies with foreign (international) operation tend to avoid taxes.

Tax avoidance cases discussed in the previous paragraphs proves how poor these companies implement business ethics as indicated by their tendency in avoiding high amount of taxes. The obligation of these companies to implement its corporate social responsibility is merely written on tax regulations and laws, yet the implementation depends on the management of each corporation. The most common way done by the companies to avoid taxes is through aggressive tax planning.

One of the concepts that is closely related to business ethics is Corporate Social Responsibility (CSR). CSR is a sustainable commitment made by business companies to act ethically and contribute the economic development of local communities and society in general, alongside with improving the living quality of the employees and their family (World Business Council for Sustainable Development). Every corporation must commit on implementing ethics on all financial and operational activities because through business ethics, fair business practice, environmental effect, and Corporate Social Responsibility (CSR) play significant role in improving the legitimation of a corporation (Briefing, 1999). Carrol (1979) explains an organization with social responsibility must be profitable (economic responsibility), obeying the laws practiced by the society where the organization located (legal responsibility), conducting right actions and be fair (ethical responsibility), and becoming a good corporation (philanthropic responsibility). Hence, the implementation of CSR is the obligation of every corporation because it strongly correlates with reputation, social interests, economic interests, and environmental interests. Tax avoidance cases will never happen if all operational and financial activities are carried out based on the principles of business ethics. Previous studies carried out by Lanis and Richardson (2012, 2015) and Davis et al, (2013) find negative significant correlation between CSR and tax aggressiveness of a corporation, indicating the more social responsibility implemented by a corporation the less likely the corporation performs aggressive taxation. Meanwhile, Hoi et al. (2013) said that corporations with excessive irresponsible CSR activities have greater chances to avoid taxes and having greater difference on its discretionary/book-tax permanent. All of these previous studies took its sample in the US and Australia, countries with different cultural background and regulations applied from Indonesia.

This study aims to examine the role of CSR in mediating the effects of foreign operation on tax aggressiveness. In this study CSR plays as mediating variable because of its positive effects on the corporation itself, community, and the environment. CSR also brings negative effects to the government in term of income taxes. In this study, the writer attempts to view CSR from different perspective taken by previous researchers. In previous studies, the researchers viewed CSR as a part of
business ethics that must be implemented in order to avoid taxes. CSR in Indonesia is a mandatory activity rather than voluntary activity. CSR may bring negative effect to the government related to tax aggressiveness. The cost of CSR may reduce the gross income of a company. This regulation may be used to develop a new strategy to lower gross income through CSR. Corporations will avoid taxes by allocating higher amount of CSR implementation cost from its gross income (Sibarani et al. 2014). As stated on agency theory, there is conflict of interest between the management and the shareholders. The management are hesitant to avoid taxes (although tax avoidance may increase investment value provided by the investors) unless the management gains some profits from tax avoidance. The theory of agency stated that every individual has a tendency to be selfish and act rationally to maximize his/her economic profit (Jensen, 2005; Donaldson dan Davis, 1991; Crutchley dan Hansen, 1989). The study conducted by Carroll and Joulfaian (2005) found that charity events carried out by corporations aimed to reduce the amount of taxes to be paid. Corporations also face two options that bring consequences to the reputation. The options whether to spend greater amount of CSR cost or to pay taxes depends on the policies made by the management after considering the advantages of both options. Preuss (2010) found that some corporations with high CSR activities has avoided taxes. This phenomenon also occur in Indonesia. The corporation winning CSR Award in 2014 has been found performing aggressive tax evasion (Nugroho, 2016). Sikka (2010) illustrates an example how a company claims itself having social responsibility yet at the same time the company has performed tax evasion.

This study uses corporations registered in Indonesian Stock Exchange during observation period 2012-2016 as its sample. This study finds that the higher foreign operation of a corporation the higher its tax aggressiveness indicating that the corporation has conducted tax evasion. The result of mediation test indicated that corporations with high foreign operation have low CSR rate resulting in low tax aggressiveness rate.

The contribution of this study is providing empirical evidence on trade-off between CSR and taxes. When CSR rate is low, the corporation has low tax aggressiveness indicating that the corporation does not performing aggressive taxation. This study also contributes a recommendation for policy makers concerning CSR to explicitly state the sanctions for companies that does not implement CSR and really enforce the sanctions.

This study is organized into several parts. In the second part, the writer discusses the relevant theories and hypothesis development. In the third part, the writer describes research design applied in this study and presenting empirical findings on the fourth part. The fifth part will be conclusion.

II. THEORIES AND HYPOTHESIS DEVELOPMENT

2.1 Theory of Agency and Theory of Reasoned Action

This study is based on theory of agency and theory of reasoned action. Talking about CSR and tax aggressiveness is closely related to behavior of the company management as the agent authorized to organize the company by the investors or principals. Basically, CSR activity is closely related to business ethics, yet the activity may become unethical if the implementation violates the existing regulations, especially related to tax aggressiveness. In Indonesia, CSR activity may reduce gross income which in turns lower the amount of taxes to be paid. This regulation may bring positive effect if the company conducts CSR activities correctly as provisioned by the law, in which CSR activities function to subtract gross income. Yet, CSR activities may also bring negative effect if in implementing CSR activities the company is avoiding taxes by allocating greater amount of fund subtracted from gross income (Sibarani et al. 2014). The findings of a study carried out by Carroll and Joulfaian (2005) found that charity events carried out by corporations aimed to reduce the amount of taxes to be paid. Here the theory of agency applies. The management are hesitant to avoid taxes (although tax avoidance may increase investment value provided by the investors) unless the management gains some profits from tax avoidance. The theory of agency stated that every individual has a tendency to be selfish and act rationally to maximize his/her economic profit (Jensen, 2005; Donaldson dan Davis, 1991; Crutchley dan Hansen, 1989).

Meanwhile, according to theory of reasoned action tax aggressiveness behavior is affected by positive individual belief and negative individual belief owned by a taxpayer towards the taxes he/she should pay. If the taxpayer has stronger positive individual belief, he/she will pay taxes obediently. On the other hand, if the taxpayer has stronger negative individual belief, he/she tends to ignore his/her obligation in paying taxes.(Fishbein and Ajsen (1975) as cited in Vallerand et al. 1992).

2.2 Foreign Operation and Tax Aggressiveness

A company involves in international business through several ways, namely international sales (export-import), license, franchising, joint venture, acquisition of existing operations, and establishing new branches/affiliated companies overseas (Madura 2012, p.10).Companies with extensive foreign operation has greater chance to avoid income taxes compared to companies with domestic operations. Multinational corporations with foreign operations are likely to avoid taxes through tax planning. Mills et al. (1998), Mills (1998) and U.S. Department of Treasury (1999) revealed positive correlation between foreign operation and tax avoidance practice. Corporations with extensive foreign operations tend to perform tax planning to avoid taxes. Meanwhile, Rego (2003) found negative between foreign operations and tax avoidance, indicating that multinational corporations with extensive foreign operations do not have tendency to avoid taxes because these corporations have applied effective tax planning while Stickney and Mcgee (1982) did not find correlation between foreign operation and ETR as indicator in measuring tax avoidance. Based on explanation above, the first hypothesis proposed in this study is:

H1: Foreign operation has significant effect on tax aggressiveness

2.3 Foreign Operation and CSR

World Business Council for Sustainable Development defines CSR as a sustainable commitment made by business companies to act ethically and contribute the economic development of local communities and society in general, alongside with improving the living quality of the employees and their family. Carrol (1979) mentions the aim of corporate social
responsibility is to implement the responsibilities of a company to its society, consisting of economic responsibility, legal responsibility, ethical responsibility, and discretionary responsibility. Economic responsibility is the obligation that must be implemented by the company related to profit making. This is the main obligation of a company. Legal responsibility is company’s obligation to obey laws and implement regulations in its operation. Ethical responsibility refers to behavior and activities that need to be done by the company as part of society although these actions not regulated or provisioned in the laws or regulations. Discretionary responsibility is additional obligations usually implemented through charity events or philanthropic activities.

Companies with overseas sales are multinational corporations that must consider its CSR activities so that its products can be recognized internationally. Islam and Deegan (2008) found that since 1990 the stakeholders had pushed garment industries in Bangladesh to improve its social performance. This pressure directly correlates with expectations of global society which in turn encourages the social policies of the industry and closely relates to practice of disclosure. This finding indicates that concerning international (overseas) sales, the corporations must also consider the ethics and regulations applied in the destination country. The government and the consumers in the destination country do pay much attention on social and environmental performance of the corporation. Bennett (2002) explains the correlation among multinational corporations, social responsibility, and conflicts that may occur if a corporation fails to comply the social responsibility. International business community plays an important role in improving economic and social justice through its business operation or to be blamed for contributing a condition where conflicts easily occur. Multinational corporations have a power and responsibility to the community where the business operation locates. Branco and Rodrigues (2008) examined the social responsibility disclosure by comparing the company website and company’s annual financial website through several variables, namely international experience, company size, industry affiliation, consumer proximity, environmental sensitivity, and media exposure. The result of examination indicates that international experience does not significantly affect social responsibility disclosure on the website and the financial statements. Based on this discussion, the second hypothesis proposed in this study is:

H2: Foreign operation has significant effect on CSR

2.4 Foreign Operation, CSR, and Tax Aggressiveness

Foreign operation is one form of business activities that surpasses national borders. Foreign operation can be applied by establishing overseas branches, export sales, and many other ways. A company doing international trade must implement CSR (Islam and Deegan, 2008). International business community is very important in improving economic and social justice or to be blamed for contributing a condition where conflicts easily occur (Bennett, 2002). Carrol (1979) explains an organization with social responsibility must be profitable (economic responsibility), obeying the laws practiced by the society where the organization located (legal responsibility), conducting right actions and be fair (ethical responsibility), and becoming a good corporation (philanthropic responsibility). Hence, the implementation of CSR is the obligation of every corporation because it strongly correlates with reputation, social interests, economic interests, and environmental interests. CSR activity is expected to benefit both the company and the society however it is not impossible that CSR activity also provides negative effect for the government related to the amount of taxes should be paid by a company. Carroll and Joulfaian (2005) found that charity events carried out by corporations aimed to reduce the amount of taxes to be paid. The cost of CSR may reduce the gross income of a company. This regulation may be used to develop a new strategy to lower gross income through CSR. Corporations will avoid taxes by allocating higher amount of CSR implementation cost from its gross income (Sibarani et al. 2014). Therefore, it can be said that the company has done aggressive taxation considered in legal area or illegal. Taxes paid by a corporation may be related to CSR if the payment does imply the society. In this sense, the corporation must realize that paying taxes is a responsibility of the corporation towards its society, not a burden. If a company perceives tax payment merely as a part of business transaction and operational cost, the company will try to minimize the amount of tax owed as much as possible (Avi-Yonah, 2008). Hence the third hypothesis proposed in this study is:

H3: CSR activities mediate the effects of foreign operation on tax aggressiveness

III. RESEARCH DESIGN

3.1 Sample Description

The population of this study consists of all corporations registered in Indonesian Stock Exchange. The sample of this study was chosen based on following criteria:

- Corporations registered in Indonesian Stock Exchange in 2012-2016 and not categorized as service companies
- Corporations that have been continuously registered in Indonesian Stock Exchange with complete report during 2012-2016 period in order to see its consistency and not to disrupt the observation
- Corporations that have exported its products consistently during 2012-2016 period.
- Corporations with positive profits (not experiencing loss in 2012-2016 period).

Based on criteria above, the number of corporations taken as sample of this study was 33 corporations with the total number of samples meeting the criteria was 165 corporations.

3.2 Operational Definitions of the Variables and its Measurement

The dependent variable examined in this study is tax aggressiveness measured based on Effective Tax Ratio (ETR). ETR is used by the writer because of several considerations. First, previous empirical studies on taxation has found that ETR summarizes tax aggressiveness (Slemrod, 2004; Dyreng et al. 2008; Robinson et al. 2010). Second, ETR indicates tax aggressiveness proxy that is commonly used by the academicians (such as Mills et al. 1998; Phillips, 2003; Rego, 2003; Dyreng et al. 2008). In this study, the ETR uses cash ETR proxy defined as
the ratio of tax paid on total accounting profits before taxation (Dyreng et al. 2010).

The mediating variable examined in this study is CSR activities measured through CSRI based on GRI 3. This study still applied GRI 3 because the data collection began in 2012 and Indonesia has not applied GRI 4. Indonesia started adopting GRI 4 in 2013 implemented in few corporations. The independent variable examined in this study is foreign operation defined as corporations operating international trading by exporting its products overseas. Hence, this variable is measured by dividing total export rate with total sales operation in one period.

3.3 Technique of Data Analysis

In this study, the writer applied path analysis to analyze the data. Path analysis was chosen because this technique can examine the variables simultaneously and identify the direct effect and indirect effect. The data was processed using Warp PLS 6.0.

The procedure in examining the hypothesis assuming the role of CSR variable in mediating the effects of foreign operation on tax aggressiveness consists of two steps, namely:

1. Estimating the direct effects of foreign operation on tax aggressiveness

Estimating the indirect effects of foreign operation on tax aggressiveness simultaneously based on the following path: foreign operation → CSR → tax aggressiveness.

The conclusion about mediating variable are:

1. If the effect of foreign operation on tax aggressiveness remains significant and unchanged when CSR variable is inputted as additional predictor variable, the function of CSR variable as mediating variable is rejected.
2. If the effect of foreign operation on tax aggressiveness decreases yet remains significant after CSR variable is inputted as additional predictor variable, the function of CSR variable as partial mediator is accepted.
3. If the effect of foreign operation on tax aggressiveness decreases at some point insignificant statistically when CSR variable is inputted as additional predictor variable, the function of the variable as full mediator is accepted.

IV. EMPIRICAL RESULTS

4.1 Statistical Description

The statistical description of research variables examined in this study is presented on Table 1 below. Foreign operation variable is the ratio between export sales to total sales operated by the corporations. The average foreign operation rate is 27.12% with the lowest rate 0.07% operated by PT. Lion Metal Work, which markets almost all of its products domestically and the highest rate 100% found on PT. Vale Indonesia Tbk because all products of this nickel mining company are sold overseas according to long-term contract.

The CSR variable examined in this study is measured based on items stated by the companies on its annual financial statement divided by the number of items that should be stated. CSR in this study is measured based on social dimension, environmental dimension, and economic dimension. The average CSR variable statement is 34.34% with the lowest rate 6.41% by PT Tunas Baru Lampung Tbk. During observation period, the company always showed low CSR index. Meanwhile, the highest rate is 56.38% by PT Indocement Tunggal Perkasa Tbk. this company has won many environmental awards and achieved environmental certifications.

Tax aggressiveness variable proxied by Cashetr is the ratio between tax payment in cash and net profit. The average cashetr ratio is 52.72% with the lowest ratio 0.02% by PT Vale Indonesia Tbk and the highest rate 177.50% by PT Vale Indonesia Tbk in 2016 because in previous years PT Vale Indonesia involved in tax dispute that must be solved in 2016.

<table>
<thead>
<tr>
<th>Description statistic</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std.Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Operation</td>
<td>165</td>
<td>0,0007</td>
<td>1,0000</td>
<td>0,2712</td>
<td>0,3006</td>
</tr>
<tr>
<td>CSR</td>
<td>165</td>
<td>0,0641</td>
<td>0,6538</td>
<td>0,3434</td>
<td>0,1403</td>
</tr>
<tr>
<td>Cash ETR</td>
<td>165</td>
<td>0,0002</td>
<td>17,7503</td>
<td>0,5272</td>
<td>1,5889</td>
</tr>
</tbody>
</table>

4.2 Results of Hypothesis Examination

After conducting examination on research hypotheses proposed in this study through several steps of examination because of the existence of mediating variable, the writer generates the following examination model:
Figure 1 above describes the direct effect of foreign operation variable on tax aggressiveness (indicated by path coefficient 0.23 and p-value < 0.01). This finding indicates H₁ stating foreign operation positively affects tax aggressiveness is accepted. The following step is examining the indirect effect/mediating effect. Figure 2 indicates the mediating effect of CSR on the effect of foreign operation on tax aggressiveness. H₁ stating foreign operation has significant effect on tax aggressiveness is accepted while H₂ stating that foreign operation has significant effect on CSR is accepted (indicated by path coefficient = -0.28 and p-value < 0.01) and CSR significantly affects tax aggressiveness (indicated by path coefficient = 0.27 and p-value ≤ 0.01). The examination results the path coefficients of foreign operation and tax aggressiveness on the second-phase examination are lower than their path coefficients on the first-phase examination (0.23 decreases to 0.21) yet remains significant (p < 0.01). Based on this finding, H₃ stating that CSR activities mediate the effect of foreign operation on tax aggressiveness is accepted. Based on the p-value that remains significant, the characteristic of existing mediation is partial mediation.

4.3 Discussion

4.3.1 Foreign operation provides positive effect on tax aggressiveness

The findings of this study indicated that foreign operation variable has positive and significant effect on tax aggressiveness. Therefore, the first hypothesis proposed in this study stating that foreign operation has significant effect on tax aggressiveness is accepted.

The rationality of this finding is that companies with more extensive foreign operation have greater chance to avoid income taxes compared to companies that only operates domestically. Multinational corporations with foreign operation often avoid
income taxes through tax planning. This finding is consistent with the result of previous studies carried out by Mills (1998), Mills et al (1998) and U.S. Department of Treasury showing positive correlation between foreign operation and tax avoidance practice. According to U.S. Department of Treasury companies with more extensive foreign operation have greater chance to avoid income taxes compared to companies that only operates domestically. By utilizing the data collected through survey carried out by Slemrod and Blumenthal (1993) on 365 corporations in the U.S., Mills et al. (1998) conducted an examination on company investment on tax planning. They applied planning, company size, foreign operation, leverage, capital, inventory and entity as the research variables. They found that burden planning decreased as the increasing company size. Corporations with foreign investment tend to perform tax planning. Capital intensity and entity positively correlates with tax planning while inventory intensity and leverage do not correlate with tax planning. Mills (1998) explains tax avoidance activity may affect Effective Tax Rate (ETR) in two ways. First, tax avoidance creates Book-Tax Differences (BTD). BTD refers to temporary and permanent difference between accounting profit and taxation profit. The transactions that may affect taxation are foreign sales, tax-free income, tax credits, deferring profit admission. These transactions lower ETR rate of the corporations. Second, multinational corporations tend to use its foreign operation activities to avoid income taxes.

The findings of this study are inconsistent with the result of a study conducted by Stickney and McGee (1982). In their study, they examined empirically the correlation between Effective corporate Tax Rates of the companies based on indicators of company size, capital intensity rate, foreign operation, natural resources, and leverage rate. Corporations with lower Effective Tax Rates (ETR) tend to have high leverage rate, intense capital, and involve in natural resource industry while foreign operation and company size do not provide dominant effect in defining ETR (not correlated with ETR).

4.3.2 Foreign Operation Has Significant Effect on CSR

The result of examination indicates that foreign operation provides significant negative effect on CSR therefore the second hypothesis proposed in this study stating foreign operation has significant effect on CSR is accepted. This finding can be interpreted as the higher foreign operation (in this study proxied as the division between total export rate with total sales) the lower CSR practice.

This finding contradicts the legitimation theory proposed by Gray et al. (1995) stating that multinational companies must operate based on social values practiced by international society in order to legitimate its products and its existence internationally. Gutrie and Parker (1989) also failed to confirm the legitimation theory in defining CSR activities implemented by corporations in Australia from time to time.

Gunawan et al. (2009) perceived that CSR understanding of companies in Indonesia is still considered low as indicated by low disclosure of CSR activities made by companies in Indonesia. The low disclosure indicates that companies’ concern on CSR activities in Indonesia is still low. Retamangshih (2015) explains that CSR activities in Indonesia has good concept yet only few companies are able to implement the good concept well.

The low CSR implementation may be caused by the characteristics of the management. Thomas and Simerly (1995) defined the role of top management and social performance. There is significant correlation between the characteristics of top management and social performance of chemicals and electronics companies. Characteristics of top management correlates with organizational strategies and systemic changes of economic performance affecting CSR performance. Rashid and Ibrahim (2002) examined the attitude of Malaysian managers and executives towards social responsibility and the range of activities categorized as social responsibility, company disclosure, and several factors affecting the attitude towards social responsibility. They found significant difference in attitude showed by the managers working in banking sector, telecommunication sector, manufacturing sector, and construction sector towards social responsibility. The most determining factor affecting the attitude towards social responsibility is family education while other important factors are belief and habits and general practices of industry. Diez et al (2011) examined the importance of CEO role on CSR, particularly the correlation between managerial profile and CSR practice mediated by ethics and social responsibility based on agency and stewardship approach. Based on stewardship approach, the CEOs tend to emphasize on ethics and social responsibility to implement CSR activities in their companies. Fernandez et al. (2006) defined the main characteristics of a manager with environmental responsibility and examined whether his/her proficiency and critical attitude towards environmental success through literary review. Behavioral characteristics, especially orientation, attitude, and competence of a manager do directly affect his/her role in CSR and the performance of his/her corporation because these characteristics serve as input of the system and generate performance.

Another fact indicating poor CSR implementation in Indonesia is low disclosure of labor on CSR disclosure. Cahaya et al. (2012) find that corporations in Indonesia do not perceive its responsibility towards the employees as the key performance and CSR disclosure as proven by low labor disclosure practice and by focusing on certain items and thus omitting other important items. Indonesian corporations may hide some information to protect its image and reputation. These practices indicate institutional pressure causing low labor disclosure in Indonesia.

The rationality of this finding is that the increasing foreign operation does not necessarily improve the implementation of CSR activities as idealized by theory of legitimation because the implementation of CSR activities is still strongly affected by the characteristics of Indonesian corporation managements and most of these corporations do not implement their CSR activities well. Indonesian corporations only focus on certain items of CSR practice and disclosure. The implementation of CSR in Indonesia is only as a formality to follow regulation, not as morality (Aditya and Juniarti, 2016).

The finding of this study confirms the result of previous study conducted by Sikka (2010). Sikka (2010) attempts to examine the taxation practice carried out by international corporations claiming that they have implemented their social
responsibility. From the examined cases, Sikka found differences in terms of topic discussed by the corporations, decisions made, and actions taken that led to organized hypocrisy (smoke and mirror). The corporations develop two practices, namely assuring ethical behavior towards external community and separating organizational practices aimed to gain profit and avoiding taxation. In principle, these corporations have developed a complicated practice towards the society through social capital investment, transfer pricing, royalty programs, offshore tax havens, and careful transaction organization through tax avoidance techniques.

The findings of this study are not consistent with the result of study carried out by Islam and Deegan (2008). In their study, Islam and Deegan informed that since 1990, stakeholder groups have encouraged the garment industries in Bangladesh to improve its social performance. The encouragement is directly correlated with the expectation of global society which in turn inspires the development of social policies of the industry related to disclosure practice. This process indicates that in international sales, a company must also consider ethics and regulations applied in destination countries where the government and consumers in the destination country pay much attention on social and environmental performance. Bennett (2002) explained the correlation between social responsibility of a multinational company and potential conflicts may occur if the company fails to implement its social responsibility. International business community plays important role in promoting economic and social justice improvement through its operation or to be blamed for contributing a condition vulnerable to conflicts. A multinational company has the authority and responsibility to the community living in the area where the company operates. Meanwhile, Branco and Rodrigues (2008) found that international experience variable provided insignificant effect on social responsibility disclosure presented on company website or annual financial statement.

4.3.3 CSR Activities Mediate the Effects of Foreign Operation on Tax Aggressiveness

The findings of this study indicates that CSR activities significantly mediate the effects of foreign operation on tax aggressiveness, therefore, the third hypothesis proposed in this study stating CSR activities mediate the effects of foreign operation on tax aggressiveness is accepted. The rationality of this finding is when the foreign operation of a company is high, the CSR activity implementation is low. An observation on a sample of multinational corporations in Indonesia performing export trade indicates that a company with higher export rate does necessarily mean the company has high CSR activities. The sample companies perform low CSR implementation because of the characteristics of the management and there are many companies in Indonesia have implemented CSR well (Thomas dan Simerly, 1995; Rashid dan Ibrahim, 2002; Diez dkk., 2006; Retmaningsih, 2015). Most companies in Indonesia only focus on certain items of CSR practice and disclosure. CSR implementation in Indonesia is only to follow regulations, not as part of morality (Aditya dan Juniarti, 2016). The result of statistical analysis shows positive correlation between CSR and tax aggressiveness. This condition indicates that although these companies have poor CSR implementation these companies have less tax aggressiveness meaning that these companies obediently pay taxes. This situation suggests there is a trade-off between taxation and CSR implementation. The companies chose paying taxes rather than diversifying its CSR activities in a larger scale. CSR activities performed by these companies are merely as a formality to comply with regulations stipulated by the government rather than a part of morality (Aditya dan Juniarti, 2016). Disobeying tax obligation may be risky for these companies. They consider aggressive taxation as a risky illegal action that my bring sanction from taxation authorities and may reduce the reputation of the company. Rego and Wilson (2012) define tax avoidance as a risky action the managers won’t dare to take by minimizing the investment. Tax avoidance may increase additional operational and managerial costs of a company including paying tax consultant, spending more time for tax audit, reputation fines, and other fines paid to tax authority while the sanction given to companies not doing CSR is not clear and not realized (Irawan, 2016).

The finding of this study is consistent with agency theory describing the relationship between company management as an agent with the shareholders. There is a conflict of interest between the management and the shareholders. The management are hesitant to avoid taxes (although tax avoidance may increase investment value provided by the investors) unless the management gains some profits from tax avoidance. The theory of agency stated that every individual has a tendency to be selfish and act rationally to maximize his/her economic profit (Jensen, 2005; Donaldson dan Davis, 1991; Crutchley dan Hansen, 1989). The finding of his study is consistent with the result of previous study conducted by Carroll and Jouffaian 2005. In their study, Carroll and Jouffaian found that the number of charity events held by the company was low, the company paid higher tax rate. Consequently, when the number of charity event was high, the company tend to decrease its tax rate because the charity events held were intended to lower tax rate. Another study illustrated positive correlation between CSR activity and tax avoidance is a study conducted by Preuss (2010). In his study, Preuss compared a sample of companies located in tax haven countries and companies located in the US. He found that companies located in tax haven countries tend to carry out more CSR activities than compared to companies located in the US. This finding indicates companies with high CSR activities tend to be more aggressive in taxation. Davis et al. (2013) also confirmed positive correlation between CSR activities and tax avoidance through tax lobbying activity. Their finding indicates that companies with high CSR activity also have high tax avoidance. Sikka (2010) proves that multinational companies claiming that they had done CSR yet they also performed tax evasion. Siswianti and Kiswanto (2016) examined the effect of CSR activities on tax aggressiveness of multinational companies in Indonesia. Their findings indicated positive and significant correlation between CSR and tax aggressiveness. Companies with aggressive taxation tend to reveal much information on CSR activities in order to transfer the allocated fund for taxation to CSR activities.

V. CONCLUSION

This study examines the mediating effect of CSR activities in the correlation between foreign operation and tax
aggressiveness. Based on the results of empirical examination, this study finds that CSR activities significantly mediates the effects of foreign operation on tax aggressiveness. The rationality of this study is when the CSR activities carried out by a company is low the tax aggressiveness of the company will also be low meaning that the company does not perform aggressive taxation. This finding also signifies a trade-off between CSR activities and tax payment. The companies consider tax aggressiveness as a high-risk action due to its legal consequences and sanctions given by tax authority and the potentiality of reducing the reputation of the company. Tax avoidance may significantly increase operational and managerial costs including to hire tax consultant and spend much time on tax auditing, reputation fines, and other fines paid to tax authority (Rego and Wilson, 2008) while the sanction given to the companies not doing CSR is still unclear and not realized (Irawan, 2016).

The contribution of this study is providing empirical evidence on trade-off between CSR and taxes. When CSR rate is low, the corporation has low tax aggressiveness indicating that the corporation does not performing aggressive taxation. This study also contributes a recommendation for policy makers concerning CSR to explicitly state the sanctions for companies that does not implement CSR and really enforce the sanctions. The further researches in the future should be able to add some variables as the factors that strengthen the correlation between CSR and tax aggressiveness because the finding of this study still varies. Among these factors are culture and managerial characteristics of the nation where the research samples taken.

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Strengthening of Reinforced Concrete Building by Externally Bonded Carbon Fiber System

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Abstract- This paper deals with the strengthening of deteriorated reinforced concrete building by externally bonded carbon fiber composites. Four storied reinforced concrete residential building is selected for case study. It was constructed in 1992 and various deterioration symptoms are found. Static and dynamic analyses are performed by E-Tabs software using the various strength of members obtained from rebound hammer technique. The overstressed members are strengthened by externally bonded carbon fiber sheet. Experimental work for compression test on concrete cylinders externally bonded by carbon fiber sheets is performed. Compressive strength increment depends on the number of composite layers and percentage of wrap on concrete specimens. The required areas and thickness of carbon fiber wrapped sheet for the members are calculated by using Sika Carbodur FRP analysis software. For flexural strengthening, the maximum area required is 92 mm², for shear strengthening and confinement the maximum thickness of FRP required are 0.35 mm and 0.18 mm respectively.

Index Terms- strengthening, carbon fiber wrapped sheet, E-Tabs software, experimental works, Sika Carbodur FRP analysis software.

I. INTRODUCTION

Reinforced concrete is one of the most common materials used by the construction industry all over the world. It is used for the construction of transportation infrastructure, offshore platforms, dams and a wide range of public and private buildings. Owing to the wide variety applications, reinforced concrete structures are subjected to a range of exposure conditions, including marine, industrial or other severe environments. Due to increasing the ingress of aggressive agents into the reinforced concrete structures the microstructure and consequently the properties change with time. Due to the increasing decay of infrastructure and buildings, upgrading and strengthening of those structures is important. Various methods and different materials are available for repair and upgrading of concrete structures. In recent years, the use of externally applied fiber-reinforced polymers (FRP) has gained significant popularity for strengthening and repair of concrete structures. The FRP composites have been used successfully for rehabilitation and upgrading of deficient reinforced-concrete (RC) structures such as buildings, bridges, parking garages, chimneys, etc.

II. STRUCTURAL CONFIGURATION

The case study building is four storied reinforced concrete residential building located in Chan Aye Tharzan Township, Mandalay. It was constructed in 1992 and various deterioration symptoms are found. The total length is 36 m and the width is 10.36 m. The total height is 15.84 m. The bottom storey height is 2.74 m and typical storey height is 2.59 m. Typical floor plan for the building is shown in Fig.1.

Figure 1. Typical floor plan for the case study building

Figure 2. Beam layout plan for the case study building

Figure 3. Column layout plan for the case study building

The beam sizes are 0.23 m x 0.3 m for main beams, 0.23 m x 0.23 m for secondary beams and 0.152 m x 0.23 m for cantilever beams. The column sizes are 0.23 m x 0.3 m from first floor to roof level. Beam layout plan and column layout plan for the case study building are shown in Fig. 2 and Fig. 3.
III. DATA PREPARATION FOR ANALYSIS

A. Material properties
Material properties for structural data are as follows:
Compressive strength of concrete $f'_c$ = 17MPa
Yield strength of reinforcing steel = 276 MPa
Modulus of elasticity of steel = 2 x 10^6 MPa

B. Loading Consideration
The applied loads are gravity loads, including dead loads and, live loads, and lateral loads that include earthquake load and wind load.

C. Dead Load
Data for dead load are as follows:
Unit weight of concrete = 23.55 kN/m^3 (150 pcf)
229mm (9 in) thick brick wall = 4.78 kN/m^2 (100 psf)
115mm (4 1/2 in) thick brick wall = 2.39 kN/m^2 (50 psf)
Weight of finishing = 0.96 kN/m^2 (20 psf)

D. Live Load
Data for live load are:
Live load on residential area = 1.92 kN/m^2 (40psf)
Live load on walkway = 1.92 kN/m^2 (40psf)
Live load on stair = 2.87 kN/m^2 (60psf)
Live load on roof = 0.96 kN/m^2 (20psf)

E. Wind Load
Required data for wind load are:
Exposure Type = Type B
Basic wind speed = 128.7 km/h (80mph)
Important factor = 1
Windward coefficient = 0.85
Leeward coefficient = 0.5
Effective wind exposure height = 12.8m

F. Earthquake Load
The required data for earthquake loading are as follows:
Seismic zone = 4
Seismic source type = A
Soil Type = SD
Seismic response coefficient (Ca) = 0.44Na
Seismic response coefficient (Cv) = 0.64Nv
Near Source factor Na = 1
Near Source factor Nv = 1
Response modification factor = 8.5

G. Load Combination
Design Load combination s are as follows:
(1) 1.4(DL+SD)
(2) 1.4(DL+SD)+1.7LL
(3) 1.05(DL+SD)+1.27LL+1.275WXP
(4) 1.05(DL+SD)+1.275LL+1.275WYP
(5) 1.05(DL+SD)+1.275LL+1.275WXP
(6) 1.05(DL+SD)+1.275LL+1.275WYP
(7) 0.9(DL+SD)+1.3WXP
(8) 0.9(DL+SD)+1.3WXN
(9) 0.9(DL+SD)+1.3WYP
(10) 0.9(DL+SD)+1.3WYN
(11) 1.05(DL+SD)+1.28LL+EX
(12) 1.05(DL+SD)+1.28LL-EX
(13) 1.05(DL+SD)+1.28LL+EY
(14) 1.05(DL+SD)+1.28LL-EY
(15) 0.9(DL+SD)+1.02EX
(16) 0.9(DL+SD)-1.02EX
(17) 0.9(DL+SD)+1.02EY
(18) 0.9(DL+SD)-1.02EY
(19) 16 DL+1.28LL + EX
(20) 1.16 DL+1.28LL - EX
(21) 1.16 DL+1.28LL + EY
(22) 1.16 DL+1.28LL - EY
(23) 0.9 DL+ 1.02EX
(24) 0.9 DL- 1.02EX
(25) 0.9 DL+ 1.02EX
(26) 0.9 DL- 1.02EX

H. Modelling of the Case Study Building
Three dimensional view (3D) of the proposed building is shown in Fig.4.

IV. STATIC AND DYNAMIC ANALYSIS FOR CASE STUDY BUILDING
For the case study building, since deterioration symptoms such as cracking and spalling are observed, it is required to know the condition of concrete. So rebound hammer technique has been used to know the in-situ compressive strength of concrete. The in-situ compressive strengths of floor beams and first floor columns obtained from rebound hammer technique are shown in Fig.5 to Fig.9.
Static and dynamic analyses are performed using these various compressive strengths of the building to check the member sizes and structural capacity. The design strength of the case study building is 17 Mpa. The minimum and the maximum steel ratios are 0.005 and 0.0232. For all cantilever beams (0.152 m x 0.23 m), the minimum and maximum steel areas are 145 mm² and 674 mm². For main beams (0.23 m x 0.3 m), the minimum and maximum steel areas are 276 mm² and 1280 mm². The provided steel area is 258 mm² at top and bottom for cantilever beams and 604 mm² for main beams. According to static and dynamic analysis results, all the cantilever beams CB1 to CB13 and the main beams B23 to B32 in all story levels require to be strengthened. The compressive strength of columns less than 20MPa in the first floor are also necessary to be increased to satisfy the dynamic analysis. Table 1 shows the members require to be strengthened from first floor to roof levels from static and dynamic analysis results.

Table 1. Floor Beams and Columns Required to be Strengthened

<table>
<thead>
<tr>
<th>Floor</th>
<th>Beam</th>
<th>Strength Obtained (MPa)</th>
<th>Size (m x m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st F</td>
<td>CB1, CB5, CB6, CB2, CB4, CB7, CB9</td>
<td>&lt; 30</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB3, CB10, CB13, CB11, CB18</td>
<td>&lt; 35</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB8, CB12</td>
<td>&lt; 40</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>B23, B28</td>
<td>&lt; 40</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>B24, B26, B30, B31</td>
<td>&lt; 17</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B25, B27</td>
<td>&lt; 25</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B29, B32</td>
<td>&lt; 30</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>C5, C6, C13, C16, C19, C33, C34</td>
<td>12 &lt; 17</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>C17, C18, C20, C21, C22, C23, C29, C31</td>
<td>9 &lt; 17</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>C25, C32</td>
<td>20</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>C36</td>
<td>16 &lt; 17</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>C15, C26</td>
<td>18</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td>2nd F</td>
<td>CB1, CB7, CB6, CB11</td>
<td>&lt; 30</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB2</td>
<td>&lt; 40</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB3, CB13, CB4, CB10, CB12</td>
<td>&lt; 25</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB5</td>
<td>&lt; 35</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB8, CB9</td>
<td>&lt; 20</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>B23</td>
<td>&lt; 35</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B24, B31</td>
<td>&lt; 25</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B25, B27, B28</td>
<td>&lt; 20</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B26, B29, B32</td>
<td>&lt; 17</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td>3rd F</td>
<td>CB1</td>
<td>&lt; 40</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB2, CB10</td>
<td>&lt; 25</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB3, CB4, CB5, CB6, CB7, CB9, CB12, CB13</td>
<td>&lt; 20</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB10</td>
<td>&lt; 25</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB11</td>
<td>&lt; 17</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>B23</td>
<td>&lt; 35</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B24, B28, B30</td>
<td>&lt; 25</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B25, B26</td>
<td>&lt; 30</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B27, B29, B31</td>
<td>&lt; 17</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>B32</td>
<td>&lt; 20</td>
<td>0.23 x 0.3</td>
</tr>
<tr>
<td></td>
<td>CB2</td>
<td>&lt; 30</td>
<td>0.152 x 0.23</td>
</tr>
<tr>
<td></td>
<td>CB12</td>
<td>&lt; 40</td>
<td>0.152 x 0.23</td>
</tr>
</tbody>
</table>
V. EXPERIMENTAL WORK FOR FRP CONFINED CONCRETE CYLINDERS

Axial compression test for concrete cylinders bonded by carbon fiber composite is performed to investigate the strength results. Concrete specimens for selected three concrete mixtures 6 MPa, 10 MPa and 15 MPa are prepared using 150 mm x 300 mm cylindrical molds. The design slump of the concrete is between 75 to 100 mm. The carbon fiber sheets used in this study are the UT 70-30 G product, a unidirectional wrap made in Japan. The manufacturer’s guaranteed tensile strength for this carbon fiber is 3.4 kN/mm², with a tensile modulus of 245 kN/mm², and a sheet thickness of 0.167 mm. The resin system used to bond the carbon fabrics over the cylinders in this work is Sikadur-330, the epoxy resin made of two-parts, resin and hardener. The mixing ratio of the two components was 4:1. The properties of the resin are given in Table 2.

Table 2. Properties of the Resin Sikadur-330

<table>
<thead>
<tr>
<th>Properties</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>about 1.3 at 20°C</td>
</tr>
<tr>
<td>Ultimate elongation</td>
<td>0.9% after 7 days at 23°C</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>30MPa after 7 days at 23°C</td>
</tr>
<tr>
<td>Tensile modulus</td>
<td>4500MPa after 7 days at 23°C</td>
</tr>
<tr>
<td>Flexural modulus</td>
<td>3800MPa after 7 days at 23°C</td>
</tr>
<tr>
<td>Temperature resistance</td>
<td>Exposure condition until 50°C</td>
</tr>
</tbody>
</table>

After 28 days of curing concrete cylinders, FRP jackets are applied to the specimens by hand lay-up of CFRP wraps with an epoxy resin. The components are thoroughly mixed with a mixing spindle for at least 3min. The concrete cylinders are cleaned and completely dried before the resin is applied. The mixed Sikadur-330 epoxy resin is directly applied to the substrate. The fabric is carefully placed into the resin with gloved hands and any irregularities or air pockets are smoothed out using a plastic laminate roller. The roller is continuously used until the resin is reflected on the surface of the fabric, an indication of full wetting. After the application of the first wrap of the CFRP, a second layer of resin is applied to the surface of the first layer to allow the impregnation of the second layer of the CFRP. Before testing the wrapped cylinder specimens are stored at room temperature for one day. Specimens are loaded under a monotonic uniaxial compression load up to failure. The applied compressive load is 0.3 MPa/s and is recorded automatically. The compressive strength results of 6 MPa and 10 MPa, fully jacketed with carbon fiber sheet throughout the height of the specimens are listed in Table 3.

For concrete mixture 10 MPa, the one-layer specimen exhibits an increase in 236%. The two-layer specimen exhibits an increase in 555% in strength greater than the one-layer specimen. For concrete mixture 15 MPa, only 75% (100 mm at the middle) and 33% (50 mm at the middle) of the height of the specimens are jacketed by carbon fiber sheet. The failure patterns of confined concrete cylinders are shown in Fig.10. Fully confined concrete cylinders fail by rupturing of only the center part of the carbon fiber sheet by giving a snapping song in an explosive manner. For 75% and 33%, the cylinder fails starting from the cracking of unconfined concrete at the top or bottom part of the cylinders.

Table 3. Compressive Strength Results for 6MPa and 10MPa

<table>
<thead>
<tr>
<th>Mix (MPa)</th>
<th>No of Specimens</th>
<th>Unconfined Strength</th>
<th>Strength (1Layer) (Full)</th>
<th>Strength (2Layer) (Full)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>9</td>
<td>9MPa</td>
<td>35MPa</td>
<td>52MPa</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>11.3MPa</td>
<td>37MPa</td>
<td>74MPa</td>
</tr>
</tbody>
</table>

The compressive strengths for 15MPa obtained from compression test are shown in Table 4. For 75% wrapping, the one layer specimen shows an increase in 208% of compressive strength while for the two-layer specimens, the increment of strength is 246%. For 33% wrapping, strength increments are much lower than that of 75% wrapping. The one-layer specimen exhibits an increase in 46% while for the two-layer specimen, there is an increment of 92% in compressive strength. Overall, it can be seen that carbon fiber composite can be used to enhance the ultimate strength.

Table 4. Compressive Strength Results for 15MPa

<table>
<thead>
<tr>
<th>Mix (MPa)</th>
<th>No of Specimens</th>
<th>Unconfined Strength</th>
<th>Strength (1Layer)</th>
<th>Strength (2Layer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 (75%)</td>
<td>9</td>
<td>13MPa</td>
<td>40MPa</td>
<td>45MPa</td>
</tr>
<tr>
<td>15 (33%)</td>
<td>9</td>
<td>13MPa</td>
<td>19MPa</td>
<td>25MPa</td>
</tr>
</tbody>
</table>
VI. FRP REQUIREMENT FOR THE CASE STUDY BUILDING

In this case, the members require to be strengthened are externally bonded with fiber reinforced polymer (FRP) composites because this method is suitable for the existing building. Flexure strengthening of concrete beams is accomplished by epoxy bonding the FRP sheet to the tension face; for shear strengthening, the FRP wrapped sheets are bonded to the beam web. The required FRP dimensions (area/thickness) for the members of case study building are calculated by using Sika Carbodur FRP analysis software. For flexural strengthening FRP dimensions are given as area (mm²) and for shear strengthening and confinement, thickness (mm) of FRP are given by software as in Table 5. For flexural strengthening, 100 mm wide FRP strips are applied to the bottom of the beams and for shear strengthening, U-shape wrapping of 300 mm wide strips are used. For confinement of columns, 300 mm wide strips are applied around the columns.

VII. CONCLUSIONS

This paper deals with strengthening of deteriorated reinforced concrete building by externally bonded carbon fiber composites. Static and dynamic analyses are performed using E-Tabs software to check the adequacy of member sections. The overstressed members are strengthened by externally bonded FRP wrapped sheet. According to experimental work for concrete cylinders bonded by carbon fiber sheet UT 70-30 G product, the use of carbon fiber sheet can enhance the strength of the concrete. The required FRP for flexural, shear strengthening and confinement are calculated by using Sika Carbodur FRP analysis software. For flexural strengthening, the maximum area required is 92 mm² and for shear strengthening, the maximum thickness of FRP required is 0.38 mm and for confinement of columns, the maximum thickness required is 0.18 mm respectively.

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ACKNOWLEDGMENT

The author would like to express her deepest gratitude to Dr. Nilar Aye, Professor, Head of Department of Civil Engineering, Mandalay Technological University, for her encouragement. The author would like to show her thankful to all of her teachers from Department of Civil Engineering at Mandalay Technological University. The authors wishes to extend her special thanks to all of summarized conclusive results from experimental works, literature surveys, selected readings in research papers which were very helpful for her study.

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Issues and Challenges of Post Landslide Management in Sri Lanka

(A case study of Meeriyabedda landslide in Badulla District)

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Abstract

Landslide is a geophysical event that has become one of the most calamitous natural hazards in Sri Lanka. Approximately, over 50000 people have been directly affected by landslide during the last five years and thousands of people are living at risk situation today particularly in the Badulla, Ratnapura, Kegalle, Galle, Matara, Kandy, Kaluthara districts. Since many unexpected adversities are emerged during and after the landslides, it is very important to have a proper mechanism of post disaster management in order to address the resettlement and rehabilitation phases. The study aims to identify the failures of post landslide management while proposing new strategies to overcome existing issues and challenges. By considering the catastrophic landslide hazard occurred in Meeriyabedda of Badulla District in 2014, 92 families who lived in temporary camps and the vicinity of the damaged area was selected as the study area in this research. Both quantitative and qualitative methods which enable data collection through questionnaires, structural interviews, semi structural interviews and case studies are used. A mix method of descriptive and analytical was applied along with cartographic techniques for data analysis and discussion. The results revealed that, among the three phases of post landslide management such as immediate response and relief, short term recovery and rehabilitation and long term reconstruction and development, most of the issues and challenges could be identified in the phase of long term reconstruction and development. Institutional arrangements that need to be directed to identify and resolve the emerging issues particularly in the process of resettlement, have
not properly functioned due to internal and external factors. Therefore, it is recommended that, a proper institutional coordination and commitment must be in the scene until are reached the durable solutions in the phase of reconstruction and development.

Key words: Landslide, Post Landslide Management, Issues and Challenges, Badulla District

1. Introduction

A disaster is an occurrence disrupting the normal conditions of existence and causing a level of suffering that exceeds the capacity of adjustment of the affected community (WHO; 2002).

Natural disasters are very common compare to the anthropogenic disasters. A natural disaster is a threat of naturally occurring event will have a negative effect on humans. Any natural process that causes a direct threat to human environment is can be identified as a natural hazard while disaster is identifying as the effect of a hazard on society, usually as an event that occurs over a limited time in a defined geographical area. (Nelson; 2014)

Among the various natural disasters, landslides have become a very frequent phenomenon due to natural forces like slope of the gradient, soil type, and rainfall as well as manmade forces like irregular land use, settlement patterns etc. Landslide is a downslope movement of soil, rock and organic materials under the effects of gravity and also the landform that results from such movements (US Geological Survey; 2008).

Due to the fatal landslides, number of deaths and injuries as well as property damage report by destructing the normal conditions of human lives. And it adversely affects to various services such as transportation, electricity, water supply and other infrastructure facilities also. Displacement also occur as the impact of massive landslides by hitting to socio economic lives of the people. Even though, Sri Lanka is a small island, it is often affect by flash floods. Recently, an unexpected landslides occurred and effect on human life, their economy and natural environment. Therefore it should be rethink about management of disasters in Sri Lanka.

In landslide history of Sri Lanka, two devastated landslide were occurred in Ratnapura and Matara districts in 2003. In addition to that, Haguranketa affected severely in 2007 from the landslide. Due to landslides occurred in Sri Lanka in 2003, 22,328 people were displaced while 2006 and 2007 landslides displaced 26,989 and 27,497 people respectively. Since displacement is a life changing event, the resettlement process should be accelerated by addressing all dimensions of internally displaced person’s problems. Since the landslide impacts on human life and property, government and institutions have adopted different disaster management strategies for minimizing the effects as well as for the response and recovery of affected people and areas. Disaster management basically can be divided in to three phases such as;

- Pre disaster management phase
- During the disaster phase
- Post disaster management phase

The post disaster management phase encompasses three main tasks; such as recovery, rehabilitation and resettlement. Although it is the conclusive part of the
disaster management cycle there is a less attention for the post disaster management process in developing countries like Sri Lanka. Therefore it should be considered the post landslide management process for the speedy recovery of displaced people. Generally, the post landslide management mechanism concerns, seeking lands possible for resettlement and reestablish livelihoods through giving durable solutions for socio cultural issues and challenges. Several strategies taken by Sri Lankan government to accelerate the recovery of displaced such as, ensure appropriate guidelines are available for identification of lands for resettlement of people living disaster prone areas, systems to support reconstruction/repair, replacement of damaged properties, and other recovery needs are available through government, private sector agencies and civil society organizations including risk transfer mechanisms and etc. But still there are some failures can be identified specially in post disaster resettlement and rehabilitation process in Sri Lanka.

Riffering the Meeriyabedda landslide in Badulla district, most of the issues and challenges could be identified under this case as it was not well addressed the requirements of the affected community. Therefore, this attempt is to recognize the issues and challenges separately and introduce new strategies for the proper post landslide management mechanism.

2. Statement of the problem

The landslide occurred in Meeriyabedda area in Kotabathma Grama Niladhari division in Haldumulla Divisional Secretariat Division in Badulla District was one of catastrophic disaster in Sri Lankan history. This was happened on 29th October 2014 at around 7.30 am. It was recorded as one of the worst and huge landslides next to the Aranayaka in 2016. Meeriyabedda landslide affected to 330 people of 92 families in Ampitikanda tea estate. Approximately 63 buildings including Houses, Hindi temple, Community Center, Dairy collection Centers, Boutiques, Telecommunication Center, and 3 Estate bungalows were destroyed due to the landslide (Disaster Management Center 2014).

As this landslide was one of catastrophic event of landslide history in Sri Lanka, the issues related to the poor post disaster management process in Meeriyabedda landslide were highlighted. Because of the huge impact of this landslide already it displaced 92 families and devastate their livelihoods, property, social and infrastructure facilities also. In addition to that, 15 families have been evacuated recently. Approximately 330 people displaced due to this catastrophic event and later on they were resettled temporary in Poonagala, Ampitikanda and Makaldeniya areas. Even two years after IDPs are still living in welfare centers and they have to face several socio economic and cultural issues at different level. This shows the failures in post disaster management mechanism including poor resettlement process regarding to landslides.

In this background, it is timely needed to address the issues of post disaster management including resettlement and rehabilitation. Within the frame of research problem, few questions can be formulated as follows.

- What is the nature of post landslide management in relation to Meeriyabedda landslide?
- What are the impacts on landslide induced internal displacement?
What are the causes for issues and challenges in post landslide management?

What are the new strategies to overcome the issues and challenges of post landslide management?

In the light of foregoing, the study has set three objectives for conducting the research:

1. To examine the impact of displacement due to the meeriyabedda landslide.
2. To identify the influential factors to post landslide management.
3. To seek the possibilities to overcome post landslide issues and challenges.

3. Literature Review

Abansi and Dizon (2013) describes “Post-disaster rehabilitation and recovery encompass support strategies that are geared towards the restoration of human-centered services and infrastructure, as well as the restoration of the physical and ecological integrity of the affected ecosystem”. As well as Keraminiyage and Piyatadsananon (2013) described post disaster management process as the “top-down approach to design and implement post-disaster resettlement programmes are often influenced by spatial factors such as land availability and access to infrastructure facilities, failure to recognize socio-economic and cultural sensitivities of resettling communities have been noted as a common reason for unsuccessful resettlement programmes”.

One of key attempts is to introduce the resettlement model by Michael M Cernea in 1997. When concern about the Sri Lankan context, Deheragoda and Herath (2008) studied based on the topic of social impacts of landslide disaster with Special Reference to Sri Lanka. Even though landslide are viewed from several perspectives, the issues and challenges of post landslide management has been touched very limited. One of research was done by Fernando and Kumari (2015) and they emphasized that, failures of post disaster management procedure in case of Meeriyabedda landslide. There is another study also based on the progress of post disaster management process of landslides in Sri Lanka: with special reference to two major landslides in Budulla district by addressing the failures in post landslide mechanism in Sri Lanka.

As it identified the issues faced by the IDPs of Meeriyabedda landslide, it illustrated that, what would be the factors reconsidered for proper post landslide management process. As well as it focused the issues and challenges of resettlement process by achieving the objectives of the study. After identified the issues and challenges, this study proposed new strategies to overcome these issues. Because of that, by going through this kind of research it can be introduced new suggestions and identify the durable solutions for reduce the failures in poor post landslide management process in Sri Lanka. In addition, this kind of research can be used as public opinion in policy making to prepare a better policies by appreciating the community support. Therefore finally it can be highlighted that, practically this kind of research would be important to the institutions related to the disaster management

4. Methodology

4.1. Conceptual framework

The issues and challenges of post landslide management could be considered as the dependent variable (Y). There might be several factors that could
be assumed to affect in positive and negative mean on post landslide management. Those factors here are established as independent variables (Xi-Xn) as shown in the Figure 5.1;

Figure 4.1: Dependent variable and assumed independent variables

4.2. Hypotheses

Null and alternative hypothesis are created for this study shown as follows;

H₀ – “There is no impact of selected variables such as rules and regulations, institutional co-operation, availability of resources, involvement of the government and attitude of the people on issues and challenges of urban flood hazard management”

H₁ – “There is an impact of selected variables such as rules and regulations, institutional co-operation, availability of resources, involvement of the government and attitude of the people on issues and challenges of urban flood hazard management”

4.3. Sampling

Haldummulla DSD located, from North to Haputale DSD, from South to Monaragala and Rathnapura districts, from East to Monaragala district and from west to Nuwara Elliya district in Uva province in Sri Lanka. The extent of the Haldummulla DSD is 430.5 Km² and it includes 39 Grama Niladhari divisions. Majority of the area located in 305-1400m elevation (1000-3000 feet), minor parts of the area located in 150-305m elevation (500-1000 feet) in Haldummulla DSD (Resource Profile; 2015).

Figure 4.2. Haldummulla Divisional Secretariat Division

The total population of this study represents the all affected people from Meeriyabedda landslide in 2014. They have categorized as resettled, returnees and living with friends and relatives. Sample population of this study was selected from these three categories. It was suggested that; select 50% from the total population of living under three categories by using
the snow ball sampling. The sample size as shown in table 4.1.

### Table 4.1. Sample Population

<table>
<thead>
<tr>
<th>Resettled Population</th>
<th>Returnees</th>
<th>Live with relatives</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>76 Families</td>
<td>12 Families</td>
<td>04 Families</td>
<td>92 Families</td>
</tr>
<tr>
<td>76/2 = 37 Families</td>
<td>12/2 = 6 Families</td>
<td>4/2 = 2 Families</td>
<td>45 Families</td>
</tr>
</tbody>
</table>

#### 4.4. Data collection

The primary and secondary data collected by using the following methods:

Primary sources – Questionnaire, Observations, Formal and informal discussions.

Secondary sources – books, journals, institutional reports, web sources.

#### 4.5. Analysis of data

Data analysis of the study may concern qualitative techniques as this research belongs to the quantitative research. Therefore, descriptive methods used for the data analysis by using:

- Graphs
- Pictures
- Tables

In addition to that, as this research mainly concerns the qualitative data, it used the qualitative data analysis techniques also such as content analysis. Accordingly, this research mainly based on the descriptive analysis.

### 5. Results and discussion

#### 5.1. Nature of post landslide management

For the clear identification on nature of post landslide management, it divided into three categories as mentioned below.

- Emergency Response and Relief
- Short term: Recovery and Rehabilitation
- Long term reconstruction and development

Among those three phases, emergency response and relief as well as short term recovery and rehabilitation processes were succeeded than the long term reconstruction and development.

#### Table 5.1. Success of the Emergency Response

<table>
<thead>
<tr>
<th></th>
<th>Most Successful</th>
<th>Successful</th>
<th>Unsuccessful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rescue</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evacuation</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camping process</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Donation Distribution</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Emergency response and relief includes several activities such as rescue, evacuation, camping process and donation distribution. Among them, immediate rescue process implemented during just after the disaster and people have been evacuated with the guidance of DMC in Badulla district. As well as they requested public support from the people, who are capable to support for the tri-forces. The rescue process and evacuation were most succeeded in this case with the involvement of government agencies and
tri forces. After the evacuation affected community were moved to several temporary camps such as Poonagala Tamil School, Poonagala Sinhala School, Gapkade camp. The government were provided basic needs of the affected community like foods, cloths, sanitary facilities and other things which they want. But according to the affected community’s opinion, unequal distribution of donations was major issue that occurred in the emergency response phase as some of people were highly supported while others having less attention even for their basic needs.

Table 5.2. Success of the Short term Recovery and Rehabilitation

<table>
<thead>
<tr>
<th></th>
<th>Most Successful</th>
<th>Successful</th>
<th>Unsuccessful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camping Process</td>
<td>✅</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donation Distribution</td>
<td>✅</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restoration of Basic Service, Infrastructure</td>
<td>✅</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restoration of Livelihoods</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Short term recovery and rehabilitation includes the restoration of basic services, infrastructure and livelihood. In here, camping process considered under the short term recovery also as IDPs were lived nearly two years in welfare centers after the disaster. Donations were equally distributed among the people in here than the emergency response as people said. But restoration of basic services such as communication and electricity as well as restoration of infrastructure facilities like roads, water supply were delay to reconstruct because of inadequate attention of the government. Therefore, returnees also had to stay considerable time in welfare centers. Not only that, the government support for restoration livelihoods of IDPs also very less as the people mentioned.

Table 5.3. Success of Long term Reconstruction and Development

<table>
<thead>
<tr>
<th></th>
<th>Most Successful</th>
<th>Successful</th>
<th>Unsuccessful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land selection for Resettlement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resettlement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessibility to Livelihoods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Resettlement Assistance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All the activities regarding to the long term reconstruction and resettlement process related to the Meeriyabedda landslide were failed as shown by the above table. It took long time period for the land selection and other pre resettlement activities also. Therefore the resettlement procedure also delay and many failures occurred like poor accessibility to livelihoods and lack of socio cultural values. After the resettlement, it is essential to have post resettlement assistance from the government to recover as soon as possible. But there was no any assistance after the resettlement. Therefore easily it can be recognized as shown by the above tables, most of the issues of post landslide management were occurred in long term reconstruction and development procedure.

5.2. Impact on Landslide Induced Internal Displacement
The impact of landslide induced displacement can be categorized as follows.

- Social impact
- Economic impact
- Cultural impact

Social impact have been identified based on the impact on family, social relationship, education and health. Deaths, furiously injured and physical disable situations could be identified as the social impact on family. Accordingly 14 deaths were reported while furiously injured and physical disable people reported as 08 altogether. When concerning the economic impact, their livelihoods have been fully, partially and less damaged as shown by below chart.

**Figure 5.1. Impact on Livelihood**

Accordingly 28 families or the 61% have completely loss their livelihoods while partially and less damage reported 17% and 7% respectively. It have been discovered that, economic impact was higher than the socio and cultural impact in case of Meeriyabedda.

5.3. Issues and challenges of post landslide disaster management

The total process of resettlement and rehabilitation is examined under this theme. The discussion on this matter will be forwarded as follows.

- Issues of emergency response and relief phase
- Issues of short term recovery and rehabilitation process
- Issues of long term reconstruction and development process
- Issues regarding to these three phases as well the causes for the issues also identified for the minimum clarification. Accordingly,

**Table 5.4. Issues and causes of Emergency Response and Relief**

<table>
<thead>
<tr>
<th>Issues</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unequal distribution of donations</td>
<td>Lack of strong institutional arrangements, Lack of responsibility provision</td>
</tr>
<tr>
<td>Inability to attending schools to school children</td>
<td>Failures in providing educational facilities at the initial stages</td>
</tr>
<tr>
<td>Socio cultural issues</td>
<td>Lack of socio cultural studies of the community, Attitudes of the people</td>
</tr>
<tr>
<td>Delay of construction of the damaged roads and other infrastructure facilities</td>
<td>Lack of institutional support, Lack of responsibility provision</td>
</tr>
</tbody>
</table>
Table 5.5. Issues and causes of Short term Recovery and Rehabilitation Phase

<table>
<thead>
<tr>
<th>Issues</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unequal distribution of donations</td>
<td>Lack of strong institutional</td>
</tr>
<tr>
<td></td>
<td>arrangements, Less of satisfaction</td>
</tr>
<tr>
<td></td>
<td>of people</td>
</tr>
<tr>
<td>Conflicts between host and</td>
<td>Lack of social consideration,</td>
</tr>
<tr>
<td>affected community</td>
<td>Negative attitudes of the</td>
</tr>
<tr>
<td></td>
<td>people to commitment</td>
</tr>
<tr>
<td>Socio cultural issues</td>
<td>Lack of socio cultural studies,</td>
</tr>
<tr>
<td></td>
<td>Attitudes of the people</td>
</tr>
<tr>
<td>Lack of infrastructure facilities</td>
<td>Lack of consideration of basic</td>
</tr>
<tr>
<td></td>
<td>needs of the people</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2016

Addition to that, prominent issues and causes were identified under the phase of long term reconstruction and development also.

- Long delay in resettlement implementation
- Land selection, Houses designing and construction issues
- Unexpected disasters Eg: Wild Elephant threat
- Newly constructed houses have been abandoned for not having any means of livelihood opportunities at or near to the resettlement
- Newly constructed houses have been abandoned due to poor accessibility to existing public and social infrastructure

The major issue was the long delay in resettlement implementation as the result of poor institutional arrangements, lack of community participation and informal involvement of the government. The new resettled area has been also just identified disaster prone area and it proves the mechanism failures. These are also occurred lack of interdisciplinary teams for specific functions. Among the three phases discussed above, the later one has several issues recorded. The study revealed that most of the issues emerged due to the lack of major institutional arrangements.

5. Conclusion and recommendation

Despite Haldummulla DSD is declared as a landslide prone area by the authorities, people have neglected the warning due to different reasons. Most significant factor is most of them did not have option to leave their place of origin. The awareness of the post landslide management is very less among the vulnerable community.

Most of issues as well as challenges were identified under the phase of long term reconstruction and development. The lack of strong institutional arrangements has caused to arise this situation. In addition, it can be concluded people’s attitudes also make considerable influence to increase the complexity of the issues and challenges of post landslide management. By going through the findings it can be recommended that,

- Establish a proper mechanism to enhance the institutional coordination and commitment.
- Update the laws of environmental protection and to implement them at any circumstances.
- Promote regular land use and limit the cultivations at steep slopes
- Modern methods for protecting the lands from soil erosion
- Maintain a proper hydrological system

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The role of PHA transformation in obtaining distinct bioproducts: insights into biorefinery and medical applications

Leonardo Bastos Moraes, Maria Viviane Gomes Muller, Rosana de Cassia de Souza Schneider

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Abstract- Since polyhydroxyalkanoates (PHAs) can be obtained by utilizing organic waste as a substrate, they form one of the most suitable classes of organic acids with many applications, ranging from medical supplies to energy and biorefinery products. In total, PHAs are found in at least 150 different molecular forms, with the basic differences determined by the length of the carbon skeleton (4 to 14 C-bonds) and the radicals, which are formed by many organic groups. These characteristics make up their unique physicochemical properties, biodegradability and nontoxicity. Many new approaches are now being developed to obtain PHAs and modify these molecules into new green chemicals as well as renewable alternatives for petroleum and other non-sustainable compounds. This mini review gives insight into the genetic characteristics of PHA synthases, the most important enzyme group related to this compound. This review addresses chemical techniques to modify PHAs to obtain compounds with a high market value. Therefore, this work shows new applications and possibilities for PHA, such as drug-delivery systems, building block chemicals, new polymeric structures for tissue scaffolds and certain energetic compounds, such as n-butanol.

Index Terms- Polyhydroxyalkanoates, polyhydroxybutyrate, biorefinery, bioproducts.

I. INTRODUCTION

Polyhydroxyalkanoates (PHAs) are a class of organic compounds that occur naturally in bacteria, serving primarily as a carbon reserve in environmentally and metabolically unfavorable situations[1]. Usually, the PHA production process in the cells is attributed to factors such as an excess of carbon sources, the absence or depletion of nitrogen, phosphorus or other essential nutrients and even as a result of physiological stress[2, 3]. They are all biodegradable, nontoxic, water insoluble and are renewable[4], and at least 150 forms of monomeric units of these polyesters can be found [5]. Additionally, PHAs have unique physicochemical characteristics, such as a low glass transition temperature (Tg), high melting temperature (Tm) and tensile strength[6].

Currently, the elevated production and extraction costs and the use of chlorinated solvents are the major difficulties for using PHAs as a substitute for plastics. There are new alternatives for extraction that use nontoxic solvents, but they are expensive in most cases and difficult to employ at a large scale. Thus, the total amount of waste generated in this process of extraction could be a secondary problem, leading to cost increases for the final product[7-9]. Considering those situations (high costs to produce, extraction and substrate problems), many works are suggesting employing PHAs for other uses besides the production of petroleum-derived plastics, such as medical applications[10, 11], drug delivery and targeting[11], synthetic drugs[12] and even for obtaining new materials for industry[13].

This review provides a comprehensive vision of in vivo and in vitro transformations of PHAs into new bioproducts. There are a wide range of applications and forms of presentation for PHAs, including several economic aspects about the raw materials to obtain biopolymers.

II. OBTAINING PHAS: FROM GENE MANIPULATION TO REACTOR DESIGN

The natural conversion of PHAs into bioproducts occurs in two types of processes, in vivo and in vitro. The in vivo approaches to convert PHAs into bioproducts involve several key points and strategies, depending on the focus of the PHA type. There are common techniques to manipulate PHA production when a specific type of HA is desired: strain selection, i.e., choosing a strain that produces several or only one HA type[14]; genetic transformation, i.e., inserting, modifying or blocking specific enzymes or metabolic pathways[15]; and feeding strategies, i.e., modifying the substrate or cultivation to increase the production[16, 17].

a. PHA SYNTHASES: INFLUENCE OVER PRODUCTION OF BIOPOLYMERS

According authors[6], PHA synthesis can involve at least 45 enzymes and 12 known routes. Doudoroff and Stanier[18] studying poly-3-hydroxybutyrate (PHB), one of the most common PHAs, found a metabolic route that uses acetyl-CoA and at least 3 enzymes: PhaA (β-ketocetyl-CoA thiolase), PhaB (acetoacetyl-CoA NADPH-dependent reductase or dehydrogenase) and PhaC (PHA synthase), as exemplified by Figure 01. Since acetyl-CoA, FADH and FADPH are the key resources in PHA formation, other metabolic routes that use those substrates will interfere with PHA biosynthesis[19, 20].
Each metabolic pathway has specific enzymes and activities with HA monomers and precursors. PHA synthases seem to be the most important enzyme involved in the process to obtain specific polymers, having a particular role in polymeric structure and conformation[21, 22]. PHA synthases are the main class of enzymes[22] that polymerize HA units in the cell within PHA-granules where they are located, which are generally attached to the cellular membrane[3, 23].

PHA synthases classes I and II are very similar, having one single subunit (PhaC) with a molecular weight of 65 kDa that polymerizes CoA thioesters of short chain length (scl-HAs) and medium chain length (mcl-HAs), such as 3-hydroxybutyrate (3-HB) and 3-hydroxyvalerate (3-HV)[24]. Class III is composed of two subunits (approximately 40 kDa each), PhaC and PhaE, and utilizes scl-HAs, ranging from three to five carbons in length. Classes IV and III are very similar, the difference being that class IV has another subunit, PhaR, that improves the enzyme stability in the PHA granule-structure[1, 6, 19].

Since PHA synthases are the major enzymes involved in polymerization, they are suitable for changes and mutation insertions to manipulate the way that the enzymes synthetize different polymers. The most common way to change the production is the addition of recombinant plasmids into strains with high production rates, such as Escherichia coli, from other organisms or from different species[25, 26]. Pseudomonas stutzeri and Pseudomonas putida[27], Cupriavidus necator[28] and Bacillus megaterium[29] are the preferred sources of PHA-related genes for applications involving genetic transformation.

b. USING BIOREFINERY AS A PLATFORM TO OBTAIN PHAS

Most of our chemical industry is based in fossil fuels and non-renewable resources, leading to a dangerous situation and imminent exhaustion of those sources of energy. In the late 90s, the term biorefinery started to be employed, and it initially involved looking for alternatives to replace common methods for non-food bioproducts and certain chemicals[30, 31]. The National Renewable Energy Laboratory defines a biorefinery as “a facility that integrates biomass conversion processes and equipment to produce fuels, power and chemicals from biomass;” thus, biorefinery takes the perspective of an integrated process that absorbs organic residues to transform them into value-added products and energy[32].

In a biorefinery, the whole process usually involves at least three steps: 1) selection of organic waste, 2) pretreatment and 3) insertion into the system to generate the desired products, with or without the generation of byproducts. In this context, two steps are crucial to an environmentally and economically friendly process, i.e., the pretreatment and the system to obtain the product[31, 33]. Thus, pretreatment can be carried out by three different approaches: physical, chemical or biological. Physical pretreatment involves freezing, extrusion, microwave and heat processes to breakdown the main components of the organic waste. This process is environmentally safe but normally has high energy costs[34, 35]. Chemical pretreatments, such as oxidation, alkali or acid hydrolysis, organic solvents or ionic liquids, are some of the most effective single processes and are widely used on an industrial scale. However, there are several environmental aspects that need to be carefully monitored, since these pretreatments can generate toxic byproducts (e.g., chlorinated organic compounds)[31, 36].

Biological approaches to treat organic wastes seem to be the best option, considering the environmental and economic aspects. However, these pretreatment processes do not generate large yields of biomass ready for usage. They need to be improved for larger applications, such as the fuel and energy industry, green chemicals and new polymeric materials research[35, 37].

The costs to operate and implement a biorefinery are high, and they require skilled labor. These costs mean that the product obtained at the end of the process must have high market value or high demand, thus giving the project economic sustainability. With this premise, the idea is to modify the products obtained in the process, such as building blocks or chemicals, into new substances with specific markets. For example, the pharmaceutical industry is quite appropriate for the commercialization of this type of technology. In the case of HAs, there are numerous processes to convert the main building blocks such as 3HB, 5HV and 3HO (3-hydroxyoctanoate) into fine chemicals, drugs for Alzheimer’s treatment and other noble applications.

III. TECHNIQUES TO MODIFY HAS INTO NEW BIOPRODUCTS

a. Chemical transformations, different applications and bioproducts from HAs

Since HAs can easily be produced from organic biomass (as described above) and purified, many approaches can be designed to modify those organic compounds into distinct bioproducts with noble applications. Reactions such as coupling, esterification, cyclization and substitution are the most common approaches to obtain new products from organic compounds, and HAs have great potential and diverse applications[10, 38]. Among the scl- and mcl-HAs, considering their polymeric forms, production rates and easy purification, HB, HV, HHx (hydroxyhexanoate) and HO stand out with respect to quantity and applicability[39].
The most common HA is HB, which is easily obtained from almost all microorganisms that accumulate PHAs. The methylation of 3-HB generates methyl-hydroxybutyrato, a molecule with a great potential in the medical field[40] that is used to combat Alzheimer’s[41] and improve memory in mice[42]. This approach is an alternative to the high cost to obtain these molecules. Another use is to convert PHB to n-butanol[43], an important fuel with a high market value and applications in the chemical industry.

Recently, Dhamankar and collaborators[44], have created an efficient platform to obtain 3-hydroxybutyrolactone (3-HBL) from PHB through a biosynthetic pathway. Furthermore, the platform utilizes a recombinant E. coli to produce 3-HBL and 3,4-dihydroxybutyric acid (3,4-DHBA)[44] utilizing glucose as a carbon substrate. As described by Werpy and Petersen[45], 3-HBL and 3,4-DHBA have interesting market applications, including as precursors in the pharmaceutical industry and for the synthesis of important building blocks.

Another compound with medical applications is γ-hydroxybutyrate, a psychotropic drug that affects the central nervous system (CNS) and is known as “the date-rape drug”[46]. Commercially, γ-hydroxybutyrate is prepared as a sodium salt (sodium oxybate) and utilized to treat alcohol withdrawal[47]. It is also consumed illegally by many young people because it causes a sense of euphoria, but it can cause severe toxicological effects and be fatal in high doses[48].

HV or hydroxyvalerate, another important HA, can be changed by adding a methanolic group at position 4 to generate 3-hydroxy-4-methylvalerate (3H-4MV) utilizing an approach developed by Saika and co-workers[49]. 3H-4MV has an interesting use as a flexibility-enhancing agent in polymers, changing their crystallinity[50]. HV is mostly found in a copolymer formation due to its capability to change crystallinity and cause changes in melting and glass transition temperatures[28, 51]. It is also used for medical applications[11, 52], including as a drug delivery system and in implants[40, 53].

Another HA with a variety of medical and clinical applications is hydroxyhexanoate (HHx), which can be used as a support material for tissue engineering[54], advanced drug delivery systems[55] and even as a polymeric material[56]. Since both are applicable in the medical field, HAs used for human implants or drug delivery systems need to pass a series of tests to avoid contamination by other compounds, especially endotoxins[9, 57]. In an early article, Kunz and Weimer[58] proposed the in vivo production of adipic acid by feeding Pseudomonas spp. 6-hydroxyhexanoate. Another utilization of HHx is in block copolymers[6] to change the aging properties of the main polymer, thus providing more stability and durability.

Along with HB in applicability, hydroxyoctanoate (HO) is a medium-chain length alkanoate that has many uses and sub products that can easily be obtained through modification of the main molecule. First, in the medical and pharmaceutical fields, HO can be used in a film form for pulmonary valve implants and drug-eluting stents[11], polyesters with antimicrobial activity[59, 60], drug-release systems[61], tissue engineering materials and other applications[40, 62, 63]. Second, grafted polymers can be obtained, which adds a functional group in the polymer to generate a product with new characteristics[6]. Nano composites with graphene[13], that have a great added value, as well as chiral hydroxyacids[64] are options for more economical uses of HO.

IV. Final considerations and future prospects of HAs

PHAs have emerged as a new bio-based chemical platform for the green production of top-value products due to the diversity obtained from their byproducts and their applicability in different areas. Many microorganisms have been found to accumulate HAs, mainly in the form of 3-HB (PHB), but only a few have been exploited until now[6, 65]. Cheap substrates, such as xylose, palm oil, glycerol and melt waste, can easily be employed as raw materials to obtain HAs[1] with small modifications in the process and in the microorganisms utilized to carry out the conversion.

Looking at the polymers market, one of the most readily available organic molecules is HA, which appears to be the most promising building block, along with succinic acid and polyactic acid[65], but has lower costs compared to petroleum-derived compounds[66], though the production of petroleum-based plastics is still economically attractive for industry. Governmental incentives for R&D, tax exemptions or lower taxes and other fiscal obligations would support more initiatives for biopolymers and other products. Considering the long-term perspective, petroleum-based products such as plastics will be replaced gradually by green chemicals and renewable organic processes.

Other attractive sectors are the bio-medical and pharmaceutical industries, with promise in drug-delivery systems[52, 67], tissue engineering support materials[54, 68], scaffolding, and even drugs themselves[41, 42]. These applications need a pure polymer, without other contaminants, such as solvents[9] or toxins, such as LPS (lipopolysaccharides)[69] or other compounds that affect human health.

HA utilization in more diverse applications is still in the process of obtaining the raw materials needed for production. With advances in biorefinery technology and research on metabolic pathways that regulate the raw materials needed for production. With its support as well as the Biology and Pharmacy Department (UNISC) for assistance with the translation and English revision fees.

V. ACKNOWLEDGMENTS

We acknowledge all the help from Professor Dr. Alexandre Rieger for all the considerations of our work. Additionally, we thank the Master in Environmental Technology program for all its support as well as the Biology and Pharmacy Department (UNISC) for assistance with the translation and English revision fees.

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The Inaugural Caribbean Cancer Survivorship Conference 2016

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Abstract-The Inaugural Caribbean Cancer Survivorship Conference held on October 21-22, 2016 provided a forum to discuss strategies and solutions to reduce the burden of cancer on both the patient and their communities. The event was structured around seven short presentations delivered by experts from the Caribbean and internationally, testimonials from cancer survivors, and question and answer sessions to encourage the audience to interact with the presenters, as well as a conference evaluation questionnaire. Conference presentations focused on the significance of survivorship to the delivery of care to cancer patients. Specific topics included the History of Breast Cancer; Cancer Research Statistics in the Caribbean; Cancer Survivorship Models and Care Plans; Perceptions, Myths and Mysteries that Impact Breast Cancer; and Hope and Empowerment for Survivors. Analysis of the conference evaluation forms pointed to/highlighted that patients and survivors require greater and improved cancer surveillance, integrated medical care regionally and internationally, psychosocial support, and improved information and resources for self-care following treatment such that their quality of life can improve and be sustained. The participants found the seminar to be very informative and significant as it related to the issues related to surviving cancer and quality of life. Strong recommendations were made for similar conferences, possibly annually, with the inclusion of a greater number of cancer survivors in attendance (including regional and international cancer support groups, cancer survivors attending public oncology units, etc.).

Index Terms- Cancer survivor, Cancer Survivorship, Diagnosis, Management of Cancer and Treatment Options in the Caribbean.

I. INTRODUCTION

The Inaugural Caribbean Cancer Survivorship Conference was a collaborative event between the University of Trinidad and Tobago (UTT), Cancer Survivors in Action (CSIA), City of Hope and the Healthy Caribbean Coalition (HCC). The Conference was held on Friday 21st October, 2016 at The National Academy of Performing Arts (NAPA), Port-of-Spain, Trinidad; and Saturday 22nd October 2016 at Ortinola Great House, Maracas, St Joseph, Trinidad. This Conference was the first to be hosted on the topic of Cancer Survivorship regionally.

An additional component to the Conference was a Cancer Survivors Forum hosted by NCD Alliance and the Healthy Caribbean Coalition (HCC). This discussion allowed researchers to better understand the disparities and barriers related to survivorship care.

Speakers for this Conference included: Dr. Charusheela Andaz, Breast Surgeon affiliated with Maimonides Medical Center in Brooklyn; Dr. April Barbour, Internist/Associate Professor of Medicine with The George Washington University School of Medicine and Health Sciences; Dr. Rita Strickland, former Chair of the Nursing Department at New York Institute of Technology; Ms. Kimberly Badal, Director of Caribbean Cancer Research Initiative (CCRI); Dr. Agatha Carrington, Assistant Professor/Program Leader, Master's in Health Administration (MHA), UTT; Dr. Bernadette Sheridan, Founder/Family Practitioner at Grace Family Medical in Brooklyn; Ms. Jasmin Holder, RN, Case Manager, Founder/President of Care Masters LLC and Dr. Shevon Joseph, Physician in the Department of Obstetrics and Gynecology at the NYU Lutheran Medical Center in Brooklyn, NY.

In 2013, the World Health Organization (WHO) advised that Cancer is a priority in the Caribbean [1]. Prostate cancer is the leading cause of cancer death among males, with 51,000 deaths annually, followed by lung cancer and stomach cancer. Among females, breast cancer is the leading cause of cancer death, with about 43,000 deaths annually, followed by cervical and lung cancer [2]. A review of the World Health Rankings-Health Profile: Trinidad and Tobago, 2017 indicated that cancer is a priority with the age-standardized death rate per 100,000 population for Prostate and Breast Cancer being ranked 4th and 9th respectively [3]. Across the developing world, cancer has become a major health challenge that needs to be urgently tackled. More than one third of cancers can be prevented and another third are curable if detected early [4].

According to the American Cancer Society Inc (2016) [5], “more than 15.5 million children and adults with a history of cancer have survived in the United States (US) as of January 1, 2016. It is estimated that the population of cancer survivors will increase to 20.3 million: almost 10 million males and 10.3 million females by 2026. Cancer screenings for early detection; promoting healthy lifestyles by attention being focused on reducing obesity, healthy diets, physical activity, and avoiding tobacco; and cancer care through a number of high-profile programs are encouraged to prevent cancer and are instrumental to the continued increase in the cancer survivorship rate in the US [5].

Currently, there is limited statistics on cancer survivorship in Caribbean countries, and there exists a great need for research to be done in this area. The barrier of non-existent/non-functioning cancer registries and government statistical agencies is a limitation to obtaining this data; and hampers the the design of
credible cancer plans, including initiatives for primary prevention [6].

Healthcare Professionals world-wide have been searching for ways to deal with the effect that cancer is having on their societies.), In an attempt to avoid and arrest the late effects of cancer and to ensure the best possible outcomes for cancer survivors, fostering healthy communities, prepared patients, responsive health care professionals and supportive health care systems through applied cancer research, education, advocacy and translation of evidence to practice was recommended, according to Institute of Medicine and National Research Council (2006) [7].

The HS&HAU, UTT has been striving to improve the cancer care continuum in the Health Sector of Trinidad and Tobago. In support of Breast Cancer Awareness Month worldwide and Cancer Awareness Month in Trinidad and Tobago (held annually in October), the Conference brought together a host of Healthcare Professionals including government ministers, oncologists, oncology nurses, surgeons, other medical practitioners, NGO’s, international stakeholders and cancer survivors. It was structured around presentations to encourage all participants to enter into discussion on the issues related to survivorship and patient navigation in Trinidad and Tobago.

The Conference, having regard to the fact that the profile of our population indicates that cancer is a priority, highlighted the existing gaps in the provision of health-care for a growing number of cancer survivors. Gaps highlighted included medical, psycho-social, health policy and economic issues on cancer survivorship; networking and building collaborations with cancer specialists, oncology professionals, cancer supporters, and cancer survivors from the region and internationally.

II. SCIENTIFIC PRESENTATIONS

The Chairman of the University of Trinidad and Tobago, Professor Kenneth Julien, spoke on the importance of hosting a Conference such as this. He spoke to the role of healthcare management, which includes improving affordability and quality of service offered by healthcare professionals. He indicated that to ensure management of the health sector was up to standard, there must be up-to-date databases for decision making. He also spoke on the issue that there should be improved training available to clinicians and information should be made available to patients so that they can help manage their care.

DAY 1: Friday 21st October, 2016

Presentation 1 - Technical Advances in Breast Cancer - What is to be expected on the horizon?
The first Conference presentation was from Dr. Charusheela Andaz who spoke on the Technical Advances in Breast Cancer. In her presentation Dr. Andaz spoke on the Cancer Age-Standardized Mortality Trends over the period of 2000 - 2012 in Trinidad and Tobago, and the intent to decrease the Cancer Mortality Profile by early diagnosis and better screening, treatment and outcomes. She also noted developments in breast imaging and guidelines for early detection and improved treatments whereby more women than previously are surviving breast cancer in the UK and US.

Presentation 2 - The Role of Research in Improving Cancer Survivorship in the Caribbean

The second Conference presentation was by Ms. Kimberly Badal, who spoke on the continuum of cancer care being a process in which care must be accurate, precise and quick at all stages of the continuum. She highlighted the fact that there are external factors that also influence the success of this continuum and that the role of research as an integral part of our health care system, will assist identifying these factors and move to improve the cancer survival rate in the Caribbean. She presented statistics on Breast and Prostate Cancer Survival Rates in the Caribbean for the period - 2005. There was no current cancer survival information. Ms Badal closed by affirming that research is the foundation of Public Health and Medicine, and this body of research can only be achieved through successful collaborations throughout all sectors of society.

Presentation 3 - Models of Survivorship Care

Dr. April Barbour presented on models of survivorship. She defined the term ‘cancer survivor’ and the needs of a survivor for a better quality of life. She mentioned the effects of cancer treatment and the need for them to be managed when they do occur. In response to these needs, mention was made of the IOM seminal report “From Cancer Patient to Cancer Survivor: Lost in Transition”, which identified gaps in coordinated and comprehensive care; called for care plans to be delivered to all people treated for cancer and called for improved care delivered to patients post treatment.

Dr. Barbour’s extensive experience in the field of Survivorship spoke to survivorship care plans as a key survivorship care component, as they serve as a roadmap for post-treatment care and can be used as a tool for care coordination and communication. The survivorship care plan should be created by the patient’s treating team and shared with other specialists, primary care providers and the patient. Lastly she spoke to the different models of survivorship care and the integration of these models within the cancer care continuum.

Cancer Survivor Testimonial

The survivor gave her experience surviving cancer. She recalled the discovery of a lump in the nipple of her breast which led her to have an ultrasound done (as she was afraid of mammograms). The result was in concurrence with her family history and other medical facts and she had to proceed further to get a biopsy done. The biopsy results confirmed that she had cancer. She stated that at that moment, she was strong and asked the doctor what she could do to get it out of her body since it didn’t belong there.

Two weeks later she had surgery. She also stated that a friend referred her to an Oncologist in Venezuela, whom she immediately made contact with and went to Venezuela. There she ran several tests and the doctor sent her the results verifying it was Stage II Cancer. She returned to Venezuela and started...
treatment (this was about six weeks after her surgery). She was pleased with the fact that her treatment included meeting with a nutritionist and psychologist (she discovered eight years later that the same services were now available at the National Radiation Centre, St. James Medical Complex, Trinidad and Tobago). She stressed that INFORMATION WAS KEY which was/is not readily available to cancer patients in Trinidad and Tobago.

**Presentation 4 - Focus Group Report of Reach to Recovery Cancer Survivors**
This Conference presentation was done by Dr. Agatha Carrington. She started by defining ‘quality of life’ and then presented a multi-dimensional mapping on the different aspects of quality of life for patients. She shared the findings of her focus group, conducted with members of the REACH FOR RECOVERY GROUP - a support group located at the St James Medical Complex, Trinidad and Tobago.

The themes which emerged from this study, which are in alignment with the social cognitive theory (SCT), include - self-image, acceptance of roles, support, impact on cognitive skills, response or adjustment, symptom distress, all impact the domains of quality of life and. In so far as the assumptions of the SCT (outcome expectations) of patients when presented with a diagnosis of cancer are concerned, these expectations (self-efficacy and self-regulation) influence the physical, psychological, social and functional aspects of the patients’ quality of life.

**Presentation 5 - Hope and Empowerment for the Survivors**
The final Day 1 presentation was by Dr. Rita Strickland on the topic of hope and empowerment for survivors. She spoke to the field of spirituality and its many definitions. She referred to studies where persons who engaged in regular spiritual practices demonstrated decreased levels of stress, better coping mechanisms, richer social support and an improvement in their quality of life.

She also spoke on the role of support groups. Her research evaluating support groups for women with breast cancer, pointed to several benefits which included sharing experiences, preventing isolation, enhancing self-esteem, exchanging information, lending support, providing hope and developing a higher quality of life. Resiliency, mentorship and travel also proved to be effective support systems.

**DAY 2: Saturday 22nd October, 2016**

**Presentation 1 - Women, Cancer, and History**
Dr. Bernadette Sheridan presented on the history of breast cancer and how surgery developed (the first mastectomy in 1882). She enlightened the attendees on the discoveries of antisepsis, anesthesia and antibiotics that made the difference in surgery for cancer. By the twentieth century, there were better treatment options which led to extended survival rates.

**Presentation 2 - Perceptions, myths and mysteries that impact breast cancer screening, diagnosis and management within immigrant communities in NYC**
Dr. Shevon Joseph described Cancer as a slowly developing illness. Once a diagnosis is made certain preconceived notions can limit a woman’s ability to grapple with details about treatments like chemotherapy, surgical and radiation options, which at times delays initiation of treatment.

Within the immigrant communities in Brooklyn there are a multitude of barriers that directly impact health care. She highlighted a list of myths, perceptions and mysteries compared with the facts and realities related to breast cancer. One such example given was the ongoing concern that antiperspirants and deodorants cause breast cancer (myth/perception/mystery) compared to the response by researchers (ACS and NCI), that this is merely a rumor and more research is needed to prove otherwise.

**Presentation 3 - Empowering the cancer patient - Faith in all options available**
This was the last presentation for the Conference with an impacting message on faith and empowerment of the cancer patient delivered by Ms. Jasmin Holder. Due to her experience as a Registered Nurse-Case Manager, she highlighted the importance of a Case Manager's role in improving the efficiencies and outcomes of the patient’s cancer care. She outlined goals that would empower the survivor namely to be informed, educated, proactive, well, curious, relentless and to know your rights as a patient/healthcare consumer. She defined faith and empowerment and she listed some essential facts about cancer and medical options for treatment.
III. CONFERENCE EVALUATION

Evaluation forms were distributed for the Conference. Eighty (80) participants attended the Conference and forty three (43) questionnaires were returned. For each session, the relevance of the topic, quality of speaker presentations, and knowledge gained were evaluated using a typical five Likert Scale. Attendees had the opportunity to answer questions rating 0–4 (0 = No Opinion, 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree). Participants were also asked to provide their comments and feedback in short answers. Overall satisfaction with the Conference and the attitudes toward location, venue facilities and session length were rated.

Figure I: Bar Graph showing Participants Overall Satisfaction with the Conference

![Figure I: Bar Graph showing Participants Overall Satisfaction with the Conference](image1)

Attendees were also very satisfied with all presentations held in the Seminar (Q#1-Q#5). They found that the presenters had a good understanding of the topics. (Q#5)

Attendees also agreed and strongly agreed that the content was helpful, the level of the conference was appropriate, the format was enjoyable, were satisfied with the facilities and location of the venue, the length of the seminar was appropriate and recommended that the Conference be repeated.

Figure II: Bar Graph showing Participants Satisfaction with Length, Location and Location Facilities of the Conference

![Figure II: Bar Graph showing Participants Satisfaction with Length, Location and Location Facilities of the Conference](image2)

IV. CONCLUSION

One of the main outcomes of the conference was the "Cancer Survivorship Guide" Towards Improving the Quality of Life of Cancer Survivors” booklet. The booklet was officially launched at the Conference and was the first of its kind in the region specifically for cancer patients in Trinidad and Tobago. The expected impact is that the booklet would be used as a resource for survivors and would be a model for use in the region. The booklet was sponsored by First Citizens Bank.

In summary, the objectives of this Conference were met as attendees were able to understand the importance of survivorship, and the delivery of care to cancer patients; since it contributes to enhancing the quality of lives of survivors throughout their cancer care continuum. It provided a forum to
discuss strategies and solutions to reduce the burden of cancer both on the patient and our communities.

APPENDIX

Appendix I: Program Schedule for the Conference.
Appendix II: Conference Evaluation Form

REFERENCES


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Prevalence, Assessment & Management of Hypovitaminosis-D in Randomly Selected Populations of Lahore

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Abstract- Objectives: The aims of this activity were to study causes, prevalence and management of hypovitaminosis D and its extent in males and females.

Methodology: An observational and questionnaire survey based study was conducted in the public and private hospitals of Lahore. Data collection form was filled during face to face interview with 50 people.

Results: Weight showed a diversified collection: among women, 11% , 22% , 38% and 29% fell under the category 30-40 kg, 41-50 kg, 51-60 kg and more than 60 kg respectively. Similarly, among men, 0%, 28%, 14% and 58% fell under the same categories respectively. 28% of the females said they do cover their skin while going out and 14% males responded yes. Usage of sunscreen among women was seen to be 19% while among men 21% of individuals used sunscreen. Among females, 3% women were diagnosed with Crohn’s disease or ulcerative colitis while among males, none was diagnosed with either of two (100% responded no).

Conclusions: hypovitaminosis D has high prevalence in females due to various factors including improper diet, ovarian cycle and hormonal changes during pregnancy. Doctors educated and counselled the patients very well and appropriately but there was no significant role of Pharmacists in treatment and education of vitamin D deficient patients so pharmacists have to work hard to prove themselves in health care system.

Index Terms- Adolesence, epidemiology, prevalence, vitamin-D deficiency, parathyroid hormone, sunscreening agents.

I. INTRODUCTION

Hypovitaminosis D is medically described as ‘low levels of vitamin D in body’. Vitamin D is both a hormone and a mineral. The production, activation and metabolism of vitamin D may be one of the most misunderstood concepts in pharmacy. In past generations, it was uncommon to encounter vitamin D deficiency since all milk is fortified with vitamin D generation and milk consumption was high. Historically, a major reason to fortify milk was to prevent the development of rickets. However, since milk consumption has substantially declined over the years, and many people do not regularly eat foods high in vitamin D, such as cold water fish, a slight resurgence of rickets and vitamin D deficiency has occurred.[1]

Biologically active vitamin D is a hormone since it is produced in one part of the body, viz the skin, and transported and used in other areas of the body, such as the gastrointestinal tract and skeletal system. Vitamin D is necessary for adequate intestinal absorption of calcium. Thus, if one becomes vitamin D deficient, one is at risk of a low calcium level which can lead to osteoporosis, osteomalacia and rickets. If vitamin D levels fall too low, a compensatory release of parathyroid hormone (PTH) occurs, resulting in secondary hyperparathyroidism. This triggers the mobilization of calcium from bone and a reduction in bone mineral density. Low vitamin D levels have been linked to an increase in osteoporosis-related fractures, muscle weakness and falls, even increased risk for cardiovascular disease and certain malignancies.[2]

Vitamin D deficiency is often clinically silent. Manifestations are shown as Children are often found to have started walking late or prefer to sit down for prolonged periods. Adults can experience chronic muscle aches and pains. Physical findings in severe vitamin D deficiency are as: In children, softening of bones & in adults, periosteal bone pain, best detected by applying firm pressure on the sternum or tibia. Measurement of serum 25-hydroxyvitamin D (25[OH] D) is the best test to determine vitamin D status. Levels of 25(OH)D are interpreted as [3], lab values of range 21-29 ng/mL (normal: 52.5-72.5 nmol/L): Vitamin D insufficiency, and values < 20 ng/mL (< 50 nmol/L): Vitamin D deficiency

Alternatively, a measure of the serum parathyroid hormone (PTH) level might be helpful in diagnosis of vitamin D insufficiency. PTH levels are related as a function of indirect proportion, indicating secondary hyperparathyroidism. Clinically, physicians go for lab findings for those patients who are at a greater risk of vitamin-D deficiency, including [4][5][6] Patients with osteoporosis or with a syndrome of malabsorption, Black and Hispanic individuals, Obese persons (body mass index >30 kg/m^2) [7][8][9] Patients with disorders that primarily affect the metabolism of vitamin-D and phosphate levels for example: chronic kidney disease.

To prevent vitamin D deficiency in individuals owning to insufficient exposure to sunlight, the Institute of Medicine has recommended adequate intake (AI) based on levels needed to have an optimum levels off vitamin-D in an individual. The current daily AI =200 IU for infants, children, and adults younger than 51 years; 400 IU = adults 51 to 70 years of age; and 600 IU= adults older than 70 years.[10] However, recent research suggests that current AI recommendations for children and adults might be sub-normal levels (above 30 ng per mL) for proper calcium absorptive levels and parathyroid hormone suppressive manifestation.[11][12] Based on these facts, the
American Academy of Pediatrics recently recommended the levels to be doubled up by 400 IU.[13][14]

Vitamin D is a fat-soluble vitamin, and there are news about toxicity from excessive supplement intake. Widespread use of fortified food and drink from the 1930s to 1950s in the United States and Europe led to reported cases of toxicity. According to the National Academy of Sciences, there is little risk associated when levels rise up to 2,000 IU per day. To replenish serum 25-hydroxyvitamin D levels in persons with vitamin D deficiency, one cost-effective therapy available is oral ergocalciferol at 50,000 IU per week for eight weeks. The optimal time for reaching the prescribed levels is not stated, but the goal is to achieve a minimum level of 30 ng per mL.[15][16][17]

Serum 25-hydroxyvitamin D levels should be measured again after complete course of therapy, and if values have not reached the sub-minimal or minimal level, a second eight-week course of ergocalciferol is to be prescribed. If the serum 25-hydroxyvitamin D levels still have not shown a rise, the most possible stated cause is non-adherence to therapy or malabsorption. If malabsorption is a suspected element, consultation with a gastroenterologist is given a second thought. After vitamin D levels have enough replete, a maintained dosage of cholecalciferol should be levelled at 800 to 1,000 IU per day from proper diet and supplement.[19][20]

Vitamin D deficiency is now among a common reason of morbidity in Pakistan and deserves to be considered in the common differential diagnosis of backache and unexplained aches and pains. There is high prevalence of vitamin D deficiency due to improper diet, inadequate calcium intake, socialized customs and confining oneself in a four-walled room that deprives the elderly, children and female population of the useful benefit of the sunshine. The other prevailing causes other than dietary intake is also poverty, poor choice of diet and excessive cooking relatively available in diet as the sunlight. Vitamin D deficiency in Pakistan has acquired epidemic outburst levels. There is need to focus on gaining an insight into the specific factors that determine such widespread loss/deficiency of Vitamin D in Pakistani population.[21][22]

II. MATERIALS AND METHODS

A questionnaire-based observational cross-sectional study was carried out from May 17, 2017 till October. We visited three hospitals: Ghurki trust teaching hospital, Jinnah hospital and Ittefaq hospital, Lahore. A convenient sample size of 50 patients was taken.

Age of 20-70 years was included along with non-discrimination of any sex and choosing healthy volunteers. People of below 20 years of age (children, adolescents, elderly) were not considered to be a part of study. It did include the postmenopause and ladies having the symptoms of dysmenorrhea. Subjects with hepatic or renal insufficiencies were ruled out. Similarly, those who showed the symptoms of metabolic rickets and those having inability to fill questionnaire were also ruled out of the study. We evaluated gender, age of patient (according to WHO guidelines, 50+ years of age is considered to be elderly), weight status, sun exposure & its duration, use of sunscreen, diagnosis of Crohn’s disease, ulcerative colitis or diarrhea and lastly, pharmacists’ interactive behavior.

Data was collected in a face-to-face manner with the individual covering the above aspects. Data was tabulated, and represented the form of graphs and tables.

III. RESULTS

The data was collected from 50 individuals, 36 females and 14 males. According to the WHO considerations, above 50 years of age, one is senescent or old. Women 80% were young females and 20% were old. Similarly, among men, 92% were young while 8% were old. (Figure 1 & table 1)

Greater the weight, lesser will be the absorption of vitamin D; reflecting the indirect proportion relativity. Weight showed a diversified collection: among women, 11%, 22%, 38% and 29% fell under the category 30-40 kg, 41-50 kg, 51-60 kg and more than 60 kg respectively. Similarly, among men, 0%, 28%, 14% and 58% fell under the same categories respectively. (figure 2 & table 2)

One of the important aspects: skin color & Exposure. 33% females & 14% males were fair-skinned. (table 3 & figure 3) 28% of the females said they do cover their skin while going out and 14% males responded yes (figure 4 & table 4). Usage of sunscreen among women was seen to be 19% while among men 21% of individuals used sunscreen (table 6). Sunscreen usage is a direct relevance to the hindrance as the sunlight is not absorbed, no vit-D activation. When they were questioned about the time duration of exposure to the sun, among women: 28%, 30%, 16% and 26% fell under the category of less than 5 minutes, 5-15 minutes, 15-30 minutes, more than 30 minutes respectively. Similarly, among men: 28%, 37%, 28% and 7% fell under the category of less than 5 minutes, 5-15 minutes, 15-30 minutes, more than 30 minutes respectively. (figure 5 & table 5)

Among females, 3% women were diagnosed with Crohn’s disease or ulcerative colitis while among males, none was diagnosed with either of two (100% responded “no”)(table 7), 16% of women said yes they have experienced diarrhea in the past 2 weeks and only 7% males said yes (table 8). 22% of females responded yes to the pharmacist’s being interactive while in the case of men, 28% responded yes to the pharmacist’s being interactive in the counselling of the vitamin-D intake. (table 9)
Figure 1: Age of the patients

Figure 2: Weight of the individuals
Figure 3: Skin color of the individual

Figure 4: Coverage done by individuals

Figure 5: Duration of exposure to sun
### Table 1: young and old individuals

<table>
<thead>
<tr>
<th></th>
<th>Women % (n)</th>
<th>Men % (n)</th>
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<tbody>
<tr>
<td>Young</td>
<td>80% (29)</td>
<td>92% (13)</td>
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<tr>
<td>Old</td>
<td>20% (7)</td>
<td>8%</td>
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### Table 2: weight of the individuals

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<th>WOMEN % (n)</th>
<th>MEN % (n)</th>
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<tbody>
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<td>30-40 kg</td>
<td>11% (4)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>41-50 kg</td>
<td>22% (8)</td>
<td>28% (4)</td>
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<tr>
<td>51-60 kg</td>
<td>38% (14)</td>
<td>14% (2)</td>
</tr>
<tr>
<td>More than 60 kg</td>
<td>29% (10)</td>
<td>58% (8)</td>
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### Table 3: skin tone of the individuals

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<th>WOMEN % (n)</th>
<th>MEN % (n)</th>
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<tbody>
<tr>
<td>FAIR</td>
<td>33% (12)</td>
<td>14% (2)</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>67% (24)</td>
<td>58% (8)</td>
</tr>
<tr>
<td>DARK</td>
<td>0% (0)</td>
<td>28% (4)</td>
</tr>
</tbody>
</table>

### Table 4: coverage of exposed skin whilst being in the sun

<table>
<thead>
<tr>
<th></th>
<th>WOMEN % (n)</th>
<th>MEN % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5 minutes</td>
<td>28% (10)</td>
<td>28% (4)</td>
</tr>
<tr>
<td>5-20 minutes</td>
<td>30% (11)</td>
<td>37% (5)</td>
</tr>
<tr>
<td>20-35 minutes</td>
<td>16% (6)</td>
<td>28% (4)</td>
</tr>
<tr>
<td>&gt;35 minutes</td>
<td>26% (9)</td>
<td>7% (1)</td>
</tr>
</tbody>
</table>

### Table 5: time duration of exposure in the sun

<table>
<thead>
<tr>
<th></th>
<th>WOMEN % (n)</th>
<th>MEN % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>19% (7)</td>
<td>21% (3)</td>
</tr>
<tr>
<td>NO</td>
<td>81% (29)</td>
<td>79% (11)</td>
</tr>
</tbody>
</table>

### Table 6: usage of sunscreen

<table>
<thead>
<tr>
<th></th>
<th>WOMEN % (n)</th>
<th>MEN % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>3% (1)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>NO</td>
<td>97% (35)</td>
<td>100% (14)</td>
</tr>
</tbody>
</table>

### Table 7: individuals diagnosed with Crohn’s disease or ulcerative colitis

<table>
<thead>
<tr>
<th></th>
<th>WOMEN % (n)</th>
<th>MEN % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>3% (1)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>NO</td>
<td>97% (35)</td>
<td>100% (14)</td>
</tr>
</tbody>
</table>

### Table 8: experience of diarrhea within past few weeks
IV. DISCUSSION

Vitamin-D, a secosteroid or better to be known as the sunshine hormone is essential and is an integral part of human body. Literature review and results show that it affects women more than men. Owning to its specific specialties, it mainly affects the women (57.7%), children and adolescents,[23] pertaining to the on-going reason, women are considered more susceptible than men as they have a more complicated physiology due to the on-going ovarian cycle as compared to men. (women:72%, men:36%)

The age affects in the similar manner as well. According to WHO guidelines, 50+ years of age shows a decline in the body levels of vitamin-D. (Above 50 years, one’s considered to be old or senescent or geriatric). With the increasing age of adulthood, the levels of vitamin-D absorption increases proportionally: showing a halt or incomplete absorption in old people (20% women, 7% men of our study). The similar study done by Lise Hnerald et.al showed that 50-90% geriatrics had their low levels of 25-OH cholecalciferol, leading to skeletal muscle degeneration and other metabolic disorders associated with it. The study also showed that hypovitaminosis D is a biomarker of age-related disorders like degeneration & cellular dysfunction, directly leading to therapeutic complications like polypharmacy and disabilities. [24] Moreover, studies reveal that despite of adequate sun exposure and vitamin-D supplements or food enriched with the vitamin-D (e.g. fortified milk, oily fish, eggs), the geriatrics are deprived of synthesizing vitamin in their bodies owning to a degrading body physiology (85.89%).[25]

Skin color also shows diversification: fair people tend to boost up their cholecalciferol (inactive form of vitamin-D that activates after exposure to the sunlight by process of hydroxylation) than medium or dark skin-colored people as the melanin underneath our skin literally tends to reflect the sunlight, causing a hindrance to the absorption of vitamin-D (women:33%, men: 21%). Reviewing the literature, it was evident that the dark skin is unable to photoactivate vitamin-D to its activated, useable form and darker skin bioactivates six times lesser vitamin-D as compared to that of pale skin.[26]

Some similarities were also seen as in the case of covering the skin. For the people who have an ethnic value of covering the whole body, as the Muslim women, lower levels of vitamin-D is manifested by weaker bones and muscular cramps on a daily basis.(28% women and 14% men do covering of body) Studies done earlier show that the women or men who wear long robes or tend to cover their skin in any possible manner tend to receive inadequate levels of vitamin-D in the body.(25.5%) [27] Another study also reveals the same fact that Asian women prefer indoor activities more as compared to men reasoning the aesthetic concern that directly implies that vitamin-D concern men less crucially as that of women (11.5% activation of vitamin-D) [28]

Obesity, a leading cause of many chronic diseases, also plays a vibrant role in determination of vitamin-D deficiency. A relation to study done (29% women, 58% men were overweight) with that of prior studies reveal that obesity is inversely related to vitamin-D deficiency, where obesity is directly proportional to increased weight (34.7%).[29]

Amongst one of the vital factors that affect vitamin-D levels, one is the time duration of one’s body being exposed in the sun; Longer the duration, greater is the vitamin-D levels (that’s why some people love to have a sun bath in summers!). A comparison of study being carried out (26% women, 7% men for a maximum exposure of more than 30minutes) and that of previous studies stated a clear-cut aspect that the human body should be exposed to sun for at least 5-30 minutes, for a proper processing of cutaneous conversion of pro-vitamin-D to its activated form. It was clearly evident that even the seasonal changes for example, autumn and mid-winters have an occlusion to the provision of vitamin-D synthesis. To add it up, decreased intensity of sunlight and cold temperature also plays a pivotal role for hindrance (10.02%).[30] Similar was the case with the usage of sunscreen. Use of sunscreen or sunblock, a nevertheless-ever-demanding cosmetic product, literally reflects back or in others words, completely or partially blocks the UV-B rays that reach our skin. A study done by Chi-Heising Huang et.al revealed that people who use sunscreen practically put one at a crucial, low levels of vitamin-D. Similarly, a study done by Diehl & Chiu 2010 says that suboptimal intake of vitamin-D, decreased activity and concomitant use of sunscreen will put this world to a pandemic outbreak of vitamin-D insufficiency. (11.5%).[31]

Liver or kidneys, the vital organs of human machinery, tend to work 24x7 hours a day. Losing their genuineness, the tendency of absorption of vitamins & minerals is also lost like, as in, diseased states (e.g. Crohn’s disease, ulcerative colitis) (3% women only suffered from Crohn’s disease. Besides being essential for bone homeostasis and mineralization (balance of calcium & phosphorus) it is an innate inflammatory mediator too, an autoimmune disease mediator to be precise like that of the Crohn’s disease (10% decreased absorption of vit-D) (Marco Adresia et.al).[32] Our gut wall i.e. stomach is also very efficient in absorption process owning to its increased surface area. Poor gut conditions e.g. diarrhea, constipation, provides efficient blockade system to a process like absorption. Moreover, to quote, dr. Fred Arnold says that the vitamin-D insufficiency also leads to bowel problems (constipation, diarrhea or both) & urinary tract problems (urinary urgency etc.). [33][34][35]

Pharmacists, a person who is well-known for his interactive behavior and counselling, should continue as such. Strong bones ends up with a beautiful, strong and endured life. That’s why it is said, to synthesize vitamin-D, your shadow should be lesser than your height! Being interactive and having a open-body language for counselling comes up with a better outcome: a change in one’s life!

Table 9: interaction of pharmacists

<table>
<thead>
<tr>
<th></th>
<th>WOMEN % (n)</th>
<th>MEN % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>22% (8)</td>
<td>28% (4)</td>
</tr>
<tr>
<td>NO</td>
<td>78% (28)</td>
<td>72% (10)</td>
</tr>
</tbody>
</table>

Notes:

[24] Heising Huang et.al.
[25] Lise Hnerald et.al
[26] Diehl & Chiu 2010
[27] Marco Adresia et.al.
[28] dr. Fred Arnold
V. CONCLUSION
Hypovitaminosis-D is becoming one of the most undetectable yet most alarming pandemic conditions. This study revealed that muscle strain, poor bone mineralization, low exposure to sunlight & increased usage of sunscreen and poor eating habits trigger the condition & muscle pain was found to be one of the most observed among symptoms. Majority of individuals didn’t seek any medical advice or had taken supplements. A large amount of population had different symptoms gone unnoticed like muscular cramps, pelvic pain etc. Hypovitaminosis-D was also seen in patients with concomitance of smoking habit. Thus, pharmacist has his role here; in counselling and motivation in taking vitamin-D supplement for a better bone care!

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Stories Learning by a Rational Agent Using CPM

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Abstract - Artificial Intelligence has the ability to represent the Highly-Autonomous Artificial Intelligence system that must be designed in such a way to return reactions and achievements which guarantee to align much similar to human values throughout their actions. In this paper, Alignment-based CPM is presented. The CPM does not impose restrictions on the process notation. This proposed method provides the closest matching path through the process model for any trace in the event log (as required for performance analysis). This method improves 99% accuracy of learning stories by a rational agent similar to human story learning according to different circumstances. Which is 56% better to previous mechanisms. This paper is based on an autonomous change in artificial intelligence's property of value alignment to enhance their relations with humans as well as other aspects of human life. This model helps a rational agent to learn/use a direct and fast method to solve a query form environment that doesn't need to follow any special rules. In this research some facts are presents to solve any situation from our environment that can be resolved by a human thinking but we achieve it by using Candidate Process Model (CPM) Artificial Intelligence.

Index Terms - Artificial Intelligence, Highly Autonomous, Candidate Process Model (CPM), circumstances, autonomous.

I. INTRODUCTION

In this Research Paper, we introduce the human story learning according to different circumstances in the process-mining task as shown in Figure 1 CPM, namely conformance checking [1]. We want to discover a process model but we would like to compare across a process model to the corresponding event log. In previous research according to *** many process discovery techniques represented but the ability to reply the event log on the model was missing, which is the most important. Many researchers discussed many techniques we focused on the different dimensions. All dimensions are important *, but event logs as special value in the model. When we look at the replay fitness, we have already seen the principal before. Therefore, the basic idea is that we would like to add replay traces that if we see in the log. On top of a model we executed A and C. and now the event log access that we should do e. Nevertheless, if you look at the model though and you look at the state that we are in E is not-yet unable. Therefore, we need A to force the process forward although we see that something does not fit completely. However, while doing that yet counting how many problem cc other Riyadh also recording the types of problems that you have said. So this is what we are trying to do if we check for fitness and compare observed behavior with, model behaves so the kind of diagnostics that we show our diagnostics at the level of an event log, for example, these other traces that do not fit well into the model. We also provide diagnostics at the model level showing the path of the model. When we look at the global Matrix, For example, we often look at the fitness metric, if it have a value between zero and one best zero means that a fitness is very poor and a fitness of one means that everything was seen in the log was indeed possible according to the ball.

Use cases for conformance checking

Now, why we are using use-cases for conformance checking? The first use case is related to auditing and compliance Finks at the level of business processes. Firstly we have to understand how people deviate and why they deviate the things. According to our research, they balked at reported correctly. Another use case is that we want to use conformance checking to evaluate the quality of process discovery algorithms and its result. Finally yet importantly often, we want to check conformance to some specification based on the actual behaviour. For example, if we have a piece of software and the software has a specification describing how it should work. We cannot compete for the daily find log and see where the software is deviating from the specification. Also if we provides services, we also check whether the description of the surface is consistent with the actual behaviour. So there are many different use cases for all of these cases we need to have a model that check the event looks and these models in our case, it will typically be any set of rules on any set of the model that capture some kind of behaviour.
Auditing
The basic idea is to check whether a report that was reported correctly and this is done to check whether the business processes are executed within the boundary set by mine just governments that all the stakeholders and these boundaries are expressed in terms of a process model or a set of rules and one difficult rules as model profits model.

Increase emphasis on compliance
In the last couple of years, that has been lots of emphasis on compliance and auditing related issues. To ensure that organizations are doing what they say they are doing. A completely different use case is the evaluation of process discovery algorithms. In our research we study many algorithms. By using these algorithm we got four process models. And according to these algorithms we get a new process model CPM.

Typically looking at the four dimensions.
1. Fitness
2. Simplicity.
3. Generalization
4. Precision

In this paper, we tried to compare the results of different processes. Discovery algorithms and process has many parameters in which you can also create many discovered models. What are the best models that we can look at? In this diagram, every red bolt corresponds to discovered process model [6]. Moreover, the two dementias indicate how will the fitness of the model is and how will the precision of the model is working? At this stage their a question arise which one is good model to consider? There is not a single model because you can clearly see Figure 3 Candidate Process Model that is apparently a tradeoff between the precision of fitness?

If we pick a model Pareto front [2] [3] and start to analyses the model there is no other models that are better in all dimensions. We can look at that although a mole on the Pareto front and again you can see that a couple of models are discarded because they are dominated by the models on the plate of what we can do that for all model on the Pareto front and then be got that red dots as well as if we are just interested in these two dimensions.

These are all the models that we should inspect because they are interesting. The other models are not interesting because there is always a model that is better than or at least as good in all dimensions. So far, we consider two dimensions one is Fitness and the second is precision. In this diagram Figure 5 Difference between Precision and Simplicity, you concede that model five is being dominated by model two because model two is better in terms of fitness and is better in terms of precision. However, if we include the third dimension. It may be that model five is on the Pareto front. For example, plots fitness against simplicity. One can see that if we look up model five it is no longer dominated by model two on any of all the models. Therefore, there is no model but at the same time has a better fitness precision and simplicity model five so, it is not dominated on the Pareto front. We are interested in the models that are out on the potato frogs and compelling disco fourth bottles is not very easy.

Comparing positive and negative deviants in any event log with the process model
If there are deviations, an obvious question to ask is the model wrong or is the log and both can be the case? THEREFORE, deviations considered good or bad. In many processes, People deliberately deviate from the process and in that way do something good. So for example, in hospitals, doctors will deviate and by these deviations, they are saving the lives of patients. We can also look for positive deviance things that deviate but in a positive manner. THEREFORE, deviations
are not always negative and it is not always the case that the process mobility rights and the event log are wrong. So far we have been discussing conformance checking mostly an offline but of course, you cannot do this at runtime. Online conformance checking means that the moment that the deviation Acer ups you immediately generate on the left.

Conformance checking techniques and control flow

There are many situations where we would like to compare modeled and observed behavior. In this section, we discuss a particular technique to check conformance called causal footprints [4] and the idea based on one of the ingredients of the alpha algorithm [5]. In the introduction of Alpha algorithm, we used made recess like that is called the footprint of particular log. We are using notions such as causality parallel and choice, they are based on the direct succession relationship. For example. If you look at this particular causal footprints, you will see that this arrow is indicating, that is followed by d at least once in the log. However, it is never the case that B. is followed by a. This parallel symbol is indicating that b a sometimes followed by c and c a sample is followed by d. Therefore, they happen in both directions, and then there is # symbol, which is the choice symbol. It is indicating that never followed by e and E is never followed by d. Therefore, these are the ingredients of creating a footprint. Nevertheless, it is very important to realize that you can create a foot but it based on the log. Butterfield can also create the footman place on a model because a model general authorized and by static analysis of these types of models, we can already derive this matrix with all the causalities. In this case, who opposes all discovered by Alpha algorithm both have the same cause of footprint, also there are no differences. Weather is disagreement between log on model and that leads to a foot print-based conformance of zero point seven five. Let us look at a much more refined method that resulted Fitness Ratio.

Figure 6 Approach to check in conformance by graph

We can see a trace A B. E. G., if we just consider a fitness at the level of complete traces one would say. This strays as a fitness or zero because it does not fit. We would like to look at fitness and conformance at the level of events because we have a long traces. However, we may have logged well known of the traces actually fitting we would get the conformance of zero but this would be very misleading them. This is done through counting called missing out remaining tokens to illustrate this. Let’s a reply add this trace on this model. So first we execute an after executing a, we executed b we still do not see any problem. Nevertheless, while doing this we are producing and consuming tokens then, A the event log says that we need to execute E. that’s why, we count the missing token. We continue, Then we execute E After executing E. we need to execute a G and we do not encounter any additional problems. Except for the fact that when we reach the end of the trace that is still a token left behind. Therefore, this example we have one remaining token of one missing token. It totaled over six produced tokens never six consume tokens that are one missing token and won the remaining tokens. Therefore, we can put this into a formula but looks like this but computes fitness as a number between zero and one zero means the fitness is as bad as is possible. The fitness of one means perfect fitness the trace could be applied without encountering any problems, as shown in Figure 7 Resulted Fitness Ratio.

Figure 7 Resulted Fitness Ratio

Therefore, this case p and c is equal to six. M and R is equal to one, so if we find that formula, we get the conformance over 0.83. For this particular tries this approach based on simply counting the number of produced consumed missing out a mating token. Missing tokens are taken, that are consumed. While they are not, there so we need to add a token. The counter r country

Limitations

1. Frequencies are not used
2. Behavior is only considered indirectly
3. Aims to capture fitness, precision, and generalization in a single metric

Approach to check on conformance

This approach is based on replaying the event log to diagnose differences between models and observed behavior. This figure shows a desire line this desire line is clearly indicating that the behavior of people is very different from the expected or model behavior, one can think of the gates. One can think of the desired line as the event log and that is clearly deviating behavior. Nevertheless, this approach has all kind of problems, for example, it does not take into account the frequency of traces. However, it does not actually look at the behavior. Now we look at a much more refined method that based on token based replied. So let us look at an example.
first to the tokens that are left behind at the end. That was not consumed while replaying a trace. At any point, in time the place complaints \( p + m - C \) tokens, and this number should be positive because it cannot be a negative number of logs and applies at the end. Therefore, this leads to a couple of invariants. If you done this, we play \( P+M \) will always be bigger or equal to \( c \). Because we cannot have a negative number of tokens in a place, \( C \) will also be at least \( M \), because we are never going to add missing tokens if they are not needed for consumption and at the end \( r \) is the number of tokens remaining in the place, so \( r \) is equal to \( B + \) and \(-c\). All numbers they hold out the level of an individual place but they all also held at the level of all places in the process model and at the end the environment needs to produce a token for the soft place. Moreover, at the end, the environment needs to consumer token from the same place. In the latter case, that is no the token of remaining on the final place at the end of the trace you still need to consume it so this bill out extra missing token. In this way we really check whether the trace exterminated in the desired final study.

**Alignment-Based conformance checking**

In this Section, we discuss the most advanced approach relating event logs to process models. We only compare the syntactical structure using directly follows relation. Then we looked at a more advanced approach using token-based reply then we will look at alignment-based conformance checking. What are the requirements for conformance checking overcoming the limitations of the approaches that you have seen before first conformance checking should not impose any restrictions on the process model notation? We should not be restricted to work flow nets. We should not be restricted to models where can't be two transitions having the same label or whether are silent steps. For example, the model when all split or join. If we see something, in reality, we want to relate it to a valid path through the process model. It is necessary for performance analysis where replay a reality on top of the model, also if we look at more of a sophisticated notion of conformance involving. Precision generalization or more advanced forms of diagnostics, we first need to relate reality to a path to the model. It’s a kind of an enabler for all types of analysis.

**II. CONCLUSION**

CPM is the best illustration of Stories learning by a rational agent using logs. The research paper discusses the behavior of CPM in real life as well as the explanation of how CPM works with their different type. We discuss Compare positive and negative deviants in any event log with the process model. Conformance checking techniques and control flow is briefly explained in this research paper. We use an approach to check on conformance. I hope my suggested CPM should effective to learning story for a rational agent. In Future enhancements may be possible form the modern techniques in conformance checking approach that may be more efficient as well as more effective.

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Intelligent Floor Cleaning and Insect Killing Robot Machine System

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Abstract- Automated and having self-thinking sense of the machines are now become the focus point to the engineers as well as to the computer scientists. AI has the core development procedure for the automated machines which just not only thinks like a human being but can do the task more accurately through environment retrieving methods. The system is developed for the ease that the robot cleaner will sense to the dust by the sensor used e.g. sonar so that I’ll clean the dusty area, during the cleaning process if the battery of the machine gets down then it will go to its charging station by itself and let it be charged after the charging process I’ll get to work again so that in this way machine can work all the time. Data will be collected and stored to the system whether of the most dusty areas of the house and as well as about the low areas so that in next wave the machine will go and check the most dusty area first and then to the other areas. AIDL(Artificial Intelligence Description Language) is used for this problem solving technique, moreover the system based on AI and therefor as the system learn more from the environment the more the system will be able to improve its abilities to do the proposed work.

Index Terms- Sonar, AIDL(Artificial Intelligence Description Language), Self-thinking, Automated.

I. INTRODUCTION

A sensational increment in the elderly populace alongside the blast of nursing-home expenses postures extraordinary difficulties to society. Current nurture. The elderly is inadequate, and later on, there will be less youngsters to enable more seasoned grown-ups to adapt to the difficulties of aging.1 Robots for senior care must fulfil a few necessities.

Current robots, with their settled speeds, can baffle clients. We require robots that can keep pace with the subject, moving neither too quick nor too moderate. Wellbeing while at the same time exploring within the sight of an elderly individual is additionally essential. Given the impediments of current vision frameworks, an eldercare robot may not continuously distinguish deterrents past its field of view and could inadvertently hit a man. Additionally, the robot must have the capacity to comprehend and react to voice orders. Current discourse acknowledgment and union advancements are adequate to make this conceivable, yet a few issues exist, for example, not having the capacity to fathom a ceaseless open-space discourse comprising of befuddling words, experiencing difficulty following who is talking when different individuals are available for the discussion, and not having the capacity to shut out natural commotion.

Figure 1 Schematic view of deliberation process

Numerous apply autonomy applications do not require pondering capacities, e.g., settled robots in assembling and other very much demonstrated conditions; vacuum cleaning and different gadget constrained to a solitary assignment; surgical and other tele-operated robots. Consideration is a basic usefulness for an independent robot confronting an assortment of conditions and an assorted qualities of undertakings.
III. MACHINE LEARNING

Learning approaches are being connected to numerous issues emerging in the outline of robots. As per the structure embraced previously, both activity and recognition can be upheld by learning approaches. Additionally, a few methodologies that incorporate a preparation step are sought after going from machine learning ways to deal with hereditary programming, furthermore, neural systems.

![Figure 2 Increasing instructions table](image)

From the stance of activity, learning approaches can be utilized for the essential activity aptitudes, particularly movement, be that as it may, likewise learning agreeable practices, adjustment to the earth, and taking in rivals' conduct, among others. Clearly, the learning procedure must face the difficulties of the trials with genuine robots. By the by, in a few exploratory settings (e.g. RoboCup), learning and adjustment of the essential expertise, for example, walking, vision calibration, have shown to be much more effective than parameter tuning by hand.

IV. NATURAL LANGUAGE PROCESSING

It is an obvious requirement of home and service robotics the ability to interact with people in natural language; therefore, natural language processing techniques find an interesting application domain on robots.

V. EXPERT CONSULTING SYSTEMS

AI techniques have additionally been utilized in the improvement of programmed counselling frameworks. These frameworks give human clients with master decisions about particular branches of knowledge.

Programmed counselling frameworks have been assembled that can analyse illnesses, assess potential metal stores, propose structures for complex natural chemicals, and even give exhortation about how to utilize other PC frameworks.

A key issue in the improvement of master counselling frameworks is the manner by which to speak to and utilize the information that human specialists in these subjects clearly have and utilize. This issue is made more troublesome by the way that the master information in numerous critical fields is regularly loose, unverifiable, or episodic (however human specialists utilize such information to land at helpful conclusions).

Numerous master counselling frameworks utilize the AI strategy of lead based finding. In such frameworks, master learning is spoken to as a vast arrangement of straightforward standards, and these tenets are used to control the discourse between the framework and the client what's more, to reason conclusions. Administer based finding is one of the significant themes in Nilsson's book.

VI. THE IMPACT ON RESOURCES AND ENVIRONMENT

Innovation is learning and data preparing innovation is information of how to deliver and utilize learning all the more adequately. Present day instruments those, for instance, that enable us to recognize follow amounts of contaminants in air, water, and sustenance — advise us about outcomes of our activities of which we were beforehand uninformed. PCs connected to the displaying of our vitality and natural frameworks follow out for us the aberrant impacts of moves made in one a player in our general public upon different parts. Information processing innovation is making every one of us assess the outcomes of our activities over ranges of time and space that from time to time concerned us previously. It is putting on us maybe driving on us, the obligations of securing future eras and in addition our own. Along these lines, the new innovation, the new information, is rethinking the necessities of ethical quality in human issues.

VII. CONCLUSION

In this area we have endeavoured to give a wide initial instructional exercise to AI. Nitty gritty talk of the techniques what's more, methods of AI and the extensive variety of issue areas in which they have been connected is given in different study articles by Minsky (1963), Newell (1969), Nilsson (1974) all of which show up as Appendixes B to E of this report. Informative supplement F (Newell, 1970) examines the connection between manmade brainpower and subjective brain research. (The book, Introduction to Artificial Knowledge by Patrick H. Winston, additionally gives a great prologue to the field.)

Independent robots confronting an assortment of open situations what's more, an assorted qualities of undertakings can't depend on the basic leadership abilities of a human fashioner or tele-operator. To accomplish their missions, they need to show complex thinking abilities required to comprehend their condition what's more, current setting, and to act intentionally, in a deliberate, purposeful way. In this paper, we have alluded to these thinking capacities as consideration capacities, firmly interconnected inside a perplexing engineering.

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Efficacy of Ef-Chlor for Drinking Water Purification and Multipurpose Disinfection

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Abstract- Ef-Chlor is a product manufactured by Hind Pharma containing Sodium dichloroisocyanurate (NaDCC) as its major component, which is an effective compound used for water purification, disinfection and sterilization. Ef-Chlor ensures maximum protection against a wide range of disease-causing pathogens. This paper provides information on different areas where Ef-Chlor tablets containing NaDCC can act in an effective manner and could substitute the old methods, formulations and compounds still used for purifying water. This paper summarizes the effectiveness of NaDCC (major component of Ef-Chlor) over all other traditional formulations with emphasize on its good antimicrobial activity, more safety, better stability, long shelf life, prolonged protection and affordability. The efficiency of Ef-Chlor (NaDCC) was also analysed against harmful pathogens in microbial testing where it demonstrated its immense effectiveness. Research papers, literatures, articles, studies and experimentation results available for reference have supported the claim stating NaDCC as a superior product over others. Ef-Chlor’s capability for use in broad domestic and industrial applications, its efficiency to work from small to large volumes and its strength to kill maximum pathogens makes it an ideal product in the market. Ef-Chlor could be used for municipal water supplies, household purposes, hospital uses, fruits and vegetable disinfection, janitorial cleaning, marine applications, poultry and many more areas as well as in emergencies and disaster situations where there is a demand for immediate disinfection and a need for clean drinking water. Ef-Chlor can act as a preventive aid for the various water borne diseases prevailing globally and thus it can contribute towards improving the global health conditions.

Index Terms- Disinfection, Ef-Chlor, Hind Pharma, NaDCC, Sterilization

I. INTRODUCTION

The spread of diseases from contaminated water has taken a vigorous rise globally. There is an increasing demand for a product that can be useful in disinfecting water from various disease causing microbes. Among various water-borne diseases, the common ones which are found in India are Diarrhoea, Typhoid, Malaria, Amoebiasis (Amoebic dysentery), Cholera, Giardiasis and Filariasis (Chabba, 2013)1. The contamination levels in water have taken a hike causing an increase in health hazards in societies globally. Water borne pathogens have major health impacts, relatively causing more damage to young children, underdeveloped and developing regions that lack proper supply of treated water. With the change in climate, the threat of water borne diseases also increase as seen in the rainy season where an escalation in spread of these diseases are observed. Water contamination level rises during emergencies like floods, tsunami, and heavy rains causing a massive outbreak of infectious diseases spreading via water.

A global study states that in developing countries diarrhea accounted for 21% deaths of most children fewer than 5 years of age and total 2.5 million deaths per year (Kosek & Guerrant, 2003)2. An article of WHO stated that the water related diseases caused by microorganisms present in contaminated water leads to death of more than 3.4 million people each year in which most of the victims are young children. Also according to an assessment done by United Nations says that 4000 children die each day from diseases caused by ingestion of filthy water. Reports state that four out of every ten people in world do not have access to clean drinking water, particularly in African and Asian regions (Berman, 2009)3. A study gives information on outbreak of different water-associated infectious diseases spreading worldwide correlating it with socio-environmental factors and showing its impact on all regions globally (Yang, 2009)4. A mandatory access to pure water is required for improvement in the health conditions of people in India too. Reports have stated that between 400000 and 500000 children with an age of around 5 years die every year from diarrhoea (a major water-borne disease) due to lack of personal and home hygiene in India (Murdur, 2003)5. There is a need to purify available water to make it free from microbial contaminations that will help to slow down and cease the spread of water borne diseases in people and also mainly among children who are living in underdeveloped, poor and rural areas where contamination in water is high. There is an increasing demand for a product that can disinfect the water and make it suitable for the purposes of drinking, household works, washing, cleaning, cooking and other related activities.

A product that can be beneficiary in all the situations is Ef-Chlor, which is being manufactured by Hind Pharma, India. Ef-Chlor (manufactured in tablets as well as granules form) can be used for Water Purification, Sterilization and General Disinfection on nearly all objects. These are Sterilising Effervescent Tablets, which act as a broad-spectrum fast acting sanitizers and water sterilizers that are quick and effective against a wide range of Bacteria, Viruses, Fungi and Protozoa. These tablets are useful in a wide range of

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industries for disinfection of water and sterilization (Hind Pharma)\(^6\). Ef-Chlor consists of Sodium Dichloroisocyanurate (NaDCC) that maintains a continuous and prolonged supply of Chlorine, which reacts with organic matter and the various pathogens present in the water and kills them. Environmental Protection Agency (EPA), World Health Organisation (WHO) and The United Nations Children’s Fund (UNICEF) have marked NaDCC safe for usage. In addition to this United States and many other countries have listed NaDCC to be used in emergencies for the purpose of drinking water disinfection (Kuznesof, 2004)\(^7\).

**Ef-Chlor: General composition and working**

Ef-Chlor is a product manufactured and marketed by Hind Pharma, India consisting adequate amount of NaDCC present in them. Each tablet of ef chlor is designed to supply a specific quantity of chlorine which can be used for disinfection of a particular volume of water. NaDCC has chlorine present in the hypochlorous forms (HOCl) which is an active antimicrobial agent showing effectiveness against a broad range of bacteria, fungi, viruses and protozoas. The production of NaDCC, its formulation, safety aspects, its working efficiency and other details are briefly presented by Paul M. Kuznesof (Kuznesof, 2004)\(^7\) in his works. Ef-Chlor tablets containing NaDCC are dissolved in water to decontaminate it and make it suitable to be used for drinking and other household purposes. The high disinfecting ability of NaDCC and its antimicrobial properties makes Ef-Chlor an advisable product to be used for disinfection and sterilization purposes. NaDCC works on a broad spectrum of pathogens and a wide pH range. NaDCC has proven to be effective against different bacterial species and gave positive results in killing various pathogens. In addition to this NaDCC has delivered better working efficiency and shown higher activity then other formulations like NaOCl (Bloomfield, 1979)\(^8\). Biofilms are a effective against different bacterial species and gave positive results in killing various pathogens. In addition to this NaDCC has proven to be effective against different bacterial species and gave positive results in killing various pathogens. In addition to this NaDCC has delivered better working efficiency and shown higher activity then other formulations like NaOCl (Bloomfield, 1979)\(^8\). Biofilms are a major contaminant of water and thus their presence makes water unfit for any use and increases the possibility in the spread of water borne diseases. NaDCC has been tested and found to be effective against bacteria growing in planktonic as well as in biofilm cell populations. NaDCC did not only eliminated bacterias is planktonic population but also inhibited biofilms formation inactivating the existing biofilms (Morgenthaua, 2012)\(^9\). The high antibacterial properties of NaDCC makes Ef-Chlor convininet to be used for drinking water purification, household purposes, baby products sterilization, hospital disinfection, janitorial cleaning and other related application.

**Chemical action of Ef-Chlor (NaDCC in water)**

\[
\text{NaDCC} + \text{H}_2\text{O} = \text{HClO} + \text{Na}^+ + \text{H}_2\text{C}_4\text{O}_4
\]

Hydrolysis of chlorine compound

\[
\text{HClO} = \text{H}^+ + \text{ClO}^-
\]

Stabilization of hypochlorous acid at the pH of water

\[
\text{HClO} = \text{HCl} + [\text{O}]
\]

Decomposition of HClO to liberate nascent oxygen

\[
[\text{O}] + \text{MICROORGANISM} = \text{HCl} + \text{OXIDISED MICRO ORGANISM} \\
\text{(DEATH OF GERMS)}
\]

Oxidation & destruction of germs by nascent oxygen

Hypochlorous acid (HOCl) is electrically neutral and hypochlorite ions (OCl-) are electrically negative in nature. The cell wall of pathogenic microorganisms is negatively charged usually which can be penetrated by the neutral hypochlorous acid, rather than by the negatively charged hypochlorite ion. Thus the free available chlorine released by NaDCC (and other chlorine donors, including the chlorinated isocyanurates) in solution will oxidise many organic and inorganic compounds in water.

**Properties of Ef-Chlor**

Ef-Chlor has more free available chlorine (FAC) in the form of hypochlorides (HOCl) and it is manufactured in both tablets as well as granular forms. NaDCC (major component present in Ef-Chlor) is marked totally safe by WHO, EPA and UNICEF for the use of drinking water purification and other household works (Kuznesof, 2004)\(^7\). Ef-Chlor does chlorination of water, which is an effectively known method for disinfection of water (World Health Organization , 2004)\(^10\). Ef-Chlor does not impart any strange colour or taste in the water which it is dissolved. Sodium dichloroisocyanurate (NaDCC) have more stability and longer shelf life then any other compound used for water purification purposes. NaDCC is environmental friendly and does not react with any other non pathogenic (non-harmfull) biomolecules present in water. A toxicological review on cyanurates and its chlorinated derivatives gives information on non-toxic and harmless attributes of dichloroisocyanurates and also advice the acceptable dosage of it to be used (Hammond, 1986)\(^11\). Ef-Chlor is designed in tablet form which gives an advantage of using specific dosage for a particular volume, eliminating the chances of underdosing or overdosing. The tablet structure of Ef-Chlor makes it a product that is easy to handle and store, moreover it could be used for traveling and camping purposes for purification of water. Ef-Chlor shows high efficiency in less time and works on a far-reaching ranges of pH and temperatures. It works on a broad spectrum of microbes including different species of bacteria, viruses, fungi, protozoas, mycoplasma, etc. The antimicrobial activity of sodium dichloroisocyanurate was tested against 66 strains of fungi, 28 gram positive bacteria and 29 gram negative bacteria, protozoa such as *Trichomonas vaginalis*, on which it presented exceptionally good results even in the presence of 1% organic substance (D'Auria, 1989)\(^12\).

**General Uses of Ef-Chlor**

EF-Chlor tablets containing NaDCC are dissolved in water to decontaminate it and make it suitable to be used for drinking and other household purposes, its working efficiency and other details are briefly presented by Paul M. Kuznesof (Kuznesof, 2004)\(^7\) in his works. Ef-Chlor is designed in tablet form which gives an advantage of using specific dosage for a particular volume, moreover it could be used for traveling and camping purposes for purification of water. Ef-Chlor shows high efficiency in less time and works on a far-reaching ranges of pH and temperatures. It works on a broad spectrum of microbes including different species of bacteria, viruses, fungi, protozoas, mycoplasma, etc. The antimicrobial activity of sodium dichloroisocyanurate was tested against 66 strains of fungi, 28 gram positive bacteria and 29 gram negative bacteria, protozoa such as *Trichomonas vaginalis*, on which it presented exceptionally good results even in the presence of 1% organic substance (D'Auria, 1989)\(^12\).
The maximum use of Ef-Chlor can be drained for the purpose of purification of drinking water. As Ef-Chlor has efficient working against a wide spectrum of water borne pathogens, it can be used for improving and enhancing the water quality and making it free from microbial load. Sodium dichloroisocyanurate has shown effective working as an antimicrobial agent in purification of drinking water at household level. It has many advantages over tradional water purification practices as well as it has proven as a safe and non toxic way in which water is efficiently treated wiping out the maximum pathogenic population (Clasen, 2006)\textsuperscript{13}. Ef-Chlor can be used with water serving different purposes in household work like cleaning, washing, bathing and cooking. The high antimicrobial activity of NaDCC discussed earlier makes Ef-Chlor an optimum choice to be used for sanitization applications, bottle sterilization, fruits and vegetable disinfection and other similar activities. The hygiene maintaining and disease controlling capability of NaDCC makes Ef-Chlor a preferable choice to be used in janitorial cleaning too. The tablet manufacturing and strip packaging of Ef-Chlor extends its appliance for use in travelling and camping. Ef-Chlor is safe, easy to handle, smooth in storage and trasport as well as simple for evaluating its usable dosage. It is largely used in the fields of poultry and dairy animals and their products. There is an enormous range of pathogens which can multiply, survive and infect the poultry animals and their products leading to a decrease in their yield. Ef-Chlor tablets can be used in proper dosage by dissolving them in water served to animals or can be sprayed which will result in disinfection of water and surroundings, not only killing the bacterias but also stopping the spread of water borne infectious diseases, which would help the farmers and breeders to increase the yield and productivity. Ef-Chlor can be used in Broiler/Layer farms, Breeder farms, Hatchery units, Cattle Breeding/Dairy Production and Milk Plants. When a large number of animals are living together, there is a high risk concerning the spread of infectious diseases from one animal to other. In these situations Ef-Chlor can be used in purifying drinking water which is fed to livestock as it does not impart any uncommon colour, foul smell or unpleasant taste in water, so there won’t be any change in the water intake of animals. Regular surface disinfection, disinfection of the cages and feeding utensils of animals used at zoos, clinics and farms can help in reducing the spread of infectious diseases among animals and to humans via contaminated animal products. In Fisheries there is a danger of cross contamination to fishes from the surface and water which they come in contact with as there is presence of a diverse natural microflora in water. Fish tissues are an ideal medium for the growth of bacteria and therefore washing and rinsing the fish with NaDCC before consumption reduces the chances of spread of water borne diseases. Ef-Chlor is also effective against viruses associated with food borne diseases, especially in shellfish and it also inactivates the formation of biofilms which is generally observed at room temperature (Hind Pharma)\textsuperscript{6}. Sodium dichloroisocyanurate was also found powerful for the sterilization of explants and cultures and disinfecting micropropagated plants from a broad range of bacterial species. It was found to be stable at room temperature (in tablets as well as solution), it was able to sterilize plants contaminated heavily from bacterial species and also reduced the phytotoxicity (Parkinson, 1996)\textsuperscript{14}. More uses of Ef-Chlor in essential sectors like Drinking water purification, Hospital purposes, Municipal water supplies and during Emergencies and Disasters will be discussed in this paper later.

**Activity of Ef-Chlor against Bacterial Species**

Bacterial species commonly found in water are *E.Coli*, *Shigella*, *Salmonella*, etc. leading to food poisoning, diarrhea, in some severe cases cause bloody diarrhea, watery diarrhea, urinary tract infection, etc. Elimination of these bacteria from water is a necessity to make water potable and more suitable for purpose of drinking, cooking, washing and other works. The antibacterial properties of NaDCC were evaluated by testing it against 28 gram- positive bacteria and 29 gram-negative bacteria including strains of *E.Coli*, *Salmonella typhimurium*. NaDCC demonstrated good antibacterial activity against all the tested strains and there was no decrease observed in its activity even in the presence of 1 % organic substance (D'Auria, 1989)\textsuperscript{12}. Presence of *E.Coli* in water is a major cause of urinary tract infection. NaDCC’s effectiveness was checked against multiple bacterial species like *E.coli*, *Staphylococcus aureus*, *Salmonella typhi*, etc. using varying parameters like pH and dilution factors. Higher bacteriocidal and disinfecting capabilities of NaDCC were observed against these organisms (Bloomfield, 1979)\textsuperscript{8}. The susceptibility of NaDCC has been established for bacterial species like *Escherichia coli*, *Salmonella dysenteriae*, *Shigella sonnei*, *Campylobacter jejuni* and *Yersinia enterocolitica* (Clasen, 2006)\textsuperscript{13}. These species are the main contributers in the spread of water borne infectious diseases. The cytotoxic effects of NaDCC were tested in-vitro using human fibroblast culture taking minimal inhibitory concentration and minimal bacteriocidal concentration of NaDCC against *Streptococcus sobrinus*, *Streptococcus salivarius*, *Enterococcus faecalis* and *Streptococcus mutans*. NaDCC was found to be very effective in killing these bacterial species and also its non lethal concentration range for fibroblasts was evaluated (Heling, 2001)\textsuperscript{15}. NaDCC tablets were tested for bacteriocidal activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. It was concluded that NaDCC was effective in killing these bacteria and had minimum level of available chlorine and greater stability (Coates, 1985)\textsuperscript{16}. NaDCC used in specific concentrations have shown effective disinfection against *Pseudomonas aeruginosa* growing as planktonic cells and against aquatic biofilms which are the major contaminents of water in environment contributing in the spread of water borne diseases like diarrhoea. Aquatic biofilms even provide protection for multiplication and development of pathogens like *E.coli*, *P.aeruginosa*, *Yersinia pestis*, *Helicobacter pylori* and many more which are the primary sources of water borne diseases (Morgenthalaua, 2012)\textsuperscript{2}. *Clostridium difficile* is a major cause of hospital-associated infective diarrhea and its spores can linger around for months in the hospital environment. Chlorine (dichloroisocyanurate) containing germicides were able to inhibit the growth of *C.difficile* as well as inactivate *C.difficile* spores showing greater effectiveness than other compounds used (Fawley, 2007)\textsuperscript{17}. Fecal *Coliform* bacteria are primary indicator for presence of disease causing organisms. Presence of *Coliforms* in water hints towards the possibility of presence of organisms that can cause water borne diseases. A experiment was carried out in broiler carcass combined with chilling systems used in poultry resulted that sodium dichloroisocyanurate was not only

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effective against Salmonella and Campylobacter species but was also efficient in reducing Fecal Coliform count in the water samples (Whyte, 2002). 

Activity of Ef-Chlor against Protozoan Species

Entamoeba histolytica is the highest prevailing protozoa in water causing amebiasis and amebic liver abscess. It is capable of causing multiple illnesses like dysentery, abdominal pain, bloody diarrhoea, severe colitis, etc. In severe cases, it may lead to anaemia due to excessive loss of blood. Giardia lamblia is the causative agent of Giardiasis that is a major diarrheal disease found throughout the world, largely spreading through contamination of raw water supplies. Cryptosporidiosis caused by infection from protozoan species of genus Cryptosporidium leads to a self-limited diarrheal illness in healthy individuals. Cryptosporidiosis causes prolonged and persistent diarrhoea chiefly in people with weak immune systems. Species of Cyclospora causes Cyclosporiasis and Microsporida species cause Microsporidiasis. These both are responsible for intestinal infection and illness causing diarrhoea in immunocomprised individuals. A study conducted to analyse the efficacy of NaDCC against these protozoan species revealed that all of these parasites were susceptible to NaDCC. It was stated that E.histolytica and G.lamblia were most susceptible by the action of NaDCC on them (El Zawawy, 2010).

Activity of Ef-Chlor against Virus Species

Rotavirus is a leading cause of diarrhea and dehydration worldwide extensively affecting the infants and the children. Severe and untreated attack from Rotavirus may lead to death because of dehydration. Adenovirus are capable of causing asymptomatic respiratory tract infection creating a damage in the tissues and cells of respiratory tract. Calicivirus species causes respiratory infection in cats and acute gastroenteritis in human beings. The lehal virus species like Hepatitis A causes inflammation of liver cells and Poliovirus (type 1) causes Polio (poliomyelitis), which can also spread through contamination of water. Susceptibility to hypochlorous acid formed on dissociation of NaDCC is seen in all the above mentioned virus species (D’Auria, 1989). Human Immunodeficiency Virus (HIV) is a Lentivirus (a subgroup of Retrovirus) that causes Acquired Immunodeficiency Syndrome (AIDS) which is a mortal disease. HIV is very sensitive to action from hypochlorites and thus specific concentrations of NaDCC can be used for disinfection of soiled surfaces, dirty surfaces and also for the decontamination of blood and body fluid spillages (Bloomfield, 1990). NaDCC granules (in adequate concentration kills Hepatitis viruses in about five minutes. It also destroys the surface antigen of type B Hepatitis virus and is said to show better killing effects in acidic conditions (Sodium dichloroisocyanurate). Human Immunodeficiency Virus (HIV) is very sensitive to action from hypochlorites and thus specific concentrations of NaDCC can be used for disinfection of soiled surfaces, dirty surfaces and also for the decontamination of blood and body fluid spillages (Bloomfield, 1990). NaDCC granules (in adequate concentrations) when dissolved in water provide a much longer and stable supply of hypochlorous acid producing higher level of available chlorine that could effectively be used on spillages for inactivation of HIV viruses (Van Bueren, 1995).

Activity of Ef-Chlor against Fungal Species

Candidiasis is a fungal infection caused by yeasts from the genus Candida. Sodium dichloroisocyanurate was tested against 66 strains of fungi. It was able to kill Candida rapidly in non cultural conditions but the growth phase of yeast influenced its activity. NaDCC required a longer contact time than yeast to work against the mycelial form of Aspergillus and Penicillium (D’Auria, 1989). Aspergillus causes Aspergillosis resulting in acute and chronic lung infections whereas Penicillium produces mycotoxins which are a toxic contaminant. NaDCC represented a synergistic antifungal activity when it was combined with gamma irradiation in specific doses against Penicillium expansum on pear fruits (Jeong, 2015).

Microbial Testing of Ef-Chlor (3.5 mg) tablets.

For testing the effectiveness of Ef-Chlor, it’s activity was visualised against 5 major species of bacteria responsible for causing water-borne diseases. Ef-Chlor tablets 3.5 mg that are meant for drinking water purification were used which demonstrate effective activity with 4 PPM of available chlorine when used for purifying 500 ml of water. Table 1 mentions the bacterial species on which the action of Ef-Chlor tablets was analyzed. These bacterial species were cultured using 2 types of water – Normal water and Ef-Chlor treated water and there 3rd dilution (10^-3) was streaked on specific growth media. The plates were incubated at 37°C in incubators after streaking and then presence of bacterial colonies was checked after 12 hours and 24 hours of incubation. The reporting was done on the mentioned time periods for the media plates with normal bacterial culture and Ef-Chlor treated bacterial culture. Table 2 gives a detailed information on the Microbial testing done mentioning the media used and CFU count observed in the plates. Figure 1 to Figure 10 display the growth observed in normal bacterial culture and the Ef-Chlor treated bacterial culture of the 5 different bacterial species selected for analysis.
Table 1: The bacterial species on which action of Ef-Chlor was tested and the possible diseases that can be caused by them.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Bacterial species analyzed</th>
<th>Disease they can cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Escherichia coli</em> (ATCC2065)</td>
<td>Urinary Tract Infections (UTI), Diarrhea and bloody diarrhea</td>
</tr>
<tr>
<td>2</td>
<td><em>Shigella flexneri</em> (ATCC12022)</td>
<td>Shigellosis (Stomach cramps, fever, diarrhea), Bacillary dysentery</td>
</tr>
<tr>
<td>3</td>
<td><em>Vibrio cholerae</em> (ATCC39315)</td>
<td>Cholera (watery diarrhea, vomiting and dehydration)</td>
</tr>
<tr>
<td>4</td>
<td><em>Salmonella typhi</em> (ATCC6539)</td>
<td>Typhoid fever (headache, nausea, abdominal pain and constipation), sometimes associated with diarrhea and vomiting.</td>
</tr>
<tr>
<td>5</td>
<td><em>Staphylococcus aureus</em> (ATCC6538)</td>
<td>Skin infections, respiratory tract infections, food poisoning and Bacteremia</td>
</tr>
</tbody>
</table>

Table 2–Microbial Testing Report of the selected 5 bacterial species on which Ef-Chlor’s action was analyzed

<table>
<thead>
<tr>
<th>Parameters Observed</th>
<th>Media plates with Normal Bacterial Culture</th>
<th>Media Plates with Ef-Chlor treated Bacterial Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.) Species analysed – <em>Escherichia coli</em> (ATCC 2065)</td>
<td>Media used – MacConkey agar media</td>
<td></td>
</tr>
<tr>
<td>Volume of media used</td>
<td>20 ml.</td>
<td>20 ml.</td>
</tr>
<tr>
<td>Initial growth observed after 12 hours of incubation</td>
<td>Growth observed</td>
<td>Growth not observed</td>
</tr>
<tr>
<td>CFU count after 12 hours of incubation</td>
<td>$10 \times 10^3$</td>
<td>Nil</td>
</tr>
<tr>
<td>CFU count after 24 hours of incubation</td>
<td>$28 \times 10^3$</td>
<td>Nil</td>
</tr>
<tr>
<td>2.) Species analysed – <em>Shigella flexneri</em> (ATCC12022)</td>
<td>Media used – XLD agar media</td>
<td></td>
</tr>
<tr>
<td>Volume of media used</td>
<td>20 ml.</td>
<td>20 ml.</td>
</tr>
<tr>
<td>Initial growth observed after 12 hours of incubation</td>
<td>Growth observed</td>
<td>Growth not observed</td>
</tr>
<tr>
<td>CFU count after 12 hours of incubation</td>
<td>$12 \times 10^3$</td>
<td>Nil</td>
</tr>
<tr>
<td>CFU count after 24 hours of incubation</td>
<td>$30 \times 10^3$</td>
<td>Nil</td>
</tr>
<tr>
<td>3.) Species analysed – <em>Vibrio cholera</em> (ATCC39315)</td>
<td>Media used – TCBS agar media</td>
<td></td>
</tr>
<tr>
<td>Volume of media used</td>
<td>20 ml.</td>
<td>20 ml.</td>
</tr>
<tr>
<td>Initial growth observed after 12 hours of incubation</td>
<td>Growth observed</td>
<td>Growth not observed</td>
</tr>
<tr>
<td>CFU count after 12 hours of incubation</td>
<td>$12 \times 10^3$</td>
<td>Nil</td>
</tr>
<tr>
<td>CFU count after 24 hours of incubation</td>
<td>$30 \times 10^3$</td>
<td>Nil</td>
</tr>
<tr>
<td>4.) Species analysed – <em>Salmonella typhi</em> (ATCC6539)</td>
<td>Media used – XLD agar media</td>
<td></td>
</tr>
<tr>
<td>Volume of media used</td>
<td>20 ml.</td>
<td>20 ml.</td>
</tr>
<tr>
<td>Initial growth observed after 12 hours of incubation</td>
<td>Growth observed</td>
<td>Growth not observed</td>
</tr>
<tr>
<td>CFU count after 12 hours of incubation</td>
<td>$12 \times 10^3$</td>
<td>Nil</td>
</tr>
<tr>
<td>CFU count after 24 hours of incubation</td>
<td>$30 \times 10^3$</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>20 ml.</td>
<td>20 ml.</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Volume of media used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial growth observed after 12 hours of incubation</td>
<td>Growth observed</td>
<td>Growth not observed</td>
</tr>
<tr>
<td>CFU count after 12 hours of incubation</td>
<td>$7 \times 10^4$</td>
<td>Nil</td>
</tr>
<tr>
<td>CFU count after 24 hours of incubation</td>
<td>$16 \times 10^5$</td>
<td>Nil</td>
</tr>
</tbody>
</table>

5.) **Species analysed** – *Staphylococcus aureus* (ATCC6538)  
**Media used** – MSA media

<table>
<thead>
<tr>
<th></th>
<th>20 ml.</th>
<th>20 ml.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of media used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial growth observed after 12 hours of incubation</td>
<td>Growth observed</td>
<td>Growth not observed</td>
</tr>
<tr>
<td>CFU count after 12 hours of incubation</td>
<td>$19 \times 10^4$</td>
<td>Nil</td>
</tr>
<tr>
<td>CFU count after 24 hours of incubation</td>
<td>$44 \times 10^5$</td>
<td>Nil</td>
</tr>
</tbody>
</table>

**Figure 1:** *E.coli* media plate with normal bacterial culture after 24 hours of incubation  
**Figure 2:** *E.coli* media plate with Ef-Chlor treated bacterial culture after 24 hours of incubation
Figure 3: *Shigella* media plate with normal culture after 24 hours of incubation

Figure 4: *Shigella* media plate with Ef-Chlor treated bacterial culture after 24 hours of incubation

Figure 5: *Vibrio* media plate with normal after 24 hours of incubation

Figure 6: *Vibrio* media plate with Ef-Chlor treated bacterial culture after 24 hours of Incubation
Use of Ef-Chlor for drinking water purification

One of the vital and most important applications of Ef-Chlor is its ability to purify water and make it fit for consumption. It is highly important to maintain good water quality to ensure there is no spread of contamination and vulnerable diseases. Ef-Chlor can be a good choice for Household Water Treatment and Safe Storage (HWTS) as it removes contamination from the water making it free from any kind of pathogenic species. NaDCC releases hypochloric acid which reacts through oxidation killing microorganisms and thus purifying the water from any kind of microbial load. Also the excess chlorine that remains in water after its antimicrobial action is called free residual chlorine (FRC) which is the most effective form of chlorine (especially for viruses) and prevents recontamination of water that has already been treated. Ef-Chlor tablets which contain NaDCC do not impart any foul odour, unpleasant taste or off-color to the water being treated and ensure that the water is safe to drink after 30 minutes once the tablet has been dissolved.

NaDCC tablets are among the most preferred techniques for water purification. These tablets have newly developed applications in the HWTS sector. NaDCC effervescent tablets which have been used for emergency water purification since 30 years, have now evolved as an alternative to other products for HWTS purposes and for water purification and its disinfection. Many trials conducted have shown NaDCC as an effective product for treating drinking water. The distribution of specific size NaDCC tablets for drinking water treatment and other household purposes has taken a hike in recent times. Different researches have been done to prove efficacy of NaDCC in Kenya, Tanzania, Ghana, Bangladesh, etc. NaDCC tablets have been successful in disinfecting water by making it free from fecal coliforms which can cause water-borne diseases (Clasen, 2009). Many other trails have been done to test the antibacterial properties of NaDCC tablets in Orissa, Bangladesh to purify drinking water and slow down the spread of water-borne diseases like diarrhea. Among the many companies manufacturing NaDCC tablets, Hind Pharma, India is World’s largest manufacturer of NaDCC tablets supplying its product called “Ef-Chlor” to over 40 different countries.

Use of Ef-Chlor for disinfection purposes in Hospitals

Ef-Chlor can be used as a hospital disinfectant as it contains NaDCC which has high microbial killing abilities. Ef-Chlor can be dissolved in water used for cleaning of floors, mopping, cleaning instruments or apparatus and also in the water that is used for washing hands and bathing purposes. Transmission of diseases can easily occur in hospital surroundings and can lead to spread of fatal and viral diseases. Ef-Chlor can be used to reduce the risk of spread of diseases in hospital environment by showing its action on different pathogens prevalent at that time. The spread of viral diseases can occur from blood spillages if not disinfected properly. Thus NaDCC could be used on blood spillages to stop the spread of diseases via them. A survey indicated NaDCC was able to perform a critical disinfection of Hepatitis B and other viruses probably to be present in blood spillages and thus it is more reliable (Ching, 1989). Unbuffered NaDCC offered highly effective disinfection for hospital environment showing strong action on vegetative bacteria too (Bloomfield, 1985). There is also a possibility of using NaDCC as a root canal irrigation solution which could be applied in root canal within 1 week after dilution as it has shown antimicrobial effectiveness against E. faecalis (Hye-Jeong Kim, 2007).

Use of Ef-Chlor during Emergencies and Disasters
During the time of an emergency or a disaster, there is an arising need for a water treatment process. Ef-Chlor acting as a water purifier as well as a disinfectant can be used in such situations. NaDCC has a history of being widely used in emergencies as it offers better advantages over other products on the grounds of stability, safety, low capital investment and convenience in packaging and transport. NaDCC might be preferred chlorination technique because of its easy and convenient handling properties that allows its rapid deployment in the regions of acute emergencies (Loo, 2012).31

**Advantages of Ef-Chlor tablets (NaDCC tablets) compared to other compounds**

Various advantages of Ef-Chlor in comparison with other compounds commonly used for disinfection purposes are given in Table 3.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Sodium Dichloroisocyanurate [Ef-Chlor tablets]</th>
<th>Calcium hypochlorite (Bleach) [Ca(ClO)₂]</th>
<th>Chlorine Gas [Cl₂]</th>
<th>Sodium Hypochlorite [NaOCl]</th>
<th>Halazone [C₇H₅Cl₂NO₄S]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Chloramines</td>
<td>Chlorinated Compound</td>
<td>Chlorinated Compound</td>
<td>Chlorinated Compound</td>
<td>Chlorinated Compound</td>
</tr>
<tr>
<td>Available Chlorine</td>
<td>60%</td>
<td>&gt;65%</td>
<td>100% Active 12.5% (HOCl)</td>
<td>20%</td>
<td>50%</td>
</tr>
<tr>
<td>Stability in Water</td>
<td>48 hours</td>
<td>2-4 hours</td>
<td>2 hours, Low Hydrolysis constant</td>
<td>2 hours, Low Hydrolysis constant</td>
<td>12 hours</td>
</tr>
<tr>
<td>Hazards</td>
<td>Very Safe</td>
<td>Hazardous</td>
<td>Very Hazardous</td>
<td>Heavy Dusting Liquid</td>
<td>Safe</td>
</tr>
<tr>
<td>Taste of Water</td>
<td>No Significant change</td>
<td>No Significant change</td>
<td>Chlorine Gas</td>
<td>Alkaline</td>
<td>No Significant change</td>
</tr>
<tr>
<td>Odour</td>
<td>No Significant change</td>
<td>Strong Chlorine odour</td>
<td>Chlorine Gas</td>
<td>Chlorine odour</td>
<td>No Significant change</td>
</tr>
<tr>
<td>Shelf-life</td>
<td>3 years</td>
<td>3 months – 6 months</td>
<td>1 year</td>
<td>20-30 days</td>
<td>2 years</td>
</tr>
<tr>
<td>Environment</td>
<td>Eco-Friendly</td>
<td>Hazardous</td>
<td>Toxic</td>
<td>Eco-Friendly</td>
<td>Eco-Friendly</td>
</tr>
<tr>
<td>Formulation type (Effervescent Tablets)</td>
<td>Effervescent Tablets</td>
<td>Granules and Tablets</td>
<td>Cannot form Effervescent Tablets</td>
<td>Cannot form Effervescent Tablets</td>
<td>Cannot form Effervescent Tablets</td>
</tr>
<tr>
<td>Handling</td>
<td>Easy</td>
<td>Easy but store in dry place</td>
<td>Heavy Weight Cylinders</td>
<td>Problem in High Volume Transportation</td>
<td>Easy</td>
</tr>
</tbody>
</table>

**Advantages of Ef-Chlor over boiling water as a purification technique**

Boiling is one of the oldest and most used method for treating water to make it suitable for consumption. Though it has high effectiveness, it has many disadvantages too. It turns out to be costly due to large fuel consumption. Use of firewood leads to deforestation when boiling water procedure is being performed for household use. It is a time consuming method and does not remove turbidity, chemicals, unpleasant taste and smell from the water. Also water needs to be cooled down after boiling so that it can be used for drinking purposes (Shrestha)32. There have been multiple issues arising related to drinking water quality and tap water quality as well as safety concerns of drinking bottled water. The people are not sure that how safe is the available water for drinking. An article
published on September 7, 2014 by Gulf News informed that more than 10,000 illegal packaged water-bottling units are operating in Delhi using the labels of 64 licensed manufacturers risking the health of all the people consuming bottled water. It was also stated in the article that while licensed plant sold 10,000 bottles per day, unlicensed bottling plants were selling about 30,000-40,000 bottles everyday (Gulf News India, 2014). Instances like this scare the people drinking bottled water and raise a suspicion concerning the safety of drinking water. Ef-Chlor is a very safe product that can be used for purification of drinking water. It should be dissolved in bottled water 30 minutes prior to its consumption, which would ensure that the water being consumed is free from any kind of disease causing microbe. This purification technique can be an additional safety check on drinking water. While travelling it is certainly not possible to boil drinking water before use. Therefore, for travelling purposes Ef-Chlor tablets can be utilised to provide on spot, assured and relatively fast purification and disinfection of water to before consumption.

**Hind Pharma – Manufacturer of Ef-Chlor**

Hind Pharma is World’s no. 1 manufacturer of water purification NaDCC tablets sold by the name of Ef-Chlor. Established in 1977, now with an experience of 40 years Hind Pharma’s manufactured water purification tablets – “Ef-Chlor” is no. 1 brand of India available in 18 different sizes. Hind Pharma is currently exporting its water purification and disinfectant products to more than 40 countries and is making a big impact in the global markets. Ef-Chlor tablets are manufactured in different sizes providing varying amount of available chlorine to treat small to large ranging volumes of water. These different ranges helps in accuracy of dosage and ensures easy, simple and smooth working for users. Its packaging is mostly done in strips that makes it easy for transportation and storage. Detailed information on different ranges of Ef-Chlor are mentioned in Table 4 taken from official website of Hind Pharma. The instructions of using Ef-Chlor for emergency conditions with clouded water and for clear and household drinking water is printed on the back of every mono carton in which tablet strips are packed. Major cautions and storage conditions are also mentioned beside instructions for use for user’s safety. Both Manufacture (Mfg.) and Expiry (Exp.) dates are printed on the mono cartons as well as on individual strips present in it to ensure that the product is used under its mentioned duration. More information on applications and advantages of Ef-Chlor are mentioned in the Ef-Chlor selection under the Products tab of Hind Pharma’s official website. Hind Pharma has received several certifications for its marvellous service provided by putting efforts towards improving water quality and making it cleaner and healthier. Hind Pharma has been awarded many certificates from Food and Drug Administration (FDA) that includes Drug Licence certificate, Good Manufacturing Practices (GMP) certificate, Good Laboratory Practices (GLP) certificate and Free Sale Certificate (FSC). The company has also been ISO 9001:2008 certified by Intertek Certification Limited, United Kingdom. All the above-mentioned certificates can be viewed under the company info tab present in the Hind Pharma’s website. All these certification act as a token of guarantee assuring that Ef-Chlor tablets are produced and packed in sterile conditions and are totally safe for purification, sterilization and disinfection purposes.

**Table 4 – Range of Ef-Chlor**

<table>
<thead>
<tr>
<th>Range of Ef-Chlor</th>
<th>Available Chlorine</th>
<th>Volume of Water to be treated</th>
<th>Packing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ef-Chlor 3.5 mg</td>
<td>2 mg</td>
<td>1 litre</td>
<td>10 x 10 / 10 x 5 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 8.5 mg</td>
<td>5 mg</td>
<td>1-2 litres</td>
<td>10 x 10 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 17 mg</td>
<td>10 mg</td>
<td>4-5 litres</td>
<td>10 x 10 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 33 mg</td>
<td>20 mg</td>
<td>8 litres</td>
<td>10 x 10 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 67 mg</td>
<td>40 mg</td>
<td>10-12 litres</td>
<td>10 x 10 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 75 mg</td>
<td>45 mg</td>
<td>20 litres</td>
<td>10 x 10 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 167 mg</td>
<td>100 mg</td>
<td>25-30 litres</td>
<td>10 x 10 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 400 mg</td>
<td>240 mg</td>
<td>50-80 litres</td>
<td>8 x 8 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 500 mg</td>
<td>300 mg</td>
<td>100-120 litres</td>
<td>8 x 8 Strips</td>
</tr>
<tr>
<td>Ef-Chlor 1.67 gm</td>
<td>1000 mg</td>
<td>500 litres</td>
<td>50 Tablets Jar</td>
</tr>
<tr>
<td>Ef-Chlor 2.75 gm</td>
<td>1500 mg</td>
<td>750 litres</td>
<td>200 Tablets Jar</td>
</tr>
<tr>
<td>Ef-Chlor 3.5 gm</td>
<td>2100 mg</td>
<td>1000 litres</td>
<td>142 Tablets Jar</td>
</tr>
<tr>
<td>Ef-Chlor 4 gm</td>
<td>2400 mg</td>
<td>1000-1200 litres</td>
<td>20 Tablets Jar</td>
</tr>
</tbody>
</table>

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Using Ef-Chlor (NaDCC) tablets is an effective and fast way to purify water. The results obtained from microbial testing of these tablets prove that they are remarkably effective against harmful water borne disease-causing pathogens. The researches performed in the past and their results obtained do match with our currently performed experiment’s results supporting that Ef-Chlor (NaDCC) is a powerful antimicrobial disinfectant. The data compiled from different researches and studies suggest that NaDCC is safer, non-toxic, stable and efficient in working compared to any other compound used for the purpose of drinking water purification, water disinfection and sterilization. Ef-Chlor tablets can be used as a multipurpose disinfectant and are more stable formulation having a higher shelf life compared to other chlorinated products. There are various fields where Ef-Chlor can be effectively applicable in improving the water quality and making it fit for consumption and other works. The wide range of Ef-Chlor manufactured that contains optimum amount of chlorine, which can be used for treating specific volume of water helps in eliminating the dosage problems. Thus, use of Ef-Chlor (NaDCC) tablets for water purification and general disinfection could prosper in making a healthy society by eliminating the risk of diseases spreading via contaminated water.

II. CONCLUSION

Aknowledgment

This research was fully funded and supported by Hind Pharma, Bhopal, M.P., India. We thank our colleagues of the company who provided with knowledge, insight and expertise that greatly assisted our research.

We would also like to thank Center for Microbiology & Biotechnology Research & Training Institute (CMBT) for assistance with Microbial Testing of Ef-Chlor tablets that greatly improved the quality of paper.

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Artificial models of iron hydrogenases for their potential use in the generation of molecular hydrogen: a mini-review

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Abstract - The mimicking of natural processes and the development of alternative methods to obtain clean fuels such as H₂, have been of great interest in recent years. In nature, the hydrogenase enzymes at some bacteria and algae are responsible of the fermentation and biophotolysis processes. This class of enzymes performs the reduction of hydronium ions to molecular hydrogen. Due to the composition of its active site, the hydrogenase enzymes are classified as: [Fe-Ni], [Fe-Fe] and [Fe] -hydrogenases. The study of its active centers has allowed inspiring model compounds that promote the advance in the development of efficient catalysts for the generation of hydrogen. In this review, we present some complexes that have been studied as models to imitate the active centers of the hydrogenases. Also, we analyze some electronic properties that they present. The most commonly used methods to mimic hydrogenases are structural, spectral or functional. Some of the common metals for this purpose are iron, nickel or cobalt, among others. In order to obtain an accurate model of a hydrogenase enzyme, several properties of the metals and ligands used for the generation of a metallic complex should be considered. These might promote some effects that could interfere with the electronic transfer and the subsequent redox process in the generation of molecular hydrogen.

Index Terms - Catalytic center, metal complex, hydrogenases, hydrogen production.

I. INTRODUCTION

Fuels have been essential elements in our civilization, it is estimated that by 2080 molecular hydrogen could be the main source of energy [1]. Currently, hydrogen is considered an alternative fuel, with potential that could decrease environmental damage by reducing the consumption of fossil fuels [2, 3]. In order to generate an environmentally and economically sustainable society, molecular hydrogen must be obtained by environmentally friendly methods and green technologies should be developed, for example the water splitting using sunlight[4]. In 1912 Giacomo Ciamician manifested the necessity to abandon the use of fossil fuels and theorized the generation of new technologies based on photochemical devices, with the potential to mimic the natural systems such photosynthesis [5]. This process is considered the most important reaction in biosphere, the advances in synthetic chemistry and the understanding of natural processes might allow the mimicking of biological processes and the possible generation of clean fuels such as H₂, using water as a raw material[6]. In nature, hydrogenase enzymes carry out the reduction reactions of hydrogen ions to generate molecular hydrogen. These enzymes inspire the design of catalysts for this reduction process [7]. In order to contribute to the understanding of the function, structure and promote the imitation of hydrogenase enzymes, several compounds with an analogous structure to the active center of this enzyme have been synthesized[8]. However currently, the search continues for compounds that can work as catalysts in the generation of molecular hydrogen[6]. A common strategy involves the modification of ligands to bind two metals and allow the synthesis of binuclear complexes [9]. In this review, we show some complexes that have been synthesized as models to mimic hydrogenases. Some of its advantages and disadvantages are analyzed, as well as its properties in the electron transfer reactions.

II. HYDROGENASES IN THE HYDROGEN GENERATION

A. Hydrogen production

Molecular hydrogen has a great potential for energy storage: the energy stored per mole of molecular hydrogen at 298K is ΔG°= 237.2 KJ/mol, considering its small mass, the capacity of hydrogen to store energy per gram is of 119000 J/g. When this value is compared to fossil fuels which provide 40,000 J/g, the energy value of molecular hydrogen is considered excessively high [10]. Also, it has the advantage of generating clean combustion, because when combined with oxygen, it produces heat, electricity and only water vapor as a by-product. This characteristic is considered one of the great attributes as an alternative energy source, but only if it is obtained by sustainable methods[11]. A slight disadvantage of hydrogen is its detonation limit in air, which is 4%, while that of butane is 1.86%, so the use of hydrogen may not be more dangerous than using natural gas[10].
Currently, the hydrogen production is carried out by methods of hydrocarbon reforming by steam or coal gasification. Both methods use fossil fuels, under high conditions of temperature and pressure, which promotes the generation of greenhouse gases [4]. There are some green technologies for the production of hydrogen, such as: the electrolysis of water by photovoltaic systems [9], the photolysis of water through the use of microorganisms [4], some other pioneering technologies that are still in development [12-14] and the artificial photosynthesis [9, 11]. The use of photovoltaic systems is initially very expensive, due to the cost of the equipment used [3].

The production of hydrogen through bacterial photosynthesis has some important barriers, such as inactivation by oxygen and light capture, among other [15]. Also, the microorganisms that have been studied, show a production of hydrogen in a very low rate [4]. On the other hand, artificial photosynthesis is considered one of the most promising alternatives for the production of hydrogen from water. Artificial photosynthetic systems must carry out key processes, such as photo-excitation and oxidation, which allows an electron to be generated and with this, a subsequent reduction of chemical species [8]. To achieve a design of artificial systems producing hydrogen, attention should be focused on chemical compounds that mimic the hydrogenase enzymes present in nature and consider the structure of metal clusters at the active site, where the generation of hydrogen takes place [15].

### B. Hydrogenases

The molecular hydrogen production in microorganisms is linked to the activities of electron transport of its biogeochemical cycle [16]. Hydrogenase enzymes are present in microorganisms that incorporate hydrogen into their metabolisms, such as sulfate-reducing phototrophic bacteria and some eukaryotic algae [7, 17]. Hydrogenase enzymes have diverse functions, mainly catalyze the conversion of hydrogen ions and electrons to molecular hydrogen [7], according to reaction (1):

\[
H_2 \leftrightarrow 2H^+ + 2e^- \quad (1)
\]

The hydrogenase enzymes are classified according to the structure of its active center into three types: iron-iron hydrogenases or \([\text{FeFe}]\)hydrogenases, nickel-iron hydrogenases or \([\text{NiFe}]\)hydrogenases and iron hydrogenases or \([\text{Fe}]\)hydrogenases [8]. The functions performed by the hydrogenase enzymes, depends on its site in cell where they are present, so many bacteria have two or more different hydrogenase enzymes. Also several bacteria have a single type of enzyme \([\text{NiFe}]\)hydrogenases or \([\text{Fe}]\)hydrogenases [7]. Most of the hydrogenases can catalyze the reaction (1) in vitro in any direction [7, 8, 17]. \([\text{FeFe}]\)hydrogenases and \([\text{NiFe}]\)hydrogenases perform as redox catalysts, while \([\text{Fe}]\)hydrogenases catalyze the reversible heterolytic cleavage of \(H_2\) [8] according to reaction (2):

\[
H_2 \leftrightarrow H^+ + H^- \quad (2)
\]

In recent years, using studies of X-ray crystallography, spectroscopy and chemical modeling, different structures of hydrogenase enzymes have been characterized. This has allowed distinguishing the chemical structure in the three types of hydrogenases. Despite the spectral differences, the metal centers of the hydrogenase enzymes have structural and chemical analogies [7].

The three enzymes classes contain \(H_2\) activating sites, around one iron unit coordinated with a carbonyl (CO) and sulfur atoms. The CO and cyanide (CN) are structural elements of each active center and is the unique feature of the hydrogenase enzymes [8]. An important aspect which has generated great controversy, is the oxidation state of the metal atoms in the active center, the results in several studies are contradictory[8]. Some artificial models of hydrogenase enzymes that have been synthesized, show that their structure can be manipulated with a degree of predictability. Also several of its physical properties such as solubility, basicity and redox potential [18]. In addition, the development of several feasible method to generate the catalytic splitting of \(H_2O\) for the production of \(H_2\) on a large scale have been proposed [8].

### III. HYDROGENASE ARTIFICIAL MODELS

Several studies have reported diverse synthetic models to mimic the hydrogenase enzymes. Some of these compounds are based on the structural or spectral mimicking of the active site of the enzymes. For this purpose, some metal ions such as ruthenium, osmium, platinum, cobalt, iron and nickel have been used. Nevertheless iron and nickel are present in the active center of the enzymes, therefore they are the best candidates for participate in mimicking the structure of the active site[6].

#### A. [NiFe]hydrogenase artificial models

A crystallographic structure of the \([\text{NiFe}]\)hydrogenase was obtained by isolating the enzyme from a strain of one reducing-sulfate bacterium: \(\text{Desulfovibrio vulgaris Miyazaki}\). Its study showed that the metallic center NiFe, allows the stabilization of iron atom at the redox state +2 [19]. During the catalytic cycle, the nickel atom is the site where the reaction begins which changes for several oxidation states[20] which allows to the iron atom remain at oxidation state of +2 [8]. The studies carried out on these enzymes have been a key point for the understanding of structural and functional properties of the active center. Some of the electronic transfers in the metallic center can be reflected in the spectrophotometric studies of hydrogenase enzymes such the signal of maximum absorbance at 360 nm of hydrogenases isolated from a strain of \(M.\) marburgensis [21].

The electronic structure of the enzyme is related to its catalytic activity, this encourage the purpose to mimic the structure of the active-center of \([\text{NiFe}]\)hydrogenases.
Several research groups have synthesized and characterized multiple compounds with structural analogies such as the bonding distances and geometric arrangement analogous to the metallic center of the enzyme[22] or synthesizing compounds with metal centers analogous to this enzyme, which incorporate an iron and a nickel atom. Also, it has been determined its activity in the molecular hydrogen generation, this has allowed increasing the understanding of the mechanism of this enzyme[23]. The ligand is an essential constituent for the synthesis of these compounds, in several studies have reported that a substituted 2,2’-bipyridyl could provide the necessary characteristics for catalyzing the molecular-hydrogen generation reaction, by promoting structural and spectroscopic properties analogous to hydrogenase enzyme[23]. Some other compounds are used as ligands: 1,3,5,7-tetraphenyl-1,5-diaza-3,7-diphosphacyclooctane, substituted with aromatic rings or mercaptimidazole. These compounds have been reported as models of the active-center of the enzyme, also the generation of molecular hydrogen has been catalyzed when a nickel complex has been coordinated with this ligand by phosphorus atoms, which induces a stability to the complex[24]. An additional complex studied is nickel(II)-bis(2-mercapto-1-methylimidazolyl)borate, which shows structural characteristics similar to [NiFe]hydrogenase with interesting redox properties [25]. In another study, residues of cysteine and phenylalanine coordinated to the metal center were used, the aromatic rings of the ligands promote an electronic transfer which catalyzes the reaction of reduction [26]. Finally, a binuclear nickel compound was studied, [Ni2(L)(MeCN)3]3+ (L2 macrocycle incorporating imine N and thiolate S donors) with a Ni(III) and Ni(II) centers, linked by a two thiolates bridge, also a nickel atom is coordinated with two acetonitrile molecules [27]. While several studies focused on the synthesis of diverse compounds, other studies focused on the electronic characterization of the active center or its model compounds. Several spectroscopic techniques such as UV-Vis and Raman spectroscopy were used to characterize two model complexes with a similar structure to the active-center of hydrogenase enzyme. One of these compounds with an iron atom bonded to a thiolate bridge shows peaks of visible spectrum at 400, 500 and 590 nm. A different compound has a hydrogen atom that performs as a bridge, shows absorption signals at 290, 350, 450 and 575 nm. The peaks were assigned to a charge transfer from nickel to the phosphine and thiolate ligands, while the other assignment corresponds to the transfer between iron and nickel atoms. Another signal that was found corresponds to a charge transfer from the thiolate ligand to the iron center [28]. In a different study, some nickel complexes with trimethylphosphine, phenylselenolate or ethanethiolate, were spectrally characterized. If phenylselenolate is coordinated, absorption bands at 590 and 620 nm are shown. On the other hand if a chloride ion is coordinated its signals changed to 954 and 990 nm, with ethanethiolate were observed bands of 577 and 920 nm [29]. Other exotic studies evaluated the effect of the ligand trimethylphosphine which has an electron donor-acceptor capacity [30]. Also, have been synthesized compounds with a Ni-Fe metal-center attached to a ferrocene complex [31]. There is great controversy about the redox inactivity of iron in the proposed mechanism of [NiFe]hydrogenases enzymes. In order to promote the redox activity that nickel has in the enzyme, some studies have synthesized complexes with a metallic center that contains only nickel[8].

**B. [FeFe]hydrogenase artificial models**

The [FeFe]hydrogenases enzymes have their active center conformed by a metallic cluster with two iron atoms [8], with a three-dimensional structure of square pyramid shaped, where both iron atoms are linked by a dithiolate bridge [32]. In addition to the metal cluster, the hydrogenases have an additional ferredoxin clusters: [4Fe-4S] and [2Fe-2S], which during the catalytic cycle performing as electron transfer centers [33]. Some studies about the mechanism of H2 formation that occurs in [FeFe]hydrogenases have proposed that the first step for catalysis is the transfer of a first electron to the iron center. Subsequently, a second transfer carries out the electron to the ferredoxin center that is farthest from the di-iron center, so that the ferredoxin centers can store the second electron. Finally, the stored electrons are used for the reduction of hydrogen ions and generate molecular hydrogen [34-36]. During all steps of catalytic cycle, one of the two iron atoms of the metal center maintains its oxidation state of +2, while the other iron atom is constantly changing its oxidation state [37]. Other compounds promote a similar structure to the active-center of the enzyme using cyanide as a ligand to replace carbonyls [38] and pyridine which can generate molecular hydrogen [39]. Also, other compounds with structural characteristics different from the enzyme have been studied, using ligands such as dimethyl-azadithiolate [40], trimethylphosphine [41, 42]. It was found that due to the electrons delocalization a change in the oxidation states of the metal-centers occurs. Also, a model was synthesized with 3,6-dichlorobenzene-1,2-dithiolate and used in conjunction with a ruthenium photosensitizer, showing activity in the hydrogen generation [43]. A few complexes has been synthesized with more than two iron atoms, binding a di-iron compound with a [4Fe4S] cluster, which can be an aid to improve the understanding of the chemical processes that occur in the natural process [44, 45]. In another study, several tetra-nuclear iron compounds were synthesized with benzene-1,2,3,4-tetra-thiolato [46]. Spectral studies of the enzyme and its artificial models are a key for the understanding of the electronic structure and the catalytic mechanism for the molecular hydrogen generation. Some of the electronic transitions occurring in the enzyme active-center have been studied by UV-Vis methods. A [FeFe]hydrogenase enzyme was purified from DesulfoVibrio desulfuricans, showing absorption bands at 280 and 390 nm [45]. Some models that have been studied show absorption bands between 260 and 420 nm analogous to the enzyme. Using benzylamine and chitosan a compound was synthesized. It was determined that chitosan promotes a stabilization of the molecules linked to the metal center and increases the electrons transfer for the generation of H2. In addition, by spectrophotometric techniques were observed signals at 336 nm [44]. In another work, a compound was synthesized with the azadithiolate cofactor showing UV absorption bands at 330 nm, this system is able to use light to photocatalyze the hydrogen formation [47].
In another study, a compound was synthesized from three ether chains linked. In this compound were observed absorption bands at 350 nm and emission bands at 670 nm [48]. Also, a di-iron cluster linked to tetra-phenyl-porphyrin was synthesized, which shows a maximum absorption at 419 nm and emission at 655 and 719 nm. It is believed that these signals are due to the electrons transfer from the porphyrin to the di-iron metal-center [49]. The 7-mercapto-4-methylcoumarin was also used as ligand, in which showed absorption bands at 288 and 338 nm and emission at 370 nm. This spectral analysis indicated a photoinduced electron transfer of 7-mercapto-4-methylcoumarinligand to metal center [50]. Also, a dinuclear iron center linked with the photosensitizer bis-2,2'-bipyridyl-2-phenylpyridyl-iridium(I), is able of carrying out all process for the molecular hydrogen generation from water. This compound shows absorption bands between 260-320 nm attributed to π-π* transitions located in 2,2'-bipyridyl and 2-phenylpyridyl, other signals at 300-400 nm were assigned to metal to ligand charge transfer transitions [51].

C. [Fe]hydrogenase artificial models

Iron hydrogenases or [Fe]hydrogenases were discovered in 1990, in their structure, they have only iron atom in their active center [8]. Although [Fe]hydrogenases maintain analogies to [FeFe]- and [NiFe]hydrogenases, they are completely different. This was determined by mass spectroscopy and infrared spectroscopy studies [52]. In the iron hydrogenases, the generation of molecular hydrogen occurs in the active center which is an inverted site with a quadrangular pyramid structure, which allows the electron density to flow from the ferredoxin centers [32]. In 1972 a research group performed spectrophotometric studies on purified hydrogenases obtained from a strain of Clostridium pasteurianum, in this study were observed absorption bands at 340, 415 and 440 nm in oxidized-state and signals at 410 and 590 nm in reduced-state [53]. To evaluate the relationship between the enzyme spectrum and the active-center iron geometry were performed studies where the A. Eutrophus hydrogenase absorption spectrum was compared with other proteins that have iron components. It was found that the signals are similar to iron proteins without heme groups, showing maximum absorption at 380 and 420 nm, and emission at 526 nm [54]. Also, have been synthesized iron complexes with acyl, carboxyl and pyridine ligands, with structural analogues to those of enzyme in nature. Also, phosphine has been used as ligand, which induced a significant stability to the compound, in a greater proportion than N-donor ligands [55]. Song's group synthesized and characterized compounds similar to enzyme metal-center, linked to acylmethyl(hydroxymethyl)pyridine [56, 57]. They was observed that the geometry is similar to exists in the enzyme active-center [57]. Also, have been synthesized complexes with 2-pyridylalmino-N,N-bis(2-methylene-4-methyl-6-tert-butylphenol) and 2-pyridylalmino-N,N-bis(2-methylene-4-methoxy-6-tert-butylphenol), which show absorption bands at 348 and 520 nm, these were attributed to a charge-transfer from ligands phenolate to iron(III) atom [58]. On the other hand, some studies with models that mimic the [Fe]hydrogenase, show the importance of the ligands linked to the metal center, which can induce link-up of the hydrogen ions to the metal center for its subsequent reduction [59]. In a similar study researches found that the use of π-acceptor ligands provide a strong interaction to the iron center [60]. Finally, it was observed that methyl thiolate compounds can be incorporated with iron and these which can improve the modeling of the active center of the enzyme [61].

D. Artificial models with other metal centers

To mimic the activity of hydrogenase enzymes in the generation of molecular hydrogen, additional to the use of iron and nickel, other metal ions such as ruthenium, rhodium, osmium and cobalt have been studied. The use of these transition metals have allowed to partially elucidate the mechanism of hydronium ion reduction to molecular hydrogen [17]. The first chemical model that mimics the hydrogenase enzyme reaction was a complex with ruthenium(III) reported by Harrod et al., in which multiple reactions are promoted partially elucidate the mechanism of hydronium ion reduction to molecular hydrogen [17]. The first chemical model that mimics the metal ions such as ruthenium, rhodium, osmium and cobalt have been studied. The use of these transition metals have allowed to metal hydrogenases active center. Studies with this metal have focused in the hydronium ion reduction for the molecular hydrogen generation, on the other hand, the interaction between palladium and molecular hydrogen has been studied and it has been concluded that it can occurs from electronic delocalization and charge transfer in the complex. This allows to theorize the effect of metal complexes and hydrogen interactions and generation [69]. Since the 1980s, cobalt has been one of the most explored metal ions in the complexes formation that mimic the hydrogenases active center. Studies with this metal have focused in the hydronium reduction for the molecular hydrogen generation, some are able of generate molecular hydrogen with a low production rate. These systems show spectral characteristics similar to enzyme systems, with signals that appear between 230-350 nm and 420-470 nm. Several ligands used in the cobalt complexes promote electronic transitions and wavelengths analogous to the nature systems, these ligands are: (difluoroboryl)dimethylglyoximato that shows absorption bands at 328 and 456 nm [70]; N,N-bis(2-pyridinylmethyl)-2,2'-bipyridine-6-methanamine, shows bands assign to π-π* transitions (274 y 300 nm), d-d transitions (420/470 nm) and other transitions at 337 nm [71]; 2,2'-bipyridyl [72], with absorption bands at 300 nm [73]; 2-bis(2-pyridyl)(methoxy)methyl-6-pyridylpyridine with absorption bands at 550 and 600 nm [74]; 2-acetylpyridine shows absorption bands due π-π* transitions (275 y 230 nm), d-d transitions (450 nm) and other electronical transfers at 310 nm [75]. Porphyrins are used also, showing absorption signals at 230 nm), d-d transitions (450 nm) and other electronical transfers at 310 nm.
at 407 and 526 nm [76]; using 1,1,1-tris(diphenylphosphinomethyl) [77], shows absorption bands at 680 nm [78]. By correlating the transitions with complexes stoichiometry can be an aid to know the electronic structure and the metal centers geometry [79]. Also, it is important to consider the properties of the ligand coordinated to the metal-center, for example, the ligand: 2-bis(2-pyridyl)(methoxy)methyl-6-pyridylpyridine can stabilize the complex in aqueous solutions [74]. On the other hand, ligands such diimines and pyridines are used due to their properties to stabilize the complex and generate a electronic delocalization [80]. This allows a high electron transfer to the ligands rings, promoting stability to the complexes, with metal ions that have d-orbitals, this is probably the result of the ability to form π-bonds by overlapping d full orbitals and π* empty orbitals of ligand ring [79]. Although most complexes have been used individually, some studies report the simultaneous use of a photo-sensitizer with metal ions such iridium or ruthenium. One of the most prominent systems involves cobalt and ruthenium complexes with 2,2'-bipyridyl, in which it was determined that the activity molecular hydrogen generation increases when 2,2'-bipyridyl is substituted with methyl groups [72]. Several system uses the tris-2,2'-bipyridyl-ruthenium(II) complex as photosensitizer together cobalt(II)-dithiolene complex [81], shows an absorption band at 390 nm and also the photosensitizer characteristic bands. Finally a study use tris-(2,2'-bipyridyl)cobalt(II) complex like reducer agent and a gadolinium(III) as photosensitizer, which shows an comparable photocatalytic efficiency compared to [Ru(bipy)3]2+ complex [82].

IV. CONCLUSION

Hydrogenase enzymes have been studied extensively. However, the development of an efficient catalyst for hydrogen generation, with structural analogies to enzymes, is at a very early stage. This can be attributed to the fact that the electron transfer in the reactions promoted by this enzyme has a high efficiency, promoting the proposals of very complex mechanisms. To design an artificial model of a hydrogenase enzyme, it is important to know the previous studies of artificial models, as well have access to structural and spectroscopic information of the enzyme. The study of the intramolecular structure of the enzyme hydrogenase might allow to know the electron transfer reactions during the redox cycles of metal atoms in the active center and contribute to future designs of artificial systems. On the other hand, different studies indicate that it is important to choose the metal and ligands used to obtain these complexes. The ligand might promote a single coordination site or several in the coordination sphere, this modify the geometry and stability of the complex. To generate a catalytic activity, artificial models require that the metal ions involved should generate complexes with an adequate coordination environment and promote high stability. These factors have limited the mimic the hydrogenases metallic center. The synthesis of metal complexes requires several steric and electronic properties of ligands, to reduce bond angles, distances and decrease the intramolecular tensions, which can affect the stability. This promote to focusing investigations on the synthesis of active functional model. Finally, several research groups have initiated the study of different metallic complexes, mono, di and multi-nuclear, with iron, nickel, cobalt, ruthenium and osmium, which have been reported to achieve the reduction of hydrogen ions to molecular hydrogen.

ACKNOWLEDGMENT

The authors would like to thank the Secretaria de Educación Pública (SEP) through the “Convocatoria 2017 de Fortalecimiento de Cuerpos Académicos” and Secretaría de Innovación, Ciencia y Educación Superior (SICES) through their program “Convocatoria de Investigadores Jóvenes 2016”, in the project “Obtención de Clústeres Manganese-Calcio para su Aplicación Potencial en Sistemas de Fotosíntesis Artificial”, for their economic support, is gratefully acknowledged.

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ISSN 2250-3153


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ISSN 2250-3153

268


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(Case Study : PT X)

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Abstract- Indonesian construction industry currently does not have a regulation concerning the applicable contract standard. But in practice, some of construction contracts used either refers to presidential decree (Perpres No 54/2010) and its amendmments on procurement of government goods/services or international contract standards such as FIDIC, JCT etc. Case study in this research was conducted at an oil and gas company called PT X. It is one of the joint venture company whose majority shares are owned by one of the biggest Indonesian state-owned enterprises. PT X uses technical guidelines called Juknis as guidance in the procurement contract of good/services in which some of regulations used as reference are FIDIC and Perpres No 54/2010. Once construction contract is created and signed by employer and contractor, the important thing that must be conducted by both parties is to carry out contract administration. Some cases occurred in PT X were due to undisciplined of contract administration implementation, even though the construction contract had been well prepared. In the past ten years, the company has been experiencing dispute with several contractors which requires assistance of either court or dispute adjudication board. Besides such disputes result in substantial material losses to the company.

The problems to be solved in this research are: to examine what are important aspects of procurement contract of construction works according to FIDIC Silver Book (1999 edition) and Presidential Decree No 54/2010 along with the amendment. Furthermore, this research will focus on recommending the improvement of implementation on procurement contract of construction works in PT X with approach of FIDIC Silver Book and Presidential Decree No 54/2010 along with amendment. This research uses quantitative method with two variables which are contract administration as independent variable and procurement performance as dependent variable. These variables were then validated against 50 respondents in the company through distribution of questionnaires. Furthermore, data processing is conducted by SPSS program (Statistical Packages for the Social Sciences) 24 version.

Result of analysis using SPSS 24 shows that important aspects of contract construction procurement administration which refers to FIDIC and Presidential Decree No. 54/2010 are variables X2, X28, X20, X6, X5, X1, X11, and X26. Based on these results, it is recommended to re-evaluate selection of dispute settlement that has been done through arbitration, and use of EPC contract types in procurement system of construction works.

Index Terms- contract, procurement, construction works, FIDIC

I. THE BACKGROUND OF RESEARCH PROBLEMS

Procurement has a crucial role in the implementation of construction works in which includes procurement planning, selection of contractors, contract implementation and delivery of work. According to Davison and Wright (2004), contractual objective of any procurement process must successfully complete the project. The successful completion of project is defined by National Institute Government Purchasing (NIGP) as the right procurement in the right quantity, at the right price, at the right time, with the right quality or known as 5 "R's" (Thai, 2004). One of an important part in procurement process of construction works is contract making, which is a bond of work between employer and contractor.

Indonesian construction industry currently does not have a regulation concerning the applicable contract standard. But in practice, some of construction contracts used refers to presidential decree No 54/2010 and its amendments, PTK 007, FIDIC, etc. Procurement of goods and services using the State Revenue and Expenditure Budget (APBN) and Regional Revenue and Expenditure Budget (APBD) refers to Presidential Decree No. 54/2010 and its amendments. While procurement contract of construction works on some State-Owned Enterprises.
refers to technical guidelines called Juknis made by each company. As for international contracts, many countries refer to FIDIC documents. Case study was conducted at PT X, a joint venture company whose majority share is owned by one of the biggest Indonesian state-owned enterprises. Contracts of construction works procurement on the company refer to Juknis, Presidential Decree No. 54/2010 and its amendments, FIDIC documents and other relevant regulations, where FIDIC document embraces a balanced risk sharing principle which is charging a risk to a party whose deemed as the most capable of controlling it.

Once construction contract is created and signed by employer and contractor, an important thing that must be conducted by both parties related is to carry out contract administration. Some cases occurred in PT X were due to undisciplined of contract administration implementation, even though the construction contract had been well prepared. In the past ten years, the company has been experiencing dispute with several contractors which requires assistances of either court or dispute adjudication board. Besides such disputes result in substantial material losses.

The problems to be solved in this research are: to examine what are important aspects of procurement contract of construction works according to FIDIC Silver Book (1999 edition) and Presidential Decree No 54/2010 along with the amendment. Furthermore, this research will focus on recommending an improvement of implementation on procurement contract of construction works in PT X with approach of FIDIC Silver Book and Presidential Decree No 54/2010 along with amendment.

II. RESEARCH PROBLEMS

This research will focus on solving the problems:

- To examine what are important aspects of construction contracts under FIDIC Silver Book and Presidential Decree No. 54/2010 and their amendments
- To recommend an analysis of improvements for procurement system in PT X based on results of the research

III. LITERATURE REVIEW

Construction project implementation process began with an idea from owner which then translated by a designer in a form of construction design. The design is further constructed by observing and considering various things such as materials, mobilization, as well as technical development. Construction work has four constraints, which are cost, money, time and scope, and involves many parties such as employers, consultants as well as contractors. Relationship either between employers and contractors, or employers and consultants are legally regulated so that each party is disciplined in exercising its rights and obligations in order that construction implementation run well. Usually for some fairly complex construction work, the relationships between parties involved set in professional construction management in order to create synergies either in contractual, functional or structural relationships.

Procurement process according to Charles L. Huston encompasses all activities necessary to procure goods or services required for a project, with purpose to control the performance of contractors and suppliers in terms of cost, quality, time and technical implementation of work. Procurement methods or processes within projects vary depending on size and complexity of the project as well as the organizing party.

According to PMBOK (Project Management Institute Body of Knowledge), contracts are documents that legally bind buyers and sellers. Meanwhile, according to Ir. H. Nazarkhan Yasin, in the book of Mengenal Kontrak Konstruksi di Indonesia (2006), construction contracts can be reviewed from various aspects, such as from terms of cost calculation, service calculation, method of payment, and division of tasks. It is necessary to regulate in contract management so that contract management run properly. In other words, contract management is a process of managing all aspects related to agreements made between parties involved. In the journal of “A Detailed Analysis of The Relationship between Contract Administration Problems and Contract Types”, mentioned that contract management process consists of six phases which are: procurement planning, solicitation planning, solicitation, source selection, contract administration, as well as contract closeout. Contract Administration is an effort to manage contracts during its implementation so that the rights and obligations of each party can be executed in accordance with the terms stated in the contract. Main point in applying a good contract administration is to understand the roles and responsibilities of each party in construction contract. According to Sherman (1996), Contract Administration is a term used to describe functions performed after each party signs contract.


FIDIC is an abbreviation of the Federation Internationale Des Ingenieurs-Conseils (International Federation of Consulting Engineers), an association of consulting engineers, founded in 1913 by the French, Belgian and Swiss and based in Lausanne, Switzerland. FIDIC Silver Book (1999) Conditions of Contract for EPC/Turnkey Projects is a contract form commonly used for private infrastructure projects where contractors are fully responsible for project design and implementation. Risks regarding project completion include cost, time and quality charged to contractors but risks such as force majeure and war are responsibility of employers. The following are various research results relevant to this research:

a. Hernu Suyoso, Agoes Soehardjono, As’ad Munawir, Factors Affecting Performance of Procurement Committee of Physical Construction Works in Jember Regency, Journal of
Civil Engineering, Brawijaya University, Indonesia. This journal uses SPSS software, with validity and reliability test, multiple linear regression analysis, F as well as t test result analysis which is relevant to this research.

b. Kumarul Aripin, Kristina Sembiring, Sempurna Bangun, Evaluasi Contract administration and Monitoring of Construction Project implementation on Potential Rural Engineering Management Consultant Project. Journal of Main Science and Technology, Tama Jagakarsa University, Indonesia. According to this journal, contract administration activities shall include: monitoring administration of bidding activities, monitoring of financial progress, as well as monitoring of physical progress of infrastructure development.


d. Herman Susila, Analysis of Contractor’s Inhibiting and Supporting Factors in Understanding Construction Contract Document, Engineering Faculty journal of Tunas Pembangunan, Surakarta, Indonesia. Theories and research methods used in this journal have similarities to the research being conducted.

e. Satrio Agung Utomo, Yanuar Asmara Putra, Arif Hidayat, Frida Kristiani, Evaluasi Hak & Kewajiban antara Perjanjian Kontrak Nasional Dengan Persyaratan Standar FIDIC (Studi Kasus: Proyek Pembangunan Gedung Pemuda Dan Kebudayaan Temanggung), Jurnal Fakultas Teknik Universitas Diponegoro, Semarang, Indonesia. This journal compares each verse between national contract agreement and FIDIC standard, which is similar to the research undertaken.

IV. RESEARCH METHODOLOGY

1. Research Process

The first step taken after formulating research problems is to dig information from related sources (e.g. direct interview, website, Juknis, and some construction work contracts) to get an idea of how portrait of procurement contracts of construction works in State-Owned Enterprises, especially PT X which refers to FIDIC and Presidential Decree No. 54/2010 and its amendments. Based on these sources then obtained the factors and variables in the procurement of construction works. These variables subsequently are packaged in a form of questionnaire to be distributed to the minimum of 50 employees of PT X who have backgrounds and competencies relevant to the research topic whom respondents were selected based on certain criteria. Data obtained from the questionnaire were then summarized and processed using SPSS. In addition, various tests such as validity, reliability, correlation, intercorrelation, factor, regression, and F and t test analysis were conducted to see what are the important aspects of construction contracts under FIDIC and Perpres No. 54/2010 and their amendments. This research then ends with recommendation of improvement to PT X based on result of this research.

2. Survey Respondents

The respondents chosen in this research were homogeneous respondents who came entirely from the employee of PT X with these criteria: having minimum education of Diploma, having at least three years work experiences related to civil engineering and contracts, as well as having minimum age of 25 years. These requirements are given to ensure that respondent understands the research topic so that the answers given are in accordance with the assumptions specified. The technique used is total sampling wherein samples taken involving the entire population. With the consideration that population in this research is under 200 persons.

3. Factors and Research Variables

This research focuses on factors and variables associated with FIDIC Silver Book and Presidential Decree No. 54/2010 and its amendments in relation to contract administration. Based on comparison of two documents above, as well as other related journals and references, there are obtained 10 factors and 40 variables (X) as follows:

- Preparation of contract implementation which consists of: determining communication procedures/correspondence between parties involved before commencement date of contract (X1); conducting contract implementation and coordination meetings to monitor project progress (X2); reviewing the completeness of contract documents before commencement date of contract (X3); determining system and archive storage for all contract documents during execution period of contract (X4); carrying out contract administration in an EPC contract that refers to FIDIC or Presidential Decree No. 54/2010 and its amendments (X5).
- Management of variation and adjustments, which consists of: limiting the amount of variation and adjustments in order to run an orderly contract administration (X6); managing variation and...
adjustments in order to run an orderly contract administration (X7); minimizing the possibility of change due to scope and volume of work (X8); as well as minimizing any changes due to administrative issues (X9).

- Management of payment, which consists of: performing detailed and clear financial and/or payment documentation and administration during term of contract (X10); managing payment in accordance with agreement specified in contract (X11); monitoring payments in accordance with the currency agreed in contract (X12); determining payment procedure prior to commencement date of contract (X13); managing payment well in relation to contract administration (X14); determining all taxes, duties, and fees payable by contractors (X15); managing payments for construction works based on the work already installed (X16); monitoring the implementation of indemnities for employers in accordance with contract due to late of payment to contractors (X17).

- Management of bond, which consists of: managing payment of performance bond (X18); monitoring validity period of performance bond since commencement date of contract until handover of other goods/services or first handover of construction works (X19); managing advance payment with a guarantee in relation to the orderly contract administration (X20); monitoring return of maintenance bond/retention to contractors once maintenance period is completed, usually six months for permanent works, and three months for semi-permanent works (X21); monitoring return of performance bond after the work is one hundred percent completed (X22); managing payment of maintenance bond (X23); managing payment of retention (X24).

- Settlement of disputes, which consists of: managing settlement of disputes between parties by prioritizing it through deliberation (X25); managing dispute settlement through arbitration/court if deliberation is not reached (X26).

- Implementation of sanctions/penalties, which consists of: defining the category of violations in the contract (X27); administering sanctions/penalties for them who commit a violation (X28); administering financial sanctions in case of a violation committed by contractors (X29); monitoring the implementation of the same sanctions if employers commit a violation (X30).

- Anticipation of force majeure, which consists of: anticipating force majeure in the contract (X31); managing delay of works due to force majeure (X32); determining notification procedure of force majeure by contractor to the employer (X33).

- Termination of contract, which consists of: managing termination of contract by employers (X34), managing termination of contract by contractors (X35); ensuring that contract termination basis and criteria are clearly stated in the contract (X36).

- Final hand over, which consists of: managing signing of final handover (X37); anticipating if the contractor does not sign final handover (by being blacklisted or disputed) (X38).

- Evaluation of contract, which consists of: evaluating the completed contract (X39); providing recommendations for subsequent contracting based on the experience of the previous contracts (X40).

V. DISCUSSION

Based on the data gathered, only 39 out of 50 respondents met the required qualifications which have minimum education background Diploma, while eleven other respondents have high school education background. However the the eleven respondents have quite long working period as follows: two respondents have between 15 to 20 years working period, eight respondents have between 21 to 30 years working period, and one respondent has above 30 years working period. Assuming that the longer working period of an employee the higher the employee's competence in its field, it is decided that the eleventh of respondent's data will be taken into account in the analysis. However after recapitulation of respondent's answers, some of answers given seem to have an extreme numbers (outliers) compared to the average answers of other respondents. Those numbers are probably due to lack of respondent’s understanding to the questions given. Unfortunately the existence of extreme numbers will disrupt stability of model created. Therefore, it is conducted validity, reliability, correlation and intercorrelation test using SPSS 24, to eliminate these outliers data, then followed by regression analysis to determine the model of equation formed. Based on assumptions used at the beginning of research, there are ten factors and 40 variables affecting the procurement performance of construction works in PT X. However, the results of data analysis questionnaire using SPSS 24, as well as various tests described above show that only eight variables whose significantly influence on the procurement performance. Those eight variables are X2 with the contribution value of 46.9%, X28 with the contribution value to the model of 18.2%, X20 with a contribution value of 7.9%, X6 with a contribution value of 5.7%, X5 with the contribution value 4.9%, X1 with a contribution value of 2.1%, X11 with a contribution value of 1.5%, X26 with a contribution value of 0.9%. It shows that all the model-forming variables have contributed 88.1% to the model.

Based on results of discussion above, the following points are recommended to PT X for improvement of procurement performance in the company such as, the selection of dispute settlement which has been done through arbitration as stated in construction works procurement contracts in PT X, seems no longer relevant to do, considering in some recent cases PT X always lose. Although theoretically dispute resolution through arbitration has several advantages over other alternative settlements such as litigation, but it does not seem to be appropriate for PT X. Therefore, there should be a re-evaluation in selecting alternative dispute resolution in accordance with the characteristics of company. In addition, among some cases disputed, it turns out using EPC contract where contractor performs design, procurement and construction. But apparently not every contractors have a good access to suppliers, due to location of PT X in remote area so that access to the supplier is

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not as easy as on java island or other developed cities. Unlike if the procurement is conducted by PT X who has good access and agreements with suppliers. Therefore it need to be further evaluated whether type of EPC contract still relevant to do in PT X, especially for small projects.

VI. CONCLUSION AND SUGGESTIONS
Form the result of discussion above, it can be concluded that:

1. Important aspects of contract administration of construction works procurement referring to FIDIC and Presidential Decree No 54/2010 on procurement of government goods/services (case study: PT X) as follows: variable X2 (conducting contract implementation and coordination meetings to monitor project progress); X28 (administering sanctions/penalties for them who commit a violation); X20 (managing advance payment with a guarantee in relation to the orderly contract administration); X6 (limiting the amount of variation and adjustments in order to run an orderly contract administration); X5 (carrying out contract administration in an EPC contract that refers to FIDIC or Presidential Decree No. 54/2010 and its amendments); X1 (determining communication procedures/ correspondence between parties involved before commencement date of contract); X11 (managing payment in accordance with agreement specified in contract) and X26 (managing dispute settlement through arbitration/court if deliberation is not reached).

2. Based on results of discussion above, the following points are recommended to PT X for improvement of procurement performance in the company such as, the selection of dispute settlement which has been done through arbitration as stated in construction works procurement contracts in PT X, seems no longer relevant to do, considering in some recent cases PT X always lose. Therefore, there should be a re-evaluation in selecting alternative dispute resolution in accordance with the characteristics of company. In addition, among some cases disputed, it turns out using EPC contract where contractor performs design, procurement and construction. But apparently not every contractors have a good access to suppliers, due to location of PT X in remote area so that access to the supplier is not as easy as on java island or other developed cities. Therefore it need to be further evaluated whether type of EPC contract still relevant to do in PT X, especially for small projects.

This research only deals with aspects of contract referring to FIDIC Silver Book so as to obtain a more comprehensive picture of the effect of contract administration on procurement performance, it is also advisable to look at other FIDIC documents such as Red and Yellow Book. In addition, to complete this research, it is necessary to see how procurement performance of PT X from the aspect of contract management.

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Recommendation Analysis of Important Risk Factor in Construction Company ”X” on Joint Operation Project with Foreign Company in Jakarta, Indonesia

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Abstract- Regulations in Indonesia requires foreign companies to have local partner in a joint operation if they want to enter Indonesia construction industries. This study will examine company ”X”, who frequently get joint operation project offers from foreign companies. Within that joint operation, beside many advantages, there are also some risks to manage. Risks in a joint operation project will be more complex than projects in general, because it involve two or more companies with different culture. The purpose of this study is to indentify important risk factors in joint operations project by company ”X”. The instruments of this study consist of primary data (interview and questionnaire) and secondary data (books and journals of relevant studies). The datas gathered then analyzed using risk analysis method with Risk Significance and Relative Importance Index as to obtain the risk variables with significant influence on these three projects in this study. Based on the study, it is found that the important risk variables in a joint operation projects with foreign companies by company ”X” are distrust between employees of each company (X9) and language limitations (X30). Therefore, it is recommended to set a minimum standard of language skills (especially English) for the staff who will assigned in the joint operation project with foreign company also to provide language skills training and it is recommended that the directors from each parent’s company could ensure staff commitment, coordination, and trust by enhancing communication quality and a conflict resolution technique. Carefully selecting a staff for joint operation project and employing unbiased and experienced staff are effective measures to remove the distrust within the staff

Index Terms- risk, company, construction, joint operation

I. INTRODUCTION

Construction Company “X” as a company which provide service in building construction with specialized in commercial building such as office building and apartment. Construction Company “X” often receive an offer from foreign company to run a joint operation project. Within the joint operation beside many benefit, also facing a risk. The risk in joint operation project is much complex because it involved two or more company with different culture. In Construction Company “X” joint operation project, turns out that the project performance is not as good as their own projects. One of the reason is because of the high rate of employee turnovers in joint operation project. This high turnover rate is caused by many staff are repatriate to head office, request for transfer to another project or resigned.

II. RESEARCH PROBLEM

The research problem statements that will be analysed in this research are:
1. What are the risk variables that rise in joint operation projects?
2. What is the important risk variable in Construction Company “X” on joint operation projects with foreign company in Jakarta?
3. What are the causes of those risk variable?
4. How to mitigate those risk?

III. LITERATURE REVIEW

A. Risk Management

In project management a risk is some future happening that results in a change, either positive or negative, to the project. Risk management is a systematic way in viewing a risk and define the right solution to handle the risk. It is tools to identify source of the risk and uncertainty, dan estimate the impact that caused and develop response to control the risk. Risk always related with losses. This losses can be forecast based on two factors which is probability and severity that caused by that event. This estimation can help project manager to plan risk mitigation and decrease the losses that caused.
B. Risk Criteria

Two risk factors that are mentioned in above is probability of the event from happening and severity that caused by the event is a factor that determine the risk category. Risk criteria is a standard measurement how severe or impact that possible to happen and how likelihood the risk will happen. Risk category can be seen in table below:

<table>
<thead>
<tr>
<th>Almost never</th>
<th>Medium</th>
<th>High</th>
<th>High</th>
<th>Extreme</th>
<th>Extreme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unlikely</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Extreme</td>
</tr>
<tr>
<td>Possible</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Likely</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Almost certain</td>
<td>Very Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Minor</td>
<td>Moderate</td>
<td>Severe</td>
<td>Major</td>
<td>Worse</td>
<td>Case</td>
</tr>
</tbody>
</table>

Figure 1. Risk Criteria

Risk criteria are divided into five categories, very low risk, low risk, medium risk, high risk, and extreme risk. Every company has risk tolerance and risk appetite and it is determined by the company strategy. Risk tolerance and risk appetite will determine how the company will handle risk.

C. Risk Management in Construction Project

The purpose of project risk management is to increase the probability and positive impact from the event and decrease probability and negative impact from the event in project. The process includes several stages: Risk Management Planning, Risk Identification, Risk Analysis, Risk Response Planning, Risk Controlling.

D. Joint Operation

Joint operation can be defined as joint business activity between two or more companies to create independent business with joint ownership, operational responsibility, financial risk and reward to each member but keep the separate identity (Lynch, 1989). For foreign companies who will run a project in Indonesia are obliged to form international joint operation with local companies. International joint operation is a joint operation which involves two organizations and contributes its equity and resources and at least one of the partners have a head office in overseas where the international joint operation is operate (Ozorhon et al. 2007). In Indonesia, joint operation develop in form of administrative joint operation where joint operation are consider as separate entity from its mother company therefore the contract from client is signed on behalf of joint operation. Work responsibility to the client is on JO entity, not on each partner. Regarding share capital or project funding, procurement, labor, expense, and profit sharing related to project are based on each share which are agreed in the joint operation agreement.

IV. RESEARCH METHODOLOGY

Research work begins with literature review for compilation of risks for construction projects and then questionnaire are developed based on this list and send to expert respondents to determine the risk variable for joint operation project. From this risk variable then develop a questionnaire and distribute to 18 respondents in construction company "X" from three different joint operation project. The respondents were required to identify for the probability and severity of each risk variable based on their experience within their project on a 1 – 5 point Likert scale with 0 = very low and 5 = very high.

Data collected from respondents analyzed by validity test, then followed by reliability test. The valid risk variable then mapped on the risk map to identify which risk variable not comply with construction company "X" risk tolerance and risk appetite. Those variable then analyzed by an empirical formula to determine the Relative Important Index (RII). RII is used to rank the risks in order of their importance.

Five highest rank are consider as important risk factor to construction company "X". From these top five risk are re-validated by the expert respondents. Then a risk response plan are recommended for each risks based on literature study.

V. ANALYSIS AND REVIEW

A. Risk Variable in Joint Operation Project

Based on the questionnaire to expert respondent, from 46 variable indentified from literature review, 32 variable are relevant to risks in joint operation project. Variable that are stated relevant by expert respondent in this early survey are used to develop questionnaire for respondent. The variable are as follow:
<table>
<thead>
<tr>
<th>Faktor</th>
<th>Variabel</th>
<th>Referensi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X3. Partner bargain position</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X4. Policy changes in your partner’s parent company toward ICJV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X5. Partner’s parent company in financial problems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X6. Disagreement on accounting of profits and loss</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X7. Lack of partners competence in management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X8. Disagreement on allocation of staff position</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X9. Employees from each partner distrust each other</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X10. Disagreement on work rules</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X11. Conflict in work ethics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X12. Transfer technology dispute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X14. Disagree some conditions of contract</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X17. Price control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X18. Deficit in cost estimation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X19. Cost over-run</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X21. Specialized contractor selection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X22. Specialized contractor management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X23. Labor productivity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X24. Lack of material and labor</td>
<td></td>
</tr>
<tr>
<td>External Project</td>
<td>X25. Exchange rate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X26. Inflation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X27. Changes in regulation toward foreign investment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X29. Inconsistency in policies, law, and regulations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X30. Language barrier</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X31. Different social, culture, and religious</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X32. Force majeur</td>
<td></td>
</tr>
</tbody>
</table>
B. Validity Test

Based on acquired data through questionnaire to respondents analyze with validity test from 32 risk variable, 17 variable are identified valid and can be used for further analysis as below:

Table 2. Validity Test

<table>
<thead>
<tr>
<th>Variabel</th>
<th>Validity Test for Probability</th>
<th>Validity Test for Severity</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T count</td>
<td>T table</td>
<td>Validity</td>
</tr>
<tr>
<td>X1.</td>
<td>2.268</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X2.</td>
<td>2.067</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X3.</td>
<td>0.982</td>
<td>1.746</td>
<td>TIDAK</td>
</tr>
<tr>
<td>X4.</td>
<td>2.111</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X5.</td>
<td>2.209</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X6.</td>
<td>1.613</td>
<td>1.746</td>
<td>TIDAK</td>
</tr>
<tr>
<td>X7.</td>
<td>4.426</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X8.</td>
<td>4.740</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X9.</td>
<td>2.210</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X10.</td>
<td>0.083</td>
<td>1.746</td>
<td>TIDAK</td>
</tr>
<tr>
<td>X11.</td>
<td>2.994</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X12.</td>
<td>-0.373</td>
<td>1.746</td>
<td>TIDAK</td>
</tr>
<tr>
<td>X13.</td>
<td>2.340</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X14.</td>
<td>3.025</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X15.</td>
<td>2.794</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X16.</td>
<td>4.903</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X17.</td>
<td>1.513</td>
<td>1.746</td>
<td>TIDAK</td>
</tr>
<tr>
<td>X18.</td>
<td>0.840</td>
<td>1.746</td>
<td>TIDAK</td>
</tr>
<tr>
<td>X19.</td>
<td>2.657</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X20.</td>
<td>0.957</td>
<td>1.746</td>
<td>TIDAK</td>
</tr>
<tr>
<td>X21.</td>
<td>2.297</td>
<td>1.746</td>
<td>VALID</td>
</tr>
<tr>
<td>X22.</td>
<td>2.729</td>
<td>1.746</td>
<td>VALID</td>
</tr>
</tbody>
</table>
C. Reliability Test

Reliability test that used in this research is Cronbach’s Alpha reliability test. Acceptance Cronbach’s Alpha score around 0.7 is acceptable and above 0.8 is good. The test result are shown below:

<table>
<thead>
<tr>
<th>Reliability Test</th>
<th>Number of Variable</th>
<th>Variable Variance</th>
<th>Total Variance</th>
<th>Cronbach's Alpha</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>17</td>
<td>14.98</td>
<td>88.84</td>
<td>0.88</td>
<td>Reliable</td>
</tr>
<tr>
<td>Severity</td>
<td>17</td>
<td>18.17</td>
<td>116.89</td>
<td>0.90</td>
<td>Reliable</td>
</tr>
</tbody>
</table>

D. Risk Mapping

Construction company "X" have a strategy to avoiding risk therefore their risk appetite is on medium – very low. It shown as blue line in risk map.

From 17 variable that pass validity test are mapped in the risk map to show which variable is beyond construction company risk tolerance as shown in below:

![Risk Mapping Diagram](image-url)

Figure 2. Risk Mapping
E. Relative Important Index

RII analysis are shown on table below:

Table 4. Risk Significance and Relative Important Index

<table>
<thead>
<tr>
<th>Variable</th>
<th>Risk Significance</th>
<th>Relative Important Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>X30</td>
<td>15.120</td>
<td>0.605</td>
</tr>
<tr>
<td>X9</td>
<td>15.111</td>
<td>0.604</td>
</tr>
<tr>
<td>X15</td>
<td>12.821</td>
<td>0.513</td>
</tr>
<tr>
<td>X7</td>
<td>12.667</td>
<td>0.507</td>
</tr>
<tr>
<td>X1</td>
<td>11.994</td>
<td>0.480</td>
</tr>
<tr>
<td>X22</td>
<td>11.836</td>
<td>0.473</td>
</tr>
<tr>
<td>X19</td>
<td>11.636</td>
<td>0.465</td>
</tr>
<tr>
<td>X16</td>
<td>11.235</td>
<td>0.449</td>
</tr>
<tr>
<td>X11</td>
<td>10.543</td>
<td>0.422</td>
</tr>
<tr>
<td>X5</td>
<td>9.877</td>
<td>0.395</td>
</tr>
<tr>
<td>X2</td>
<td>9.506</td>
<td>0.380</td>
</tr>
<tr>
<td>X4</td>
<td>9.324</td>
<td>0.373</td>
</tr>
<tr>
<td>X13</td>
<td>9.148</td>
<td>0.366</td>
</tr>
<tr>
<td>X29</td>
<td>9.130</td>
<td>0.365</td>
</tr>
<tr>
<td>X32</td>
<td>8.994</td>
<td>0.360</td>
</tr>
<tr>
<td>X14</td>
<td>8.667</td>
<td>0.347</td>
</tr>
<tr>
<td>X28</td>
<td>7.978</td>
<td>0.319</td>
</tr>
</tbody>
</table>

VI. ANALYSIS AND RECOMMENDATION

Based on the RII rank, the five highest risk is language barrier (X30), employee from each partner distrust each others (X9), poor project relationship (X15), lack of partners competence in management (X7), and partner selection (X1). This five highest risk then re-validate to the expert respondents and conclude that there are two important risk factor in construction company “X” on joint operation project with foreign company in Jakarta which is language barrier (X30) and employee from each partner distrust each others (X9).

Language barrier is caused by the limitation of communication skill (English language) from the staff which involved in joint operation project. This leads to misunderstanding between each staff between partners. Risk response recommendation for language barrier risk is to recruit local staff with bilingual ability.

Employee from each partner distrust each others is caused of each staff must protect parents company interest and they carry their own agenda therefore its not surprising that the relationship between each staff is not effective and efficient. Risk reponse recommendation for distrust between each partner employee, the director could ensure staff commitment, coordination, and trust by enhancing communication quality and a conflict resolution technique and to carefully selecting a staff for joint operation project and employing unbiased and experienced staff are effective measure to remove the distrust within the JO staff.

VII. CONCLUSION

Based on the research that has been done, it is identified the important risk factor in construction company ”X” on joint operation project with foreign company in Jakarta which is language barrier and employee from each partner distrust each others. Risk response recommendation for language barrier risk is to recruit local staff with bilingual ability. Bilingual ability can offer better communication for partners speaking in different languages. And risk reponse recommendation for distrust between each partner employee, the director could ensure staff commitment, coordination, and trust by enhancing communication quality and a conflict resolution technique and to carefully selecting a staff for joint operation project and employing unbiased and experienced staff are effective measure to remove the distrust within the JO staff.

REFERENCES


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Assessment of Nutritional Health Status of the Nyishi Adults of Papumpare District Arunachal Pradesh, India

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Rajiv Gandhi University, Arunachal Pradesh***

ABSTRACT

Nutritional status or nutritional health status refers to the state of health of an individual as it is affected by the intake and utilization of nutrients. The main purpose of this nutritional assessment was to find out the facts about nutrition and health status of Nyishi adults of Papumpare district of Arunachal Pradesh, India. The various parameters that were selected to assess nutritional health were socio-economic status, dietary habit and anthropometric parameters which were implemented with the help of food and health frequency questionnaire and other anthropometric tools. The study also showed that education, occupation as well as family pattern directly affects the food budgeting of the people that ultimately shades impact on health. The anthropometric measurement was done among 100 adults of both sex of the rural and urban area and BMI were calculated. Results showed prevalence of 14% chronic energy deficiency in rural adults whereas it was only 4% in urban. Likewise, 60% people were found to be as normal in rural against 52% in the urban. On the other hand, 14% rural adult found to be normal (optimal) and 26% adult found to be in prehypertension (normal) against 8% urban adult found to be normal (optimal) and 24% adult found to be in prehypertension (normal) condition. So, it may be concluded that the results of the epidemiological study with basic comparison of socio-economic, dietary and anthropometric parameters of the adult of same tribe of different conditions with a hope to have further exploration of this topic using other parameters and different age group.

Index Terms: Nutritional assessment, Nyishi adult, Epidemiological study, Body Mass Index (BMI).

INTRODUCTION

Indigenous and local foods always play an important role in the health status of the various tribes present in different regions of the world. The purpose of nutritional assessment of a particular tribe or community is to discover facts about nutrition and health. Each tribal population has its unique food habits [1]. The Nyishi tribe is one of the principal inhabitants of Arunachal Pradesh in northeastern India. Nyi refers to "a man" and the word shi denotes "a being", which collectively means a civilized human being [16]. There are many factors that affect nutritional health status of people. Factors such as employment, income, education, cultural influences and lifestyle, sex and other genetic differences, isolation (geographic, social or cultural), age and disability, the security and standard of accommodation, and the availability of services and facilities all interact with diet, health and nutritional status. Also, the food consumption practices may differ within the same tribe or a community living in rural and urban area. That is why there is a need to assess the nutritional health status of both the areas. Nutritional status is determined from a nutritional assessment of anthropometric, biochemical, clinical, dietary, socioeconomic, and drug-nutrient interaction effects [2]. Nutritional status is the condition of health of an individual as influenced by nutrient intake and utilization in the body. In developing countries like India various forms of malnutrition affect a large segment of population and both macro and micronutrient deficiencies are of major concerns [3]. Vital signs that represent the health status of an individual are the body’s most basic functions. There is an established link between heart rate (HR) and cardiovascular health [4]. It has been recently suggested that there is urgent need to evaluate the nutritional status of various tribes of Indian [5]. Patterns of adult malnutrition show extremely poor nutritional status in the states of Gujaratt, Odisha, Arunachal Pradesh, Karnataka, Maharashtra, Madhya Pradesh and Andhra Pradesh (FAO 2010) [6]. Hence, this present study was an attempt to investigate and compare the overall nutritional status and its determinants in respect of age (i.e. adult), sex (male and female) and place (rural and urban area) of the said tribe.

Hypothesis: The nutritional health status of the tribal people residing in rural areas is found to be more satisfactory than that of the urban one.

Objectives:

i. To determine socio economic status and food consumption practices of target group people.
ii. To investigate differences in food consumption practices of Nyishi tribe at different place i.e. rural and urban.
iii. To determine vital health status and impact of their food pattern on health.
iv. To compare all above aspect in terms of sex and place.
RESEARCH ELABORATIONS

Materials and Methods
Papumpare district of Arunachal Pradesh, India was selected for the Epidemiological study area with Nyishi tribe of rural and urban area as the target population/group. During the entire study, the age group was restricted only to the adult population of the said tribe. Epidemiological studies were conducted in the randomly selected areas of Papumpare district of Arunachal Pradesh. First of all, two Nyishi tribe inhabitant target areas depicting rural and urban population since many years were selected. Under the rural area, the villages choosen are Bogoli, Denka, Gumto, Rono village and Balijan. Likewise, in the urban area, some sectors of the towns and cities like Nirjuli, Naharlagun and Itanagar were selected accordingly. The study design and methodology that was followed in the present work summarized as below.

Research Design
Developing a questionnaire
A food frequency questionnaire was developed at the beginning of the epidemiological survey [7]. The questionnaire consists of three parts viz. identification particulars, socio-economic status of family and dietary pattern of the family. Along with this questionnaire, also a health frequency questionnaire for the age group of 20-39 years i.e. for adults was developed. Here, two anthropometric measures-height and weight were included, which helps us to calculate BMI of the adults. Other measures like age, habitat etc. was also included in the process. The interesting thing is that the single questionnaire was sufficient enough to question about the overall medical condition in which we include various parameters like disease, illness and disorders. Further, two vital signs of measurement i.e. BP and pulse rate were also calculated in order to investigate the body’s basic functions are normal or not.

Subjects
The subjects were selected from two target population i.e. rural and urban population of Nyishi tribe of Papumpare district of Arunachal Pradesh, India. The study was conducted taking 100 numbers of samples (family) and 100 numbers of adult individual samples of both sexes from both the target area (50 nos. rural+50 nos. urban).

Tools and Procedures
There were many tools that have been used in our epidemiological survey. For the anthropometric purpose measuring tape and weight balance were used. With the help of body height and body weight of adult persons, the Body Mass Index (BMI) was calculated separately for males and females. The ratio of weight (in kg)/ Height (m)^2 referred to as BMI. The BMI has a good correlation with fatness (over weight or obesity). The use of BMI as an anthropometric indicator of nutritional status can be more appropriate in a country with diverse ethnic groups, such as India [14]. In case of adults, the following classification suggested by James and coworkers as given in Table I is extensively used at present [8, 9].

<table>
<thead>
<tr>
<th>BMI class</th>
<th>Presumptive diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 18.5</td>
<td>Chronic energy deficiency</td>
</tr>
<tr>
<td>18.5-20.0</td>
<td>Low normal weight</td>
</tr>
<tr>
<td>20.0-25.0</td>
<td>Normal</td>
</tr>
<tr>
<td>25.0-30.0</td>
<td>Obese grade I</td>
</tr>
<tr>
<td>&gt;30.0</td>
<td>Obese grade II</td>
</tr>
</tbody>
</table>

The measurement of basic vital signs of body was taken via an automatic blood pressure monitor (Make - Omron, Model no- HEM-8712) that could measure both BP and pulse rate.

To understand hypertension we must have an idea about normal and high blood pressure range. Table II presents the classification given by JNC, USA for the detection, evaluation and treatment of high blood pressure. [7, 8]

<table>
<thead>
<tr>
<th>Blood pressure range SBP/DBP</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>120/80</td>
<td>Normal (optimal)</td>
</tr>
<tr>
<td>120-129/80-84</td>
<td>Prehypertension(normal)</td>
</tr>
<tr>
<td>130-139/85-89</td>
<td>Prehypertension (Borderline HT)</td>
</tr>
<tr>
<td>&gt;140/90</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Stage I 140-159/90-99</td>
<td>Hypertension (stage I)</td>
</tr>
<tr>
<td>Stage II 160-179/100-109</td>
<td>Hypertension (stage II)</td>
</tr>
</tbody>
</table>
According to the National Institute of Health, USA, the average resting heart rate:
(a) For children 10 years and older, and adults (including seniors) is 60 - 100 beats per minute
(b) For well-trained athletes is 40 - 60 beats per minute.

RESULTS

Socio Economic Status

Monthly income

A large gap was found to be present between rural and urban income level. But the minimum requirement for a healthy and peaceful lifestyle was seen to be same for all individuals. Therefore, in order to fill up the gaps between the two societies by strengthening the economic status needs further research.

Education

In case of level of education, there were 4% families in the rural areas, who had not taken any formal education. In this era of scientific development, universalization of primary and all classes of higher education should be the major concern of a country like
India. Education is the most crucial factor which interferes with all aspects of our life. Increasing job opportunities or employment is also a sign of development. The scope of agriculture is reducing day by day in the North East India. As the impact of the development of science and technology has also touched this part of the region to a great extent, in the present scenario, opportunities are more in the field of agricultural extension rather than agriculture.

**Types of family**

![Types of family (Rural)](image1)

![Types of family (Rural)](image2)

Types of families are also a major concern for health and education. As the number of joint families were found to be present more in the rural area.

**Occupation**

![Occupation (Rural)](image3)

![Occupation (Rural)](image4)

From the survey, it was observed that among the selected area, one or two family member only represents as an income source of a joint family and rest of them act as followers, which results in an abnormality in the whole family budgeting. This further impacts a lot in the dietary habit as well as in the education system of that particular family. This has been seen in most joint families of the rural population.

**Dietary pattern of the family**
Income, level of education and types of family are all proportionally equivalent to the dietary pattern of a family. Food without dal, wheat, potato, oil and spice are the main characteristic features of the indigenous food system in Arunachal Pradesh, it is an interesting researchable domain [10]. Rice is used as staple food by 100% families in the rural area where consumption of wheat only shown by in minimum numbers only at rural area. Green leafy vegetables used extensively by the people of both areas. There are numerous plants that have been used as food, as well as medicine by the tribal people since time immemorial. The intake of 350-400 g vegetables per caput per day is associated with reduced incidence of many common forms of cancer, and diets rich in plant foods are also associated with a reduced risk of heart disease and many chronic diseases of ageing. Vegetables contain phytochemicals that have anti-cancer and anti-inflammatory properties which confer many health benefits [11]. Here, development of healthy food habit of oneself and of the child is the major and utmost thing to do for each and every family member. This is because; healthy food habits are not only for present health but for the long term complete health.

The adult age group was taken for further study and some anthropometric measurement were taken like height and weight to calculate BMI. It has been observed that various tribal populations have high to very high rates of chronic energy deficiency (CED) based on their body mass index (BMI) values [6]. For the measurement of vital body sign, blood pressure and pulse rate were taken from adult male and female of both rural and urban areas. With the help of health frequency questionnaire the overall medical conditions of the adult(s) were measured. Finally, the calculation was done and compares all such parameters in terms of sex and place. The comparison is shown below:
Comparison of BMI status (Rural and Urban adults)

Fig XI: Comparison of BMI status of rural and urban adults

Results showed 60% normal BMI in rural adults against 52% in urban. This indicates that almost 50% of the adults are below and above normal BMI in case of urban. Low Body Mass Index (BMI) and high levels of undernutrition (based on BMI) are the major public health problems especially among rural underprivileged adults of developing countries [12].

Comparison of Hypertension status (Rural and urban adults)

Fig XII: Comparison of hypertension status of rural and urban adults

Comparison of Heart rate/pulse rate status (Rural and urban adults)
In case of urban adults, 20% and 4% of population were under obese grade I and grade II respectively. Poor dietary habits combined with decreased physical activity have led to an increase in overweight and obesity among adults and children [13]. In case of hypertension status, 6% rural adult found to be in stage-I and 16% adult in urban. There is a need for change in the daily lifestyle as well restriction of salty foods in diet in both areas, but, especially in urban.

Comparison of health status (Male)

Fig XIV: Comparison of health status of rural and urban male

Comparison of health status (Female)
The overall medical condition of both area showed that there was a higher prevalence of water borne and infectious diseases in the rural area and some critical diseases in urban. It is to be noted that cardiovascular and cancers like diseases were not found among rural and urban adults, which indicate a better health condition of them.

**CONCLUSION**

In the conclusion, it can be said that the nutritional health status of rural people was comparatively well than urban people. The hypothesis that has been generated was achieved after a few steps of success from analyzing and comparing data of nutritional health condition of both targeted area. But the parameters of socio economic status, dietary and health condition shows vast differences among rural and urban population. A low socio-economic status (SES) is related to unhealthy dietary habits; less educated people with a low income tend to consume more energy-dense food whereas their higher SES counterparts have a higher fruit and vegetable intake. The association between SES and the healthiness of the diet was not fully understood yet but the investigating the motives underlying the food choices might provide more insight.

People with lower levels of education and income were seen to have less healthy dietary habits, partly because of their higher priority for price and familiarity, and their lower priority for health as a motive for food purchase. Price reduction of foods such as fruits and vegetables might therefore be an effective strategy for diet improvement, but the potential of different pricing strategies needs further research.

Sometimes availability of market condition surrounding also affect the dietary habit and ultimately on the health pattern of an individual. On the other hand, improper sanitation and hygiene are always responsible for many types of diseases like diarrhea, malaria, typhoid, dysentery etc. Lack of proper knowledge about healthy hygienic practices such as washing of hands before eating, water purification issues (boiling, filtering by sand or by water filter), washing and sun drying of utensils etc. are also responsible for many diseases or health abnormalities. Here, habit is a prime issue since it is the guardian, who helps to develop healthy eating routine and hygienic practices of an individual.

**APPENDIX**

**Appendix A: Food Frequency Questionnaire**

1. **Identification particulars:**
   - Name of the village: 
   - Area (Urban/Rural):
   - Name of the respondent:
   - Address:

2. **Socio-economic status of family:**
   - Occupation of the head of the family:

---

**Fig XV: Comparison of health status of rural and urban female**

The overall medical condition of both area showed that there was a higher prevalence of water borne and infectious diseases in the rural area and some critical diseases in urban. It is to be noted that cardiovascular and cancers like diseases were not found among rural and urban adults, which indicate a better health condition of them.
### Family size & Composition

<table>
<thead>
<tr>
<th>Age groups (yrs)</th>
<th>0-1</th>
<th>1-5</th>
<th>5-12</th>
<th>Adults</th>
<th>Elders</th>
<th>Total</th>
<th>No. of earning members</th>
<th>Total family income Rs./p.m</th>
</tr>
</thead>
</table>

**Sex:**
- Males
- Females
- Total

**Educational level:**

- Type of family: Nuclear/Extended/Joint
- Physiological status of woman: Pregnant/Lactating/Non-pregnant & Non-lactating
- Types of feeding child: breast feeding/formula feeding
- Number of absentees/guests/servants/pots in the family:

### Dietary pattern of the family:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Dietary Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency of usage of foodstuffs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Daily</th>
<th>3/wk</th>
<th>2/wk</th>
<th>1/wk</th>
<th>1/mth</th>
<th>Season in which used</th>
</tr>
</thead>
</table>

1. **CEREALS**
   - Rice
   - Wheat
   - Jowar
   - Ragi
   - Others

2. **PULSES/LEGUMES**

3. **GREEN LEAFY VEGETABLES**
   - Spinach
|   |  
|---|---|
| **Amaranth** |  
| **Cabbage** |  
| **Oyin** |  
| **Oyik** |  
| **Oyngor** |  
| **Marsa** |  
| **Others** |  
| **4** | **ROOTS & TUBERS**  
| **Potato** |  
| **Sweet potato** |  
| **Kath Alu** |  
| **Others** |  
| **5** | **OTHER VEGITA BLES**  
| **Bak/Kope** |  
| **Tir** |  
| **6** | **FRUITS** |  
| **7** | **MILK & MILK PRODUC TS** |  
| **8** | **SUGAR & JAGGER Y** |  
| **9** | **OILS & FATS** |  
| **10** | **FLESH FOODS**  
| **Mutton** |  
| **Beef** |  
| **Mithun** |  
| **Pork** |  
| **Chicken** |  
| **Fish** |  
| **Eggs** |  
| **11** | **MISCELL ANEOUS FOODS** |  
| **12** | **LESS FAMILIAR FOODS** |  
| **13** | **TOBACCO** |  
| **14** | **ALCOHOL (TRADIT** |
Appendix B: Health Frequency Questionnaire  
(For Adult Male/Female)  
(Age groups: 20-39yrs)

1. Height:
2. Weight:
3. Age:
4. Habitat: Rural/Urban
5. Overall medical condition(disease/illness/disorder)
   I. Blood pressure: Low / Normal / High
   II. Diabetes: Type 1 / Type 2
   III. Heart disease: Yes/No
   IV. Diarrhea: Yes/No
   V. Nausea/ Vomiting: Yes/No (if yes, then less frequently/more frequently)
   VI. Blood in stools: Yes/No
   VII. Difficulty in urinating: Yes/No
   VIII. Anemia: Yes/No
   IX. GOUT(Arthritis): Yes/No
   X. Depression: Yes/No (if yes, then state the reason……………………………)
   XI. Thyroid disease : Yes/No
   XII. Ulcer disease: Yes/No
   XIII. Cancer: Yes/No (if yes, then state the type of cancer …………………..)
   XIV. Headaches or Migraines: Yes/No
   XV. Typhoid: Yes/No (if yes then, once/twice a year/ one or two year ago)
   XVI. Jaundice: Yes/No (if yes then, once/twice a year/one or two year ago)
   XVII. Malaria: Yes/No (if yes then, once/twice a year)
   XVIII. Allergies: Yes/No (if yes then, state the body part/location…………………)
   XIX. Sleeplessness: Yes/No
   XX. Renal disease: Yes/No
   XXI. Liver disease: Yes/No
   XXII. Any Others:

ACKNOWLEDGEMENT

This study is a part of dissertation of MSCDFSM programme, IGNOU. The authors are thankful to Dr. Hui Tag, Dr. Tonlong Wangpan, Dr. Asish Paul and Dr. Jayashree Sarma for their valuable cooperation. We are great full to them for encouraging, inspiring and having faith in the team for carrying out such kind of work. Lastly, a sincere appreciation goes out to the family members and adults of the epidemiological study area for spending time getting to understand the work and completing the questionnaires.

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Perception of Parents/Guardians towards Media Policies Protecting Children against Harmful Television Content in Kenya

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Abstract- Television content is engineered primarily for these roles in society; information, agenda setting, entertainment and education among others. While people consume this content there are other effects that are reached consciously or otherwise. These effects are studied under theories and scholarly debates popularly known as media effects. Most media effects theorists point out that these effects will mostly affect children negatively as they do not have a well developed capacity to guard against harmful content. It is for this reason that people are created and these policies are put in place; to safeguard or protect children against any harmful content on television. This study therefore sought to look into the perception of parents on children media policy that protects them against harmful content on television. This study sampled 370 parents within Nairobi County with a view to evaluate their perception as their children have relatively more television content access compared to children in rural Kenya, using non-probability sampling method as the researcher hoped to involve some respondents according to their perceived usefulness to the study. Purposive sampling was therefore used. The researcher undertook data collection using self administered questionnaires. The study concluded that parents perceive implementation as inadequate, and that it is the role of the media. However, they indicated their participation in the implementation of these policies.

Index Terms- media policy, harmful television content, parents’ perception, children

I. INTRODUCTION

Parents and guardians form a sizeable part of stakeholders in children media policy implementation process (Kombo 2011). It is believed that behind closed doors of a family set-up parents must become the mediating piece to obscure exposure to harmful and inappropriate media content (Charren 2008). The question therefore should be are parents aware of their role in ensuring the implementation process does not falter in their court, are they even aware of this role and how do they view the media content effects on their children. In a study on the use of mediated television watching by use of parental control, the v-chip tool installed in all television sets, child lock and timing lock on programs identifies challenges of regulating new media technologies as that there is a widespread public anxiety on television content believed to emanate from three general assumptions as outlined by Livingstone (2009); the rapidity of internet’s development and its persuasive nature often causing difficulty to adults/parents/guardians to adjust.

Children today can catch up with programs online. This poses a challenge to the parents and guardians who practice mediated television viewing. It is defeating to learn that some programs are locked on the television sets yet children can watch them online even long after the programs have been aired (Sandra et al 2008). Parents and guardians also have been exposed to new technology as a never ending trail of new developments and therefore view them as ‘uncontrollable beasts’ and a threat to children’s safety. And the last fear is constituted in the fact that children know more about technology than parents do and are thus able to avoid parental authority.

This discussion therefore leads to the question of parents’ perception of their role in implementing media policy that protects children against harmful television content, how adequate or inadequate are the policies and how well have media content generators enacted these policies? This study seeks to look into these perceptions and give a conclusion concerning the parents’ views thereof. In a study by Parenthood America the original TV Parental Guidelines were problematic for three primary reasons: they did not reflect the kind of television rating system that parents wanted, they were not likely to (and, in the case of violent content, they did not) clearly communicate the kind of content that programs contain, and they were likely to attract children to problematic content rather than repel them. Given these problems, it is likely that parents are still wondering what it is that they can do to protect their children from television they consider to be harmful as is the case of Kenya.

In a study by Huston et al (1989) it is generally agreeable from the Likert scale questions posed that it is the responsibility of adults and of public policy to protect children from unnecessary and potentially harmful exposure to violence through the media and to protect children from television content and advertising practices that exploit their special vulnerability (Huston, Watkins, & Kunkel, 1989).

II. RESEARCH ELABORATIONS

Parents and guardians form a useful group of stakeholders for determining the usefulness and adequacy of media policies that are geared towards protecting children from harmful television content. It is for this reason that this study focused on their perception towards these media policies. This was achieved by looking into three aspects; firstly, their view on their role in ensuring the implementation of the already existing children
media policies, secondly their perception on the role of media in implementation and thirdly, the adequacy or inadequacy of these media policies protecting children against harmful television content.

Nairobi was identified and used for study as most households and children have access to television sets and other devices that allow for the transmission of television content. Theoretically, this study was founded of the Theory of Implementation with complements from Cultivation theory. This is because the study was looking at the implementation of media policy in Kenya as well as the media effects of television viewing amongst children.

This study adopted the descriptive research design as it allows for the reporting of issues as they are (Kothari 1990). The population for this study was all parents and guardians residing in Nairobi who also have access to television sets in their households or other social settings.

III. FINDINGS

A likert-scale was developed to guide the respondents on various perceptional issues relating to the role of parents in implementation of children media policy, the role of media houses in implementation of media policy and adequacy or inadequacy of media policy on children programs. Below is a reflection of their responses

<table>
<thead>
<tr>
<th>Perception of parents towards children media policy implementation</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I participate in children media policy implementation</td>
<td>22</td>
<td>8</td>
<td>98</td>
<td>201</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>5.9</td>
<td>2.2</td>
<td>26.5</td>
<td>54.3</td>
<td>11.1</td>
</tr>
<tr>
<td>Children media policy in Kenya involves all stakeholders</td>
<td>193</td>
<td>97</td>
<td>40</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>52.2</td>
<td>26.2</td>
<td>10.8</td>
<td>5.7</td>
<td>5.1</td>
</tr>
<tr>
<td>Children media policies are implemented adequately</td>
<td>107</td>
<td>98</td>
<td>10</td>
<td>140</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>28.9</td>
<td>26.5</td>
<td>2.7</td>
<td>37.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Children media policy is effective in its objective</td>
<td>94</td>
<td>81</td>
<td>0</td>
<td>98</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>25.4</td>
<td>21.9</td>
<td>0.0</td>
<td>26.5</td>
<td>26.2</td>
</tr>
<tr>
<td>Children media policy in kenya is adequate</td>
<td>8</td>
<td>90</td>
<td>14</td>
<td>99</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>24.3</td>
<td>3.8</td>
<td>26.8</td>
<td>18.6</td>
</tr>
<tr>
<td>Children media policy implementation is a role of the media owners</td>
<td>72</td>
<td>42</td>
<td>16</td>
<td>106</td>
<td>134</td>
</tr>
<tr>
<td></td>
<td>19.5</td>
<td>11.4</td>
<td>4.3</td>
<td>28.6</td>
<td>36.2</td>
</tr>
</tbody>
</table>

Where SD is Strongly Disagree, D is Disagree, N is Neutral or undecided, A is Agree and SA is strongly agree.

*the values below the shaded values are the resultant percentages

Respondents accounting for 65% of the sample claimed to participate in children media policy implementation. This accounts for more than two thirds of the respondents. On the role of parents in implementation of children media policy, more than half of respondents reflected that they participate actively; 54%. However, just about the same figure strongly disagreed that children media policy involves all stakeholders in its implementation.

Concerning adequacy or inadequacy of children media policy implementation 50% felt that it is inadequate while the rest agreed to its adequacy. As a role of the media owners, 65% of respondents felt that implementation is squarely a role of the media owners while 35% disagreed. Notably on participation and on involvement of all the stakeholders in children media policy, the numbers of those that were neutral or did not have a view was at 26.5% and 11 percent respectively. This points on the need to enhance participation and to educate the parents on their role as stakeholders as well in the media policy process.

According to Davis (1995) the primary caregivers to children are supposed to be parents/guardians. However due to the socio-economic settings of most households mostly a phenomenon in the urban settings like Nairobi, parents have passed down this role to other persons. Buckingham (2001) observes that children have been left at home on their own. She refers to this as the making of a social problem. Most parents have had little to no time to instruct, guide or even participate in media contexts. This study however depicts a picture contrary to that as most parents believe that they have been involved in the children media policy implementation process.

There also were mixed observations on the issue of who, relative to parents, is responsible for implementation of children media policy whereby, none of the covariate variables (government and its agencies, children rights bodies or consumer rights bodies) had statistical significant parameters. In other
words all parameters had significant values of more than 5 percent (p>0.05). This can be interpreted to mean that it is the concerted efforts of all stakeholders with interest in child welfare (parents, the government, children rights bodies and consumer rights associations) to ensure that children are protected from harmful media content.

IV. CONCLUSION

As outlined earlier perception of parents/guardians was studied using the following outlines of perception; role of parents, role of media and adequacy or inadequacy of media policy protecting children against harmful television content. The findings can therefore be further summarized as follows; On parents’ role, respondents felt that parents are involved in children media policy implementation up to 65.4%. There was however a large number of respondents that was neutral about this at 26.5% with only 8.1% disagreeing. Media owners were seen to possess a role in implementation up to 64.8% while 31% held a different view and 4.3% held no view. On adequacy of media policy 26.5% disagreed and 45.4% agreed and only 3.8% were without a view. On a screening question concerning the adequacy of implementation, 55.4% respondents disagreed, 41.9% agreed and 2.7 held no view.

This study recommends a clearly defined role sheet for all stakeholders involved in the implementation of media policies for children. It is also noteworthy that quite a number of parents and guardians have no view or are neutral about pertinent issues concerning this important issue. There is therefore need to educate them so that they can have a stand on matters that affect their children. There exists a gap in the understanding that the media are expected to implement these policies and the reality that media may not always produce television content that is safe for children. Parents need to play an active role in ensuring that media (business owners) ensure child safe content. Where these policies are seen to be inadequate, parents and other key players in the media contexts should hold sittings to consult on this issues. Parents and guardians as well as the media may consider a channel through which they can communicate freely, raise issues/queries concerning television content and other programming issues relating to children.

This study also recommends a survey of other regions in Kenya and especially the rural areas of Kenya in order to establish how parents view their roles and that of other stakeholders on this issue.

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Evaluating the Effectiveness of Using the Protection and Security of Information Systems in the National Organizations of Information Security

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PhD, Candidate

Abstract- All organizations, staffs, foundations and universities in this age depend completely on information and data to convey the technical and scientifically development, and as it's known today that this age we live in is called or known as the age of information or the age of technology, and we can say that having a greater amount of information means having control over several fields and the development of information systems has already done a huge qualitative leap in the field of information technology, it's preciseness, increasing it's productivity and exploiting machines for performing all works in foundations and some other organizations, therefore foundations started aiming to get the biggest amount of information, thence negativity appeared in technology and penetration, piracy and data exchange in illegal way started to be called; information technology crimes, as it is a phenomenon which has many effects over the political, martial, economical, and safety fields, therefore foundations, universities, organizations, information centers and some other administrations should protect their information and data from penetrating networks and information systems where they exchange these information and process them, whether inside that foundation / center or through the world wide web.

Among these foundations which depend on information; research centers, information centers, universities, libraries and some other different foundations which have an informational uprising that should have been protected from piracy and theft. This study ought to evaluate the reality of using security and protection of information systems in the national organization of information security from stealing, penetration, messing up, robbery, or change which effects directly on the credibility of this foundation considering information and data the spinal column of this foundation.

Index Terms- protection, security, information systems, cryptography

I. INTRODUCTION

In today's business environment, security is a major problem in all areas. Hackers and invaders have done a number of successful attempts to lower top-level corporate networks and web services. Many methods have been developed for network infrastructures and Internet connections such as firewalls, encryption and virtual private networks. Discipline is a new addition to this technology. In recent years there have been methods of attack. Using intrusion detection methods, you can collect and use certain attack attacks and find out who is trying to attack the network or private hosts. Data collected in this way can be used for network security and for legal purposes. There are also much vulnerability in the market that contain various network holes, including firewalls that block unwanted signals and signaling systems (IDSs). This determines whether the device has attempted to use it. For this purpose, both commercial and open source products are available. Trusted security systems are needed to create trusted computing platforms (network-related components). In the design of the base system, a security policy has been developed, taking into account the measures taken to ensure the privacy and integrity of the system. The privacy situation in this context shows users access restrictions and is available to protect the data. Honesty means that the information in the system and system is working properly. Furthermore, the existence of the system must be maintained, it must remain unchanged while maintaining the integrity of the system, even if it operates at a user-friendly level.

II. RESEARCH PROBLEM

In as much as foundations, staffs, data centers, universities and some other administrations depend on information technology, increasing these techniques complexity, technological advance and information systems, all put these foundations, staffs and data centers, in more risks and expose them to stealing, and losing these important information puts foundations, staffs and information centers in a situation, especially if the security and protection of information systems application has been facing many difficulties, so this foundation would be more exposed to lose a maximum amount of their information and data, what makes them in a need for using security and protection of information systems.
III. SYMMETRIC CRYPTOGRAPHY

Symmetric key cryptography has two parts: power passwords and password blocking. Stream chips are like a one-pad, but it provides security for a relatively small and controlled key. The key extends for a long period of time, which is then used as a one-off platform.

Blocking is based on the coding code concept where the code identifies the key code. The privacy block algorithms can be very scary. Passwords that are internally blocked also use confusion and diffusion.

There is a two-way encryption algorithm. Of these algorithms AS / 1 and RC4.Bit are widely used today, while AS / 1 works on GSM mobile phones. The AS / 1 algorithm represent the class of hardware-based large stream chips. RC4s use multiple places as well as Secure Layer or SSL and it is almost the only one with the current password because RC4 is powerful in software.

Blocked password DES (because of the relatively simplified block encryption standards), all these are block passwords that need to be compared.

Stream ciphers

The current length passes through the n keys of the bits k and extends to the remote key current. This key is then handled by p-text p to create encrypted text with XOR-ed. Using the mainstream is the same as using a disposable password. The same key current is created with a stream password to open a password and XOR-ed encrypted text.

Stream encryption function Stream chip (k) = S, where the key is the switch and the C key flow. Encryption Formula:

\[ C_0 = p_0 \]
\[ s_0.c_1 = p_1 \]
\[ s_1.c_2 = p_2 \]
\[ s_2 \ldots \]

Where \( P = p_0 \ldots \) is the plaintext. \( S = s_0 \ldots \) is the key stream and \( C = c_0 \ldots \) is the cipher text. To decrypt cipher text \( C \), the key stream \( S \) is again used.

\[ C_0 = c_0 \]
\[ s_0.p_1 = c_1 \]
\[ s_1.p_2 = c_2 \]
\[ s_2 \ldots \]

Provided that both the sender and receiver have the same stream cipher algorithm and that both know the key \( k \).

A5/1

A5 / 1 - Current passwords used by mobile phones to protect privacy. This algorithm

There is an algebraic description. AS / 1 uses three linear feedback shift registers [...] or LFSRs with symbols (X, Y, Z, X, x1, x2, 

Registered Y 22 bits (y0, y1, y2, y21) and Z 23 bits (z0, z1, z2, z22). Thus, three LFSRs have a total of 64 bits.

It is no coincidence that the key is \( k - 64 \) bits. The key is used as the first filler for the first registrant. We are prepared to produce the main stream only after the three recipe has been given. However, we must first discuss X, Y and Z registers.

In step X the following are:

\[ t = x_{13} \]
\[ x_{16} \]
\[ x_{17} \]
\[ x_{18} \]
\[ x_0 = t \]
\[ x_i = x_{i-1} \]
\[ \text{for } i = 18,17,16 \ldots \]

Similarly, for registers Y and Z, each step consists of

\[ t = y_{20} \]
\[ y_{21} \]
\[ y_{i} = y_{i-1} \]
\[ \text{for } i = 21,20,19 \ldots \]
\[ y_0 = t \]

and

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If \( x, y, \) and \( z \) are three, the function returns 0 if \( x, y, \) and \( z \) are zero on Return 1. Used for A5 / 1 hardware and for every hour to mix the value

\[
M = \text{maj}(x_8, y_{10}, z_{10})
\]

is computed. Then the registers \( x, y, \) and \( z \) step according to the following rules:

- if \( x_8 = m \) then \( X \) steps
- if \( y_{10} = m \) then \( Y \) steps
- if \( z_{10} = m \) then \( Z \) steps

Finally, a key stream bit \( s \) generated as:

\[
S = x_{18} y_{21} z_{22}
\]

This is then XORed with the plaintext (if encrypting) or XOR-ed with the cipher text (if decrypting.

**RC4**

RC4 codecs is unlike A5 / 1. For A5 / 1 RC4s it is optimized for software development and RC4 is the primary byte at each stage and A5 / 1 produce only one key stream.

The RC4 algorithm is very simple because it resembles a table that contains 256 bytes location. Whenever the basic validity of each input stream is created, the functional actuator is constantly changing, so the table always has its own place (0, 1, 2, ......., 255). All RC4 algorithms are based on bytes. The first step in the algorithm triggers the spreadsheet with the key. This switch is \( i = 0, 1 \ldots \) \( N-1 \).

**Table 4.1. RC4 initialization**

<table>
<thead>
<tr>
<th>For ( i = 0 ) to 255</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S[i] = i )</td>
</tr>
<tr>
<td>( K[I] = \text{key}[I \mod N] )</td>
</tr>
<tr>
<td>Next ( i )</td>
</tr>
<tr>
<td>( J = 0 )</td>
</tr>
<tr>
<td>For ( i = 0 ) to 255</td>
</tr>
<tr>
<td>( J = (j + S[i] + K[j] \mod 256) )</td>
</tr>
<tr>
<td>Swap((S[i], S[j]))</td>
</tr>
<tr>
<td>Next ( i )</td>
</tr>
<tr>
<td>( I = j = 0 )</td>
</tr>
</tbody>
</table>

Each button \([i]\) is a byte and \( S(i) \) is a lookup table for each \( S[j] \). Table (2) in the table shows the pseudo-code for the P-permutation of activation.

Interesting features in RC4 are that the key can be longer than 256 bytes. The key is used only to initiate P rights.

After the start-up phase, each key stage flas is given in accordance with the table (3) algorithm, which is the main stream. Byte is a byte with XOR-ed, open text (encryption), or XOR-ed, encrypted text (open passwords). The RC4 output can also be used as a pseudo-random digital generator for applications requiring pseudo random numbers of "cryptographic" (i.e. presumably). The RC4 algorithm you can look for as a changing lookup table is smart and powerful software. However, the attack is available for specific purposes

RC4 [.........], but we cannot attack if we remove the first 256 bytes of bytes. This can be accomplished by adding up to 256 stages to the output stage, in which each step generates and interrupts the key byte after the table 3 algorithm.

RC4 is used in many applications, such as SSL. However, the algorithm is not very optimized for older and 32-bit processors.

**Table 4.2. RC4 key stream byte**
\[ i = (I + 1) \mod 256 \]
\[ j = (j + S[i]) \mod 256 \]
\[ \text{Swap}(S[i], S[j]) \]
\[ t = (S[i] + S[j]) \mod 256 \]
\[ \text{KeystreamByte} = S[t] \]

**Block Ciphers**

Blocks encrypted blocks blocking plain text in solid format and creates encrypted text in a solid size. The encrypted text is separated from the text. Repeat an F-type F functions.

Function F, which is dependent on the K and K buttons of the previous type, is referred to as round operations because it is used in each type, not in its forms.

Blocked items are security and efficiency. Developing secure passwords or powerful algorithms is not a challenging task, but it is surprising to design very secure and encrypted passwords.

**Feistel Cypher**

Feistel encoders are, in principle, general password design, but no special passwords, but Feistel passwords for block passwords. The Feistel P text is divided into the left and right pieces.

\[ P = (L_0, R_0) \]

And for each round \( i = 1,2 \ldots \) n new left and right halves are computed according to the rule

\[ L_i = R_{i-1} \quad (3.1) \]

\[ R_i = L_{i-1} \oplus F(R_{i-1}, K_i) \quad (3.2) \]

That is the sub key for the round. The sub key is derived from the K key according to the keypad algorithm. Finally, C is the final outcome.

\[ C = (L_n, R_n) \]

Feisteline encryption is a barber that is, we have the password to decompile whatever F function. We resolve the equations 1 and 2 for \( R_{i-1} \) and \( L_{i-1} \) and return the process

\[ R_{i-1} = L_i \]

\[ L_{i-1} = R_i \oplus F(R_{i-1}, K_i) \]

And the final results is the original plaintext \( P = (L_0, R_0) \).

All circular functions work in Feistel encryption if F's output is the correct number of bits. In particular, function F must not be altered. For example, for all \( R_{i-1} \) and \( K_i F(R_{i-1}, K_i) = 0 \), we have "encoding" and "password" with this F but encrypted is not really safe. The advantage of Feistel encryption is that all security equations suspect circular activity. Thus, the analysis can focus on F.

**DES**

DES, the Data Encryption Standard was developed in the 1970's. The design is based on the Feistel code developed by IBM, based on the Focus Codes. DES is simply a simple block identifier.

By mid-1970s, the US government became clear that secure encryption was justified by the commercial need. Volume and sensitivity over time and digital data, the computer revolution grew rapidly. The National Secret Security Agency or NSA Secret Agent did not want to contact DES, but ultimately accepted the study and dissemination of Lucifer models. All of this was secretly made and the data became popular later. Most suspected that the NSA had set a "tailgate" for DES, so it could simply interfere with the password. Of course, the NSA's SIGINT operation and the general lack of trust in the government have raised such fears. But for 30 years, it has not been opened to the back door for intense cryptanalysis. However, these doubts started with DNA itself.

Lucifer was finally des, but not the least, and some of them were not so subtle. The biggest change is that the key length is reduced from 128 to 64 bits. However, eight 64-bit bits were thrown, so the actual key length is only 56 bits.

As a result of these modifications, the expected work required for a brute force exhaustive key search was reduced from \( 2^{127} \) to \( 2^{55} \). By this measure, DES is \( 2^{72} \) times easier to break than Lucifer!

The obvious, suspicious thing is that the NSA has been involved in this case. However, subsequent cryptanalysis of the DES algorithm detected shocks that required less effort than tests \( 2^{55} \). As a result, DES may have about 56 key keys because it may be a longer key.
Subtle modifications to Lucifer include change boxes or S-boxes. In particular, these changes led to a suspect in the back room. But time goes by, it seems clear that many years later the changes to the S boxes enhanced the algorithm by protecting unknown cryptanalyses.

In summary,

- DES 16 different Feistel passwords;
- DES has a 64-bit block length;
- DES uses a 56-bit key; Each DES-type contains a 48-bit sub key, and each sub key consists of a 48-bit 56-bit key.

IV. HASH FUNCTION

The spreading function (used in data structures and algorithms) takes lines from arbitrary lengths and shortens them into shorter rows. In data structures, these shortcuts can be used as an index in the table: hash function is too short. Fourthly, the hash function requires fewer contradictions (as in every table, only a few elements run out).

The cryptographic spreading function h (x) should provide:

- Packaging: any input x size, output length = h (x) is very small. In practice, the cryptographic spread function generates fixed size costs regardless of the feed length.
- Function: All inputs x, h (x) should be easy to calculate. When calculating H (x), the computational motion increases with x length, but not too fast.
- Unidirectional: x (x) = The value of y cannot be calculated taking into account any y value. Another way to say this is to overestimate the difficulty.
- Weak Impact Resistance: For x and h (x) it is difficult to find y-x such as y (x) = h (x).
- Greater crash resistance: It is difficult to find x and y xi-y and x (x) = h (y).

Output fields should be present because the input field is larger than the free space. For example, suppose that the spread function generates a 128-bit output. If the value of this estimate reaches any output, all access values are up to about 150 gigabytes on average, over $2^{256}$ or over 4,000,000. And copy 150-bit entries. Collision prevention features require that all of these conflicts (with all others) are difficult to find. Importantly, there are cryptographic hash functions.

Hash functions are very useful for security purposes. The important use of Hash is to calculate a digital signature. If Alice uses a "special" key for coding, that is, he calculates S = [M] Alis. If Alice M and Sni send it to Bob then Normal M = {S} can confirm the signatures by confirming Alice. However, if M is larger, [M] Alice pays an estimate that is not the bandwidth used to send the same size M and C.

Assume that Alice has a cryptographic spread function. M (M ) file can be considered "fingerprint". This is less than H (M) Mbit. If M is different from one or more "min", it can be assumed that about half of h (M) and h (M’) can be expected. Alice S = [h (M)] under signing you can login and send Bob M and S. (M) = {SJ Alice.

What are the benefits of a signature (M) instead of M? For example, expensive private view features should only apply to small fingerprints (M) instead of the entire file. Greater M and more efficient h (M) the funds are so large. Additionally, when you send multiple attachments to Alice, the bandwidth is stored.

Non-Cryptographic Hashes

To understand a specific cryptographic hash function, first consider a few simple non-cryptographic hashes. Suppose the input data is

X = (X0, X1, X2 .... , Xn-1)

where each Xi is a byte. We can define a hash function h(X) by

$$h(X) = (X0 + X1 + X2 + - - - - + Xn-1) \mod 256.$$  

This, of course, impresses as the input of any size is compressed into 8 bits. But this would not be safe, because if we mix directly with 2x4 = 16. For example

$$h(10101010,0000,1111) = h(0000,1111,10101010) = 10111001.$$  

The length of the hash is not very short, but has many algebraic structures. As an example of a non-cryptographic hash, look at the following. Again, data is written as bytes

X = (X0, X1, X2 ... Xn-1).

Here, we'll define the hash h(x) as

$$h(X) = nX0 + (n-1) X1 + (n-2)X2 + .... +2Xn-2 + Xn-1 \mod 256.$$  

Is this hash secure? At least it gives different results when two bytes are swapped, for example, h(00000001,00001111) ≠ h(00000000,00001000)= 00010001.

Although this is not a trusted cryptographic hash, it is used successfully in a non-cryptographic program [...].
One of the common methods for non-cryptographic "hash" is a cyclical surveillance or CRC [...]. These calculations are basically a long time interval and the remainder is CRC. The default long term division is used to substitute the difference XR value.

By choosing this distributor, it's easy to find clashes and actually make collisions easier with any CRC system [...]. CRCs are sometimes used in applications that require cryptographic integrity (incorrect). For example, WEP [.....] uses cryptographic compositions to match the more consistent CRC checksum. CRC and its equalization methods are intended solely to detect transmission errors - not to disclose information unintentionally.

- Efficiency problems. The spreading function can be calculated by applying a single input to the input, while retaining certain data. It is also very powerful for large files.
- Applies to Hash functions. Today MD5 and SHA-1 are the most resilient for hash functions. Its capacity is 160 bits.

V. POPULAR USES OF COLLISION-RESISTANT HASH FUNCTIONS

In practice, the password used to log on is required. If this file is stolen, all user passwords should be opened. In Unix, this problem solves the password only with the required passwords. That is, any input included on the desktop (usher h (pwdi)) with the lock-resistant hash function.

The structure of this structure, as we have seen, is a one-way approach to the conflict of the clash traditions. Therefore, getting a password file does not specify the passwords needed to log in. (Remember that Hw (pwdi) information does not help access the server, because the host waits for host pwdi and h (pwdi).)

VI. CONCLUSION

Our system generates enough keys; It can generate different keys for different applications; Supports withdrawal; Its security document is based on extensive research in software development and in statistical discussions under subordinates; And we have shown that it is less than half of the wrong diagnosis.

An advanced sophisticated system with two subsystems and a biometric separation system has been created to authenticate and create keys. The purpose of the first subsystem is to identify people based on biometric data. The validation of the service recognition system is carried out. The execution is controlled by parameter FRR (false encryption) and parameter difference (incorrect). The results are as follows: FRR = 0.37 and Far = 0%. Selected parts by IRSA-iris segmentation did not produce good results.

The second subsystem is responsible for developing a cryptographic key creation system. The maximum length of the key is 150 bits for the smallest FRRs and FARs. Performance and individual systems are certified with parameters FRA and LP. The results are as follows: FRR = 1.35 and Far = 0%.

Authentication and key systems have competed with Daugmans biometric key generations. In the "Biometric Effective Crypton" combination, the authors note that the key length of FRR = 0.47 and FAR = 0 is 140 bits.

VII. FURTHER WORK

The main idea for future business is to develop systems that use biometric errors to create key PKI keys. He has thoroughly studied IBM's information acquisition methods and public key production mechanisms. Photos are in RGB format. Thus, in view of the large amount of data, the length of the normal PKI key is large. The results confirm the validity of the proposed solutions.

Another idea for the future is to develop a multimedia content protection system for biometric data using cryptographic protection. Using biometric information such as a key may prevent access to unauthorized use of copyrighted material. A combination of symmetrical and asymmetrical keys used for this purpose. The proposed method can fill the system to create a water cylinder.

The latest offer for the next job is the development of a digital content management system, DRM - Digital Rights Management. System-based and identification methods that incorporate DRM are based on iris biometric data systems. The victims of the system distinguish between protection and individuality. The purpose of the system is to separate customers from illegal users, so only authorized customers have access to digital content.

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RECOMMENDATIONS RESULT ANALYSIS CONSTRUCTION PROCESS OF FLY OVER NON-TOLL CILEDUG - TENDEAN – INDONESIA

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Abstract

Observing the portrait of South Jakarta and Tangerang City environmental conditions is very solid, it is necessary infrastructure that can anticipate the risks that occur every day. One solution is to provide infrastructure for the public interest, in this case the construction of roads for public transport, which is expected to reduce and break down the congestion that occurred. Therefore, it is necessary to study Risk Management in preventing and mitigating the impact of the risk of fly over Non-Toll Ciledug-Tendean-Indonesia.

The overall research problem is: to identify and analyze the risk of construction fly over Non-Toll Ciledug-Tendean-Indonesia, analyzing the cause of the risk of fly over Non-Toll Ciledug-Tendean-Indonesia. However, the writing of this research will be focused until the process of solving the problem of identifying and analyzing the initial risks of fly over Non-Toll Ciledug-Tendean-Indonesia.

The relevant literature review of this research will discuss: risk management, construction process, portrait of the fly over Non-Toll Ciledug-Tendean-Indonesia project, and relevant research results. Relevant research results will be limited in the review of the last 10 years.

This research is complete using Research Methodology which starts from identification of research problem, research analysis, research findings study, and recommendation that expected to produce the necessary improvement. In particular, this writing is limited to before the analysis process. The method used in this research is qualitative method.

Through this research is complete will be expected to produce improvement recommendation from research study. However, this paper will specifically recommend various identification of factors and risk variables from various literature studies, expert opinions, and existing project review. It is hoped that through the results of this paper, which is an early part of the whole research series, will recommend various risks that may occur, so that all parties concerned can have vigilance in order to prevent the risk that can occur.

Keywords: risk, identification, cause, construction, flyover Non-Toll Ciledug-Tendean-Indonesia

A. BACKGROUND OF RESEARCH PROBLEMS

Construction is one type of work that has a relatively high risk potential compared to non-construction work. The complexity of the project tends to increase the level of risk, judging by the number of stakeholders involved, including the use of new methods and technologies. This development is particularly evident in large-scale projects in Indonesia, such as tall buildings, bridges, telecommunications, power generation, mining, mineral processing, petrochemicals.

Risks can have an effect on the productivity, performance, quality and cost limits of the project. The risk can be said to be a result that may occur unexpectedly. Although an activity has been planned as well as possible, it still contains the uncertainty that it will run entirely as planned. If the risk occurs it will have an impact on the disruption of the overall performance of the project so that it may cause harm to the cost, time and quality of work.
In handling risk, it can be done through risk avoidance, risk reduction / mitigation, risk retention and risk transfer. These four methods can be combined, depending on the strategy applied to the construction project.

Except for risk aversion, risk management can be done through risk financing mechanism. The form of risk reduction can be in the form of training and provision of safety equipment, in order to reduce the impact of occupational risk. Risk containment is a common form of contractors in addressing risks through allocation of funds within the contingency cost of the proposed cost budget plan when tendered. While the method of risk transition is intended to provide financial compensation to the guarantor who is willing to bear a risk. This method of transfer of risk allows owners and contractors to transfer risks that can not be overcome or controlled by themselves to other parties, in the form of insurance and or guarantee.

The risk associated with this uncertainty occurs because of insufficient or unavailable information about what will happen. Something uncertain may result in a disadvantage or disadvantage. According Wideman, the uncertainty that raises the possibility of profit is known by the term opportunity (opportunity), while the uncertainty that cause adverse effects is called the term risk (risk). Prior to the construction process construction actors can think and tackle the risks that may occur in the environment surrounding the project. However, in reality the Ciledug-Tendean Non-Tol Crescent Road construction process is less able to cope with the various impacts of risks experienced by the environment and the people around the construction project. As reported in the electronic media sindonews.com and news.okezone.com the project provides some negative impacts such as congestion is getting worse at the stage of project implementation.

B. RESEARCH PROBLEMS

This research will focus on solving the problem:
1. How is the result of risk analysis of fly over Non-Toll Ciledug-Tendean-Indonesia construction?
2. What is the recommendation result of risk assessment of fly over Non-Toll Ciledug-Tendean-Indonesia construction?

C. LITERATURE REVIEW

1. Construction Project

A construction project is an activity of establishing a building or infrastructure whose process activities have a beginning and end time and will not repeat itself on other projects. This is because the conditions of a construction project differ from one another. The life cycle of a construction project consists of six basic phases in developing a project from idea to reality. The life cycle of the construction project also shows that each construction project will coincide between one stage and another. The following are the six stages of the construction project (Donald S Barrie "Professional Construction Management"): concepts and feasibility studies, engineering and design, procurement, construction, start-up and deployment, operation and use.

From the stages above, the stage that many risk is the construction phase. For that event that allows the occurrence of risk in this study was taken at the construction stage. In addition, the construction phase also involves many parties, so it is possible to risk.

2. Construction Process

The construction process is a process whereby the plans and specifications of the designers are converted into structures and physical facilities. This involves the organization and coordination of all sources for the project: labor, construction equipment, fixed and temporary materials, general inventories and purposes, funds, technology and methods and time to complete projects on time, within budget constraints and in accordance with the standards of quality and performance / performance specified by the designer.

An important role at this stage is held by contractors and subcontractors and construction workers. Also lots of inputs for inspection and interpretation from architects / engineers. Supporting roles are provided by suppliers of materials and equipment, apesialist consultants, shipping and transportation organizations and others.
3. **Fly Over Non-Toll Ciledug-Tendean-Indonesia Project Portrait**

Here is a portrait of the Ciledug-Tendean Non Toll Toll Road project technically and project administration.

- **Project Name**: Construction of Fly Over Non-Toll Ciledug-Tendean-Indonesia
- **Service User**: Department of Public Works of DKI Jakarta Province
- **Contractor**: PT. Adhi Karya (Persero) Tbk, PT. Yasa Patria Perkasa, PT. Jaya Konstruksi MP Tbk, PT. Hutama Karya, PT. Waskita Karya, PT. Istaka Karya – PT. Agrabudi KARYA Marga JO, PT. Wijaya Karya (Persero) Tbk, PT. PP (Persero) Tbk
- **Contract value**: Rp 2,331,929,170,000
- **Wide**: 9 m
- **Long**: 9.8 km
- **Number of Bored Pile**: 1540 point
- **Number of Pile Cap**: 275 point
- **Number of Pier**: 270 point

4. **Fly Over**

Fly over is a way out that is widely used by an urban that has a minimal highway, but the number of vehicles there are very many. The low number of roadways is also exacerbated by land that has been converted as a highway. The flyover itself is divided into two kinds, namely toll road fly over and non toll overpass.

The construction of flyovers or fly over itself is more focused on areas susceptible to congestion at certain times. Like the construction of skyscraper buildings or other construction, the construction of flyovers or fly over also has a positive impact and negative impact on the life of the community around the flyover project, the following will be discussed on the impact of the construction of flyovers both toll and non toll.

Based on the main and first objectives of this flyover construction, the positive impacts that are ascertained or more accurately expected are the decreasing volume of congestion caused by the increasing volume of vehicles. With this fly over, then the congestion that occurs on some road segments will be diverted to pass this fly over or fly over. Given the flow of vehicles in this fly over smoothly then the fly over is not going to happen congestion.

In addition to having a positive impact, Fly Over Road Development also raises many new problems in the community, including: congestion during the process of fly over will grow worse, damage the beauty and beauty of the environment, poor management will result in abandoned projects, the amount of volume vehicles will increase.

5. **Project Management**

Project Management can be interpreted "As a science and art in relation to lead and coordinate human and material resources by using modern management techniques to achieve predetermined targets: scope, quality, timeliness and cost, as well as meeting the interests of stakeholders". In principle, project management is: Implementation of knowledge, skills of "tools and techniques" (tools / tools and techniques) on project activities so that the requirements and project needs are met.

Objectives / benefits of project management ie, efficiency in terms of cost, resources and time, better control of the project, so the project can be in accordance with scope, cost, resources and time specified, improve quality, increase productivity, can reduce risk which arise as small as possible, better internal coordination and improve team spirit, responsibility and loyalty to the project, with a clear assignment to each team member.

6. **Risk Management**

According to Wikipedia Indonesia states that risk management is a structured approach / methodology in managing uncertainty related to threats; a series of human activities including: risk assessment, development of strategies for managing them and risk mitigation using resource empowerment / management. Strategies that can be taken include transferring risks to others, avoiding
risks, mitigating the negative effects of risk, and accommodating some or all of the consequences of certain risks.

In general, the main objective of risk management is to prevent or minimize adverse effects due to unforeseen events through risk aversion or preparation of contingency plans related to those risks. In project risk management project is an event or condition that is uncertain, and if happened have a positive influence or it could be negative on the project objectives. A risk has a cause and when it happens it will have an impact, therefore risk can be expressed as a function of possible impact.

7. Risk Identification

Risk identification is a process for identifying, discovering, or identifying risks. Risks can be identified through the source of the risks and impacts of losses incurred. Based on these impacts can be assessed what risks are potentially large in causing losses.

After identifying the risks, the next step is the measurement of risk by looking at the potential severity and probability of occurrence of the risk. Determining the probability of occurrence of an event is very subjective and more based on reason and experience. Some risks are easy to measure, but it is very difficult to ascertain the probability of a very rare event. Thus, at this stage it is important to determine the best guess so that we can prioritize well in the implementation of risk management planning.

The difficulty in measuring risk is determining the possibility of a risk because statistical information is not always available for certain risks. In addition, evaluating the impact of damage (severity) is often quite difficult for immaterial assets.

8. Risk Monitoring

Identifying, analyzing and planning a risk is an important part of project planning. However, risk management does not stop here. The practice, experience, and occurrence of a loss will require a change in plans and decisions regarding the handling of a risk. It is important to monitor the process from the very beginning from risk identification and risk measurement to determine the effectiveness of the selected response and to identify new and changing risks. Thus, when a risk occurs the selected response will be appropriate and implemented effectively.

9. Risk Analysis

The objective of risk analysis is to reduce the risks where remedial action is taken on a project, scheduling, budget, project price / quality. Risk analysis includes consideration of the source of the risks, the consequences and the likelihood of those risks. Risks are analyzed by combining likelihood values (probability or frequency) and consequences (impact or effect). Likelihood and consequences of each risk will determine the level of risk.

To conduct an effective risk analysis, according to Burby (1991) in Duffield and Trigunarsyah (1999) should consider the following:

   a. The analysis should focus on direct financial losses from disruption to service or death and loss
   b. The degree of uncertainty in any output estimate should be assessable
   c. The accuracy of the analysis should be consistent with the accuracy of the data and the project stages
   d. The cost and effort in doing the analysis should be as low as possible that can be absorbed by the project budget.anggaran proyek.

10. Risk Allocation

Once the risks are identified in a project, those risks must be allocated to the contracting parties. This allocation is based on an assessment of the relationship between the parties involved with the risk. Risk allocation is the determination and delegation of responsibility for a risk.

Bunni (1968) states a more appropriate method for risk allocation is based on the control of the presence and the effects it generates when the risk occurs. For some cases it is more appropriate to allocate risk based on the nature of the risk or on the basis of a party's ability or inability.
11. **Risk Response**

Risk response is the action taken against the risk that may occur. Important known risks need to be followed up with the responses made by the contractor in handling those risks. Methods used in dealing with risks (Flanagan & Norman, 1993):

a. **Withholding risk (Risk Retention)**

   Is a form of risk management which will be detained or taken alone by a party. Usually this is done if the risk faced does not incur a loss that is too large or the likelihood of loss is small, or the cost incurred to overcome the risk is not too large compared with the benefits to be gained.

b. **Reduce risk (Risk reduction)**

   That is action to reduce the risk that will likely occur by:
   - Education and training for workers in risk
   - Protection against possible loss
   - Protection of people and property
   - Risk transfer (Risk transfer)

c. **This transfer is done to transfer the risk to the other party. The form of risk transfer in question is insurance by paying a premium.**

d. **Avoid risk (Risk avoidance)**

   Avoiding the risk is the same as refusing to accept a meaningful risk of refusing to accept the project.

12. **Relevant research results.**

Here are the various literature reviews that are relevant to this research:

a. Manlian Ronald A. Simanjuntak, Ismeth S Abidin, M. Rifqi HM, Risk Analysis of Construction Implementation to Improve Cost Performance on Toll Road Projects. Journal of Faculty of Science and Technology, Universitas Pelita Harapan. The purpose of this research is to identify the risk of the dominant construction implementation on the decrease of cost performance in the development of Toll Road in Java. This journal is useful in the author's research methodology.

b. Ayunita Indria Dewi, Cahyono Bintang Nurcahyo, Risk Analysis on Underpass Development Project at Simpang Dewa Ruci Kuta Bali. Journal of the Technical Faculty, Sepuluh Nopember Institute of Technology. The purpose of this research is to know the risk of underpass development project at Simpang Dewa Ruci Kuta Bali. This journal is useful in the author's research theory.

c. Ferry Wantouw, Robert J. M. Mandagi, Risk Management of High Voltage Air Traffic Construction Project (SUTT) 150 Kv Lopana-Teling. Journal of Engineering Faculty, Sam Ratulangi University. The purpose of this research is to identify, analyze and determine the risk response caused by the construction of SUTT 150 Kv Lopana-Teling. This journal is useful in collecting research data of journal authors.

d. Ari Sandhyavitri, Mmuhammad Zulfiqar, Risk Analysis of Toll Road Construction of Tahapa Konstruksi (Pekanbaru-Dumai Toll Road Case Study). Journal of Faculty of Engineering, University of Riau. The purpose of this study was to identify and analyze project risks (during the construction phase project). This journal is useful in the author's literature review.

e. I Gede Putu Joni, Project Management Risks. Journal of Faculty of Engineering, University of Udayana. The purpose of this research is to know the risks of project management. This journal is useful on the author's background.

C. **RESEARCH METHODOLOGY**

1. **Research Process**

1.1 **Research Design**

The approach to achieve research objectives is done through risk analysis method which is a decision-making system supported by various methods of analysis, simulation and optimization are done measured. These assessments are intended to identify all types of risks that arise during the non-toll road overpass project stage that may affect the performance of the construction project. This research method will use qualitative methods to find out the risks that most influence the project.
objectives on the contract and the discussion of risk handling. The following stages of research on this writing:

1.2 **Data Collection**
Data to be collected and used in this research is secondary data derived from various references and relevant research journals.

1.3 **Operational Research Model**

![Diagram 1. Research Stages](image)

**Diagram 2. Operational Research Model**

- **Research Process**
  - Issue Issues
  - Research Issues
  - Primary data
  - Secondary Data
  - Expert Opinion
  - Previous Research Results

- **Research Factors**
  1. Risk of Design and Technology
  2. Contractual Risk
  3. Project Management Risks
  4. Risk of Labor
  5. Risk of Material Supply and Equipment
  6. Risk of Construction Implementation
  7. Evaluation

![Variables and Output](image)
D. DISCUSSION OF RESEARCH RESULTS
This research started from the data collection process through literature study with the output of 6 research factors with each research variables as follows:

a. Research Factors
The factors in this study are:
1. Design and Technology Risks
2. Contractual Risk
3. Project Management Risks
4. Risk of Labor
5. Risks of Material and Equipment Supply
6. Risk of Construction Implementation
7. Evaluation

b. Research variable
- Design and Technology Risks
  1. Design error
  2. Design changes
  3. The use of untested designs
  4. The use of new technologies that have not been applied
  5. The wrong method of execution
  6. Incomplete design data
  7. Inadequate and non-conformity specification on design details
  8. Error in structural calculation and analysis
  9. Mistakes of technical assumptions at the planning stage
  10. What is the difference between the owner's and the contractor's specific perceptions
  11. Incomplete job documents
  12. Late payment by owner
  13. Termination of unilateral work by the owner
  14. What is the dispute between owner and contractor
  15. Late payment to specialist contractor through main contractor

- Project Management Risks
  1. Cost estimation error
  2. Time estimation error
  3. Lack of team control and coordination
  4. The presence of less experienced staff in the contracting team
  5. Inability of project management planners
  6. Performance of a poor specialist contractor
  7. Lack of responsibility of the main contractor on the quality of the work of the specialist contractor
  8. Non-complete daily reports
  9. Low level of management discipline
  10. There is an internal conflict within the project management ranks
  11. Claim
  12. Changes in the scope of work
  13. Changes in construction methods that have been made
  14. No receipt of work by the owner
  15. Inaccuracy of construction works (schedule and quality)

- Labor Risk
  1. Disputes between workers
  2. Removal of potential workers
  3. Unskilled labor
  4. Unavailability of the number of field workers
  5. Low labor productivity
  6. Requests for overtime hiring by workers
  7. Demand for salary increases
• Risks of Material and Tool Supply
  1. Limited material availability
  2. Damage or loss (material theft) at construction site location
  3. Lack of material storage at construction site location
  4. Lack of landfills on site construction sites
  5. Delay of material delivery from supplier to construction project location
  6. Increase in material prices that are not fair
  7. Insufficient volume of material shipped can
  8. Damage to machine tools and project equipment can
  9. Equipment that is not in accordance with the working conditions of the project
  10. If the lack of proper procurement of materials and equipment (volume, schedule, price and quality)

• Construction Construction Risk
  1. Site accessibility conditions are difficult
  2. Embezzlement of project assets
  3. Error in survey
  4. Destruction and sabotage
  5. Security disturbance at project site
  6. Quality of material that is not in accordance with the specifications
  7. Uneven compaction at the time of casting
  8. Quality of concrete not in accordance with the specifications
  9. Damage that occurs during maintenance period
  10. Changes in unplanned scheduling of work

• Evaluation
  1. No coordination with the local government
  2. Lack of coordination with experts and skilled personnel
  3. The absence of K-3 education and training (occupational safety health)
  4. Absence of equipment maintenance and completeness of K-3 (occupational safety health)
  5. Not involving residents around the project
  6. No social approach to the local government, community leaders and religious leaders who are in the project environment

E. CONCLUSION
  1. Risks can be identified through the source of the risks and impacts of losses incurred. Based on these impacts can be assessed what risks are potentially large in causing losses. Risks are analyzed by combining likelihood values (probability or frequency) and consequences (impact or effect). Likelihood and consequences of each risk will determine the level of risk.
  2. The risk associated with this uncertainty occurs because of insufficient or unavailable information about what will happen. In handling risk, it can be done through risk avoidance, risk reduction / mitigation, risk retention and risk transfer.

F. BIBLIOGRAPHY
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Ari and Muhammad. 2014. Risk Analysis of Toll Road Development At Construction Stage (Case Study: Pekanbaru-Dumai Toll Road). Pekanbaru. Journal of Civil Engineering Volume 10 No. 1
Management. Erland. Jakarta
Obesity, body fat distribution, insulin resistance and link with type 2 diabetes mellitus
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* Department of Biochemistry, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka

Abstract- Obesity is associated with insulin resistance and subsequent development of type 2 diabetes mellitus. Usage of measures of obesity including anthropometric parameters and body fat percentage assessment, in general practice is scarce in some counties except for body mass index. Recent studies have demonstrated that indicators of body fat distribution are superior risk indicators of development of insulin resistance compared to indicators of general obesity. Objectives of current review are to evaluate the association of insulin resistance with indicators of body fat distribution and anthropometric markers of general and central adiposity and to establish the association of obesity with insulin resistance and development of type 2 diabetes mellitus. Relevant literature was gathered by searching through electronic data bases. Significant data were extracted and included in to the review. In conclusion, anthropometric markers of obesity among the general population are satisfactory enough to apply in risk assessment of development of obesity associated metabolic disorders including insulin resistance, type 2 diabetes mellitus and will enable with early interventions.

Index Terms- Obesity, Insulin resistance, Type 2 diabetes mellitus, Anthropometry, Body fat percentage

I. INTRODUCTION

“Overweight and obesity are defined as abnormal or excessive fat accumulation in the body that may impair health” [1]. An abnormal growth of the adipose tissue can be due to either enlargement of fat cell size (hypertrophic obesity) or an increase of fat cell number (hyperplastic obesity) or a combination of both [2, 3].

Obesity associated metabolic abnormalities leads to insulin resistance (IR). These metabolic abnormalities including increased non-esterified fatty acid levels and increased triglyceride (TG) levels due to excess lipolysis, cause suppression of glucose uptake by the muscle [4]. Most patients with type 2 diabetes mellitus (T2DM) are obese and if they are not obese they have at least increased percentage of body fat distribution in the abdominal region [4]. The most widely used index to assess the obesity is body mass index (BMI) [5]. Waist circumference (WC), Waist to hip ratio (WHpR) and Waist to height ratio (WHtR) emerged later as markers of central obesity demonstrating to be better correlated with metabolic risk factors than BMI [5].

Later research interests drifted from general obesity to different lipid depots of the body. Methods of Measurement of body composition can be categorized in to two main types. The direct method involves cadaver dissections, which is not very practical in the research field. Therefore, indirect or in-vivo methods are used instead. In in-vivo methods, body composition is assessed using several formulae or equations using measureable parameters based on the assumption of constant relationships between variables. In the evaluation of body composition, a concept called “body compartments” is used. Generally body can be partitioned as either chemical components (water, fat, minerals) or compartments (e.g. fat mass, fat free mass). Depending on the mode of partitioning, different compartmental methods exist [6].

To measure different fat depots of the body, bio impedance analysis (BIA), dual energy x-ray absorptiometry (DEXA), computed tomography (CT), magnetic resonance imaging (MRI), magnetic resonance spectroscopy (MRS), and positron emission spectroscopy (PET) techniques are applied [7]. Reference methods of assessing body fat levels are DEXA and Hydro-densitometry [8, 9]. Due to the cost involved and technical difficulties, anthropometric indices still play an important role in assessing body fat distribution as surrogate markers [10].

Although the main effect of the hormone insulin is regulation of glucose and fatty acid metabolic pathways [11, 12], this hormone has other biological actions including vasodilation [12], cardio-protective action [12], anti-apoptosis, platelet inhibition, anti-oxidant, anti-inflammatory, anti-thrombotic, pro-fibrinolytic and anti-atherosclerotic functions [13].

Insulin resistance (IR) is defined as “defect in insulin action resulting in fasting hyper-insulinaemia to maintain euglycaemia” [14]. The ability of insulin to produce the biological action on target tissues, i.e., adipose tissue, skeletal muscle, liver is reduced in individuals with insulin resistance [15]. Genetics, age, acute exercise, physical fitness, dietary habits, medication, obesity and body fat distribution are the factors which influence insulin sensitivity in an individual [16]. Insulin resistance is strongly associated with obesity [17] especially with the central obesity [18] and is a precursor of T2DM and metabolic syndrome [19]. Features of IR include hypertriglyceridemia, increased abdominal, visceral fat and hyper-insulinaemia [4].
Diabetes mellitus (DM) develops as a consequence of interaction of environmental factors with the genetic makeup of a person. The risk of development of DM is intensified with the presence of obesity [16] which is identified as a major risk factor of type 2 diabetes mellitus (T2DM) [20, 21].

II. METHODOLOGY

A. Objectives
The Objectives of the current review are to evaluate the association of insulin resistance with indicators of body fat distribution and anthropometric markers of general and central adiposity and to establish the association of obesity with insulin resistance and development of type 2 diabetes mellitus.

B. Methodology
Relevant evidence for the systematic review was searched using electronic databases including Google scholar, Pubmed, and visually scanning reference lists from relevant studies using Insulin resistance, obesity, BMI, WC, body fat, and diabetes mellitus as keywords. Initially, titles and abstracts were selected which seem to match with the inclusion criteria. At the second stage full papers were screened for relevancy and articles which provided relevant data were included in the review. Related data were extracted using a data extraction format.

III. REVIEW

A. Techniques to assess insulin resistance
There is abundance of techniques used to assess insulin resistance. These can be basically categorized in to two main categories as dynamic tests and single specimen tests. Clamp tests are examples for dynamic tests and the other category includes tests based on biochemical markers on a single specimen which includes homeostatic model assessment (HOMA) [15].

Hyperinsulinaemic euglycemic clamp test is the current gold standard method of insulin resistance assay [19, 22]. Hyperinsulinaemic euglycemic clamp test is time consuming and complex and also requires vast technical expertise. Due to this fact, single specimen tests like HOMA-IR are commonly used and shown to correlate with hyperinsulinaemic euglycemic clamp test. Other than that, Quantitative Insulin Sensitivity Check Index (QUICKI) and beta cell sensory indices like Fasting insulin to glucose ratio (FIGR) and fasting insulin (FI) are used as markers of insulin resistance. Triglyceride to HDL cholesterol ratio can also be used as a marker of insulin resistance which is known to correlate with insulin sensitivity [22].

B. Obesity and insulin resistance
Increased BMI is associated with insulin resistance [23, 24]. However, normal weight individuals may also develop insulin resistance suggesting that whole body adiposity alone may not reveal the risk of development of insulin resistance [23]. Further, it has been demonstrated that IR correlates better with abdominal obesity compared to BMI [23, 24]. Furthermore, regional adiposity measures like volume of visceral (VAT) and subcutaneous adipose tissue (SAT) had shown strong associations with cardiovascular disease risk factors [23].

C. Anthropometric markers of obesity and insulin resistance
Due to difficulties in using some of the methodologies on field, in epidemiological studies, central obesity is determined using either WC, WHR or WTR (waist to thigh ratio) [25, 26]. BMI, WHR and WC of Asians are positively associated with increased fasting insulin levels [27, 28]. Individuals with high Waist to Hip ratios are more insulin resistant compared to individuals with low Waist to Hip ratios [29]. Serum insulin level has a statistically significant positive association with BMI, WC and WHR [27, 30]. But if the pattern of the data indicated in table 1 is followed, it is observed that the association of fasting insulin levels and insulin resistance is strongly associated with BMI and WC compared to WHR [27].

On the other hand, although WHR and WC have shown significant negative correlations with insulin mediated glucose disposal, when these two parameters were analyzed using multiple regression analysis, only WC indicated a significant correlation [31]. When correlations between visceral adipose tissue/ subcutaneous adipose tissue (VAT/SAT) and proinsulin:insulin ratio were analyzed, both BMI and WC have shown similar significance levels [23]. Furthermore other measures of insulin resistance which are indicated in this review are also significantly associated with BMI and WC [23, 32-39]. Insulin sensitivity has a significant negative correlation with BMI and WC [28, 33, 37].
<table>
<thead>
<tr>
<th>Reference</th>
<th>Study population</th>
<th>Sample size</th>
<th>Insulin resistant assay method</th>
<th>Anthropometric index</th>
<th>Correlation with IR marker (r)</th>
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<td>Chung, Cho et al. 2012 [37]</td>
<td>new-onset T2DM subjects</td>
<td>132</td>
<td>HOMA-IR</td>
<td>BMI</td>
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<td>Miyazaki, Glass et al. 2002 [32]</td>
<td>American T2DM population</td>
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<td>ISI TGD EGPxFPI</td>
<td>BMI</td>
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<td>Arora, Chen et al. 2016 [39]</td>
<td>newly diagnosed T2DM patients in Qatar</td>
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<td>Logged HOMA2-IR</td>
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<td>0.46&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>Preis, Massaro et al. 2010 [23]</td>
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<td>A healthy Japanese population</td>
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<td>Farin, Abbasi et al. 2006 [34]</td>
<td>Non-diabetic healthy females (19-44 years)</td>
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<td>BMI</td>
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<td>BMI</td>
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<td>BMI</td>
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<td>BMI</td>
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<td>BMI</td>
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<tr>
<td>Hughes, Aw et al. 1997 [27]</td>
<td>Chinese, Indian and Malay subjects in Singapore</td>
<td>122 Malay M</td>
<td>Fasting insulin</td>
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<td>0.53&lt;sup&gt;NS&lt;/sup&gt;</td>
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<td></td>
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<td>118 Malay F</td>
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<td>BMI</td>
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<td>142 Chinese M</td>
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<td>152 Chinese F</td>
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<td>BMI</td>
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<td>WC</td>
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</tr>
</tbody>
</table>

Table 1. Association of Anthropometric markers of obesity with insulin resistance
Weyer, Foley et al. 2000 [28]

<table>
<thead>
<tr>
<th>Pima Indians (diabetics + IGT + NGT)</th>
<th>280</th>
<th>IS</th>
<th>WHR</th>
<th>-0.34 c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting insulin WHR</td>
<td>0.39 c</td>
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</table>

NGT pima Indians | 172 | IS | WHR | -0.22 b |
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<tbody>
<tr>
<td>Fasting insulin WHR</td>
<td>0.34 c</td>
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</table>

Banerji, Faridi et al. 1999 [31]

<table>
<thead>
<tr>
<th>Asian Indian healthy male</th>
<th>20</th>
<th>IGD</th>
<th>WHR</th>
<th>-0.48 a</th>
</tr>
</thead>
<tbody>
<tr>
<td>WC</td>
<td>-0.63 b</td>
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</table>

M (male), F (female), HOMA-IR (insulin resistance by the homeostasis model assessment), ISI (Insulin sensitivity Index), TGD (Total Glucose Disposal), EGP×FPI [Basal Endogenous Glucose Production × Fasting Plasma Insulin (Hepatic Insulin Resistance)], NS (Not significant)

a Significant correlation (P=<0.05)
b Significant correlation (P=<0.01)
c Significant correlation (P=<0.001)

D. Body fat percentage and insulin resistance

Most commonly used cut off of body fat percentage to define overweight in males is 20.1–24.9% and 30.1–34.9% for females and that for obesity is ≥25% for men and ≥35% for women are applied [40].

Where body fat assessment is concerned, research has mainly targeted on visceral adipose tissue and abdominal subcutaneous adipose tissue levels [41]. Abdominal obesity (upper body obesity) is strongly associated with IR compared to lower body obesity. Abdominal obesity may be due to visceral and/or subcutaneous fat, but many researchers claim that visceral fat is more significant with insulin resistance [42, 43]. Although, abdominal subcutaneous fat volume and visceral fat volume have shown significant relationship with insulin mediated glucose disposal, when multiple regression is applied only visceral adipose tissue has shown a significant relationship with glucose disposal rate [31]. Studies which assess abdominal adiposity using MRI (magnetic resonance imaging), CT (computed tomography) techniques, have been able to come up with the general conclusion that only intra-abdominal and visceral adipose tissue are associated with metabolic abnormalities of obese people compared to subcutaneous adipose tissues [44].

Inter-muscular and thigh subcutaneous adipose tissue (TSAT) depots also have gained research interests [41]. Interestingly, thigh subcutaneous adipose tissue has been identified as a metabolically protective fat depot [41]. A study among overweight and obese subjects has been able to demonstrate a higher degree of insulin sensitivity when the lower VAT and higher TSAT values are present and vice versa [44].

Both SAT and VAT contribute to insulin resistance and associated complications in male African Americans [45]. Although, log insulin values among both African American and Caucasian female groups have shown a correlation with SAT and VAT, only VAT has shown a significant correlation once multiple regression analysis is done [46]. Although insulin, proinsulin, HOMA-IR and Proinsulin:insulin ratio had significant correlations with VAT and SAT, VAT has shown a stronger correlation compared to SAT [23].

Using anatomical landmarks, abdominal subcutaneous adipose tissue can be further divided into two layers [32]. The superficial fascial plane which lies within the subcutaneous adipose tissue separates subcutaneous adipose tissue layer in to superficial and deep layers. Deep subcutaneous fat (DSF) is strongly associated with peripheral insulin resistance compared to superficial subcutaneous adipose tissue. This metabolic difference may be due to arrangement of the tissue layers. Superficial layer is made of small, tightly packed fat lobules while deep layer is made of larger, irregularly distributed lobules [32].

E. Obesity, insulin resistance and subsequent development of T2DM

T2DM develops as a consequence of insulin insensitivity and failure of pancreatic insulin secretion to compensate for reduced insulin sensitivity [48, 49]. According to the findings of United Kingdom Prospective Diabetes Study (UKPDS) a cohort of individuals with recently identified T2DM has shown a gradual decline in β cell function without showing any changes in insulin sensitivity [50]. According to the current knowledge, T2DM only develops in insulin resistant individuals with the onset of β cell dysfunction [48]. When insulin resistance is present due to chronic energy supplementation and obesity, pancreatic beta cells hyper-secrete insulin as a compensatory mechanism to maintain normoglycaemia, Rodent studies have demonstrated that this compensatory insulin hyper-secretion is achieved by expansion of β cell mass and enhanced β cell function. This same pattern is observed in obese subjects compared to non-diabetic lean subjects. Increased blood glucose and free fatty acids act as stimulants for expansion of β cell mass [48].

Table 2. Abdominal fat distribution and insulin resistance
<table>
<thead>
<tr>
<th>Reference</th>
<th>Study population</th>
<th>Sample size</th>
<th>Abdominal obesity assay method</th>
<th>Insulin resistant assay method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Després, Lemieux et al. 2008 [44]</td>
<td>Obese premenopausal women</td>
<td>40</td>
<td>MRI</td>
<td>GDR</td>
<td>VAT</td>
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<td>VF volume</td>
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<td>Abdominal SC fat volume</td>
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<td>Total body fat volume</td>
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<tr>
<td>Banerji, Faridi et al. 1999 [31]</td>
<td>Asian Indian healthy male</td>
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<td>TAT</td>
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<td>VAT</td>
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<tr>
<td>Lovejoy, Smith et al. 2001 [46]</td>
<td>Healthy, white premenopausal women</td>
<td>103</td>
<td>CT</td>
<td>Log insulin</td>
<td>SAT</td>
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<td>Lovejoy, Smith et al. 2001 [46]</td>
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<td>Log insulin</td>
<td>TAT</td>
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<tr>
<td>Tulloch-Reid, Hanson et al. 2004 [45]</td>
<td>African American</td>
<td>36 F</td>
<td>CT</td>
<td>ISI</td>
<td>SAT</td>
</tr>
<tr>
<td>Tulloch-Reid, Hanson et al. 2004 [45]</td>
<td>African American</td>
<td>44 M</td>
<td>CT</td>
<td>ISI</td>
<td>VAT</td>
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<td>Preis, Massaro et al. 2010 [23]</td>
<td>USA non-diabetic males and females</td>
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<td>CT</td>
<td>HOMA-IR</td>
<td>Insulin</td>
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<td>TBF mass</td>
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<td>SSAT</td>
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<td></td>
<td></td>
<td></td>
<td>TBF mass</td>
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<tr>
<td>Miyazaki, Glass et al. 2002 [32]</td>
<td>American T2DM male and female population</td>
<td>30 M</td>
<td>MRI</td>
<td>EGP×FPI</td>
<td>TGD</td>
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<td>TGD</td>
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</table>
### Inflammation and insulin resistance in obesity

Obesity can be described as a state of chronic inflammation, since in obesity inflammatory markers like plasma C-reactive protein (CRP), Interleukin-1 (IL-6) and plasminogen activator inhibitor-1 (PAI-1) are elevated [20] and future development of T2DM can be predicted by presence of inflammation [20].

Chronic activation of innate immune system results in a low grade inflammation in white adipose tissue (WAT) of most obese individuals resulting in IR, impaired glucose tolerance and even diabetes [51]. As a result of inflammation of WAT, production and secretion of a wide range of inflammatory molecules like TNF-α (Tumor necrosis factor-α) and IL-6 (Interleukin-6) are increased and WAT is infiltrated by macrophages [13, 51]. It is presumed that several factors derived from adipocytes and infiltrated macrophages contribute to the pathogenesis of insulin resistance in obesity [13, 51]. Some adipokines [adipocyte secretory products [52]] including TNF-α and IL-6 have the ability to change the insulin sensitivity by triggering some key steps of signaling pathway of insulin [51, 53]. On the other hand, obesity is a well-known independent risk factor of type 2 diabetes mellitus (T2DM) and insulin resistance is the factor which connects the link between obesity and T2DM [20, 51].

<table>
<thead>
<tr>
<th>Study</th>
<th>Age Range</th>
<th>Ethnicity</th>
<th>Methodology</th>
<th>Measure</th>
<th>Result 1</th>
<th>Result 2</th>
<th>Result 3</th>
<th>Result 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amati, Pennant et al. 2012</td>
<td>30 to 75 years old sedentary overweight or obese individuals in USA</td>
<td>21 M 31 F</td>
<td>CT, GDR</td>
<td>EGP×FPI</td>
<td>NS</td>
<td>VAT</td>
<td>0.39 b</td>
<td>SAT</td>
</tr>
<tr>
<td>Yu, Venners et al. 2010</td>
<td>Pre-diabetic normal weight and overweight rural Chinese females aged 20–60 years</td>
<td>4071</td>
<td>DEXA, HOMA-IR</td>
<td>Thigh VAT</td>
<td>0.39 b</td>
<td>VAT</td>
<td>0.34 b</td>
<td>SAT</td>
</tr>
<tr>
<td>Raji, Seely et al. 2001</td>
<td>12 Asian Indians and 12 Caucasians with European ancestry</td>
<td>24</td>
<td>CT, GDR</td>
<td>Percent lower body fat (%LF)</td>
<td>-0.61 c</td>
<td>Subcutaneous adipose tissue</td>
<td>-0.47 b</td>
<td>BF%</td>
</tr>
<tr>
<td>Weyer, Foley et al. 2000</td>
<td>Pima Indians (diabetics + IGT + NGT)</td>
<td>280</td>
<td>Hydro densitometry</td>
<td>Insulin sensitivity</td>
<td>0.63 c</td>
<td>Fasting insulin level</td>
<td>0.68 c</td>
<td>BF%</td>
</tr>
<tr>
<td>Chandelia, Abate et al. 1999</td>
<td>Healthy migrants in USA</td>
<td>29</td>
<td>Hydro densitometry</td>
<td>GDR</td>
<td>0.65 c</td>
<td>BF%</td>
<td>0.34 NS</td>
<td>BF%</td>
</tr>
</tbody>
</table>

CT (Computed Tomography), VAT (Visceral Adipose Tissue), SAT (Subcutaneous Adipose Tissue), TAT (Total Abdominal Adipose Tissue), DSAT (Deep Sub-cutaneous adipose tissue), SSAT (Superficial Sub-cutaneous adipose tissue), TBF (Total Body Fat), MRI (Magnetic Resonance Imaging), IGT (Impaired glucose tolerant), NGT (Normal Glucose Tolerant), VF (Visceral fat), SC (Subcutaneous fat)

a Significant correlation (P=<0.05)
b Significant correlation (P=<0.01)
c Significant correlation (P=<0.001)
Glucose intake can induce acute oxidative stress status for a short period of 3 hours in body and inflammation at the cellular and molecular level in normal people [13, 20]. A meal of mixed fast food also can induce the same reaction [13, 20]. Interestingly, this condition is present in basal fasting state of obese people indicating chronic excess macronutrient intake [13, 20].

G. Storage activity of adipose tissue and insulin resistance

Other than the adipose tissue mass, studies have demonstrated the importance of biological characteristics of adipose tissue in the pathogenesis of insulin resistance [54] and these characteristics include size of adipose tissue, inflammatory properties of adipose tissue and proportion of small adipose cells [54].

It is suggested that ability of adipocyte to store excess triglyceride also plays an important role in systemic insulin resistance [21]. Buffering excess caloric intake by storing it as TG and maintaining lipid and glucose homeostasis are two main functions of adipose tissue [21]. During excessive energy influx, adipose tissue become hypertrophic and adipocyte insulin resistance may develop [21]. This leads to increased lipolysis, leading to decrease in TG storage capacity in the subcutaneous abdominal adipose tissue leading to systemic insulin resistance [21].

Research data suggests that fat cell size also has an independent association with insulin resistance, especially fat cell enlargement in obesity. As a result of reduction in capacity of adipose tissue to store lipids, enlargement of fat cells and ectopic accumulation of lipids ensue [55]. Reduction of storage capacity may be due to failure of differentiation of new fat cells due to genetic abnormalities [55]. A study has demonstrated 2-3 fold increase in genes related to adipose cell differentiation in an insulin resistant subgroup compared to an insulin sensitive subgroup [56]. It has been demonstrated that subcutaneous and omental fat cell size is associated with insulin resistance in subcutaneous fat cells and whole body insulin resistance in non-diabetic subjects [55].

As mentioned earlier, obesity can result in either hyperplasia of adipose tissue or hypertrophy of adipose tissue [3]. If adipose tissue expansion is due to hyperplasia, it is less likely to develop metabolic abnormalities of the metabolic syndrome [28, 44] including insulin resistance [21]. On the other hand, if adipose tissue becomes hypertrophic due to excess energy influx there is a tendency for the development of insulin resistance [21, 44, 56]. Hypertrophic obesity closely correlates with insulin resistance associated metabolic abnormalities [2, 57] and mean subcutaneous abdominal adipose cell size is associated with insulin resistance and predicts T2DM and this association is independent of BMI or body fat content [2].

A group of healthy first degree relatives of T2DM subjects showed that size of the large adipocyte cells are inversely correlated with insulin sensitivity (R^2=0.534, p<0.001). This correlation was intact when corrected for BMI and independent of the gender of the subjects [2]. There was no correlation between insulin sensitivity and the fraction of large adipocyte cells [2] although, a previous study has demonstrated a correlation between insulin sensitivity and fraction of large adipocytes [56]. Furthermore, inflammation in subcutaneous adipose tissue is associated with the proportion of small adipose cells among moderately obese, weight-stable individuals but not with the size of mature adipose cells [54].

H. Type of adipose tissue and insulin resistance

In normoglycemic individuals there is a variability of insulin resistance among group members and about fifty percent of this variability is due to differences in fat mass distribution among each individual [21].

As mentioned earlier, controversy still exists as to whether visceral or subcutaneous fat depots is responsible for development of metabolic abnormalities. Some researchers were able to demonstrate that not only increased visceral fat depots, but also increased subcutaneous adipose tissue is responsible for insulin resistance and glucose disposal[21].

Group of reviewers suggested three possibilities which explain involvement of visceral adiposity in the development of metabolic syndrome. One possibility is that, hyper-lipolytic state of omental adipose tissue exposes the liver to high concentration of free fatty acids through portal circulation [44]. Secondly, Adipose tissue act as an endocrine organ [44, 53]. Thirdly subcutaneous adipose tissue act as a protective metabolic depot and expansion of visceral adiposity suggests relative inability of subcutaneous adipose tissue to provide protective function due to its inability to expand (lipodystrophy) or hypotrophy and this leads to ectopic fat accumulation as well [44].

I. Ectopic fat deposition and insulin resistance

Ectopic fat is defined as “storage of triglyceride (TG) in tissues other than adipose tissue”. Liver, skeletal muscle, heart and pancreas are the sites where this excess TG deposition takes place and these are areas which generally contain only a small amount of fat [58]. These depots can affect cellular function of these organs and are associated with insulin resistance. Increase flux of plasma non-esterified fatty acids (NEFA) to other tissues promotes fat redistribution and ectopic fat deposition when the capacity of adipose tissue to store TG is decreased [21]. As a result of that glucose disposal in skeletal muscle is becoming defective and leads to the development of metabolic syndrome [21].
IV. CONCLUSION

Any defect in insulin signaling pathway can lead to insulin resistance. Alterations in the protein levels and activities of the signaling molecules, enzymes and transcription factors can affect insulin signaling pathway when obesity associated insulin resistance is present. Anthropometric markers of obesity still play an important role in risk assessment of insulin resistance and type 2 diabetes mellitus. These measures are satisfactory enough to apply in risk assessment of general population. Assessment of body fat distribution using modern techniques have been able to aid identifying the pathogenic process of insulin resistance and further development of T2DM and other cardiovascular events. But still, there is more to understand the pathogenic process of this disease since obesity is considered as only one risk factor among many involved in the process. Apart from the body fat content, body fat distribution and different body fat depots, research interests have drifted towards properties of fat cells and ectopic fat distribution in order to understand the pathogenic process of insulin resistance and subsequent development of metabolic syndrome and type 2 diabetes mellitus. Analyze and understand all the provided review comments thoroughly. Now make the required amendments in your paper. If you are not confident about any review comment, then don't forget to get clarity about that comment. And in some cases there could be chances where your paper receives number of critical remarks. In that cases don't get disheartened and try to improvise the maximum.

REFERENCES


Space Mouse - Hand movement and gesture recognition using Leap Motion Controller

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Abstract- A code based analysis of the user’s performance in selection tasks using a space mouse in comparison with a standard device is presented in this paper. A new contact free gesture based human interaction with declared point to point accuracy has been used in space mouse. Systematic evaluation of this new system as not been done prior to this point. Accurate tacking of hand fingers, and the track movement was proved testing, accuracy is last when the hand moves in to a position obstructing the controller’s ability to view. The space mouse uses a wide variety of ways to translate people’s action into usable inputs. A prominent one is mapping the 3D space in to a 2D or 3D coordinate of a virtual space. Some apps using Space Mouse in the project. To the dynamic measurements, a unique V-shape tool, repose of two tracking objects preserving a constant space between them, was produced to replicate two human fingers. The Space Mouse represent an innovative input device for human computer interact communication based on gestures with point to point accuracy. The main focal point of concentration is on the assessment of the accuracy and iteration.

Index Terms- Leap Motion Controller, User Interface, Motion capture system, Accuracy measurement, Human factors, and Arm/finger gestures.

I. INTRODUCTION

Input devices have a huge influence in the communication between humans and computer interfaces. The development of computer hardware and digital signal processing allowed for the creation of incredible sound of hardware and software synthesizers. Horizontal movement works with the device and the manipulation surface. However, electronic audio connections are common in mouse interfaces, multi-touch interfaces. In addition to standard input devices, many contactless input systems are available. Such sensors will be important for environmental cleanliness, such as medical applications or industrial applications.

- Space Mouse, a newly invented three-dimensional tactile pointing device. The sensor corresponds to the use of 3D stereo system for keyword, Especially related stereoscopic selection directly with other multidimensional standard solutions. In the Space Mouse the Leap Motion Controller Sensor, also known as the sensor, presents a new movement and spot tracking system. LMC technology design problems and models and 3D control features are predicted. The course performed in ISO standard work may not be comparable to a certain degree of difficulty and the study of LMC actions may be confused with the direction of movement. The functions of 3D mouse and sensor management tasks are evaluated and an enhanced reality enhancement is supported by the LMC. Device analysis is an attractive device such as an International Organization for Standardization (ISO).

Space Mouse works like a tangible mouse, allows for concentration of the movement of the free circulation with a high resolution and a motorized follow-up through the use of a bridge in the technological space. The portability of the Leap Motion device and the fact that this device has a large number of technical support as a usefulness of the device makes this device an attractive option for general motion control programs. The problems with calculating the device performance can be seen in the average

The main contributions in the analyses of the following: Precision and reliability (spatial scattering of measurements through time) of the controller,

- The spatial alteration of accuracy (difference of accuracy in different regions of sensory space)
- Sampling frequency and reliability. Leap Motion Controller has a wide range of applications
- It has been used for Stoke's study was part of the Smart Computer Tutoring team at the university. Another important request manually
- Many motion detection methods are discover to be presented in different environments. The ability to perceive the aslant sign in direction is considered the main advantage due to the depth of mouse’s spatial dimension. The device can constantly be familiar with individual digits in a hand. The ability of the device to recognize, address and measure digit and finger point’s location and movement is considered significant for accurately tracking of sign language motions. Despite the reference of a range of upto one meter in the technical specifications for the Space Mouse, During the
testing the device performs around roughly 40cm from the front and sides of the device.

A. Research problems
Project team encountered numerous technical problems during the life time of product development. Major problem that project team encountered was capture the hand and finger gesture. Later project team wrote a customizable gesture system for each and every windows application.

B. Research questions
1. How to develop the applications using space mouse?
2. How to control application using Leap Motion?
3. What specific set of gestures are the most natural, intuitive and user friendly?

C. Scope of the research
- The Space Mouse is utilizes the rapid movement and it is highly professional system. The Leap Motion sensor device is a low-cost, visual-based hand tracking system that has newly been launched on the consumer market. The depth based vision has bargain the effect of ambient conflict such as noise and illumination condition. A variety of arm and finger gestures are designed and a system accomplished of detection and categorization of gestures is developed and appreciated. A amount of static and dynamic tests are the configuration of control items and consumables. An artificial pattern repeating the human arm is used in static measurements. For dynamic measurements, the only V-shaped objects, two trace objects that had a constant space between them, were used to repeat two human toes.
- The Space Mouse is without a doubt represents the innovative introduction system is based on the parts of the communication of human components with accuracy in the acceleration meter. The main focus of concentration is on the evaluation of accuracy and repetition. By completing this survey, space-based space development can be used at the interface of the human computer.

II. LITERATURE REVIEW
A. Evaluation of leap motor control as a new contact point device:
- Make the mouse and LMC perform clicks and performance. 3D rendering of mouse performance tests and LMC devices and the proposed LMC Assisted Enhanced Reality Interface[1]. Units as attractive units according to the International Organization for Standardization (ISO). The standard displays the problems required to calculate device performance. This is done in a variety of studies. The six mouse units with small variations in size and shape are analyzed without significant performance. Controlling a classic game and Wii remote control using the mouse are the basic condition. Regular review of the game, 60% winning performance compared to the standard unit. The three remote devices are evaluated for use in interactive TV environments and compared to a standard mouse device with low performance compared to the initial state and the laser pointer controlled by the computer is analyzed as a device that points to an environment of collaboration. In particular, non-contact devices, such as the leap motion controller, will now also be important to avoid contamination of pathogens in medical and biological workplaces or as an interaction unit in telemedicine. As mentioned above, considering the high potential of input devices, it is necessary to compare and characterize it from the human performance perspective.
- Researchers use the concepts that the law of Fitts is undoubtedly the most popular and often used to compare human performance with input devices.
- In conjunction with the Fitts Act, any attempt to choose a goal is considered a success or failure. The selection time and error rate are used to illustrate the effectiveness of the interaction solutions.
- The Fitt's group is probably a theoretical framework that can be used to describe and compare user performance for various input devices. The area is used as a filter pattern with the cursor saved to move the button and click on it. According to the results of the current study, it was rated according to the Fitt’s team.[4]

B. A leap motion web app:
This technology will bring new technologies to the computer and the company intends to improve the product for a longer period of time, making the product connect with Hewlett-Packard and Asus in future computers. These applications must be integrated into the Internet because of the websites we have access to daily. This technology brings new innovations to how we process computers, and the company plans to further improve its product over time by implementing the product on future computers through connections with Hewlett-Packard and Asus7.
Leap Motion Web Socket, a website that uses JavaScript, allows us to access websites outside Leap Motion. In addition, the Google Maps API was written in JavaScript. Because of this, you do not need extended libraries or access points to use the Google Maps API resource. In the end, the users of our application could go to other travel sites to book the latest hotel preferences.[3]

C. Hand movement and gesture recognition using leap motion controller:
- Multimedia and cultural movements that create a perceptual form of control of control perceptions. Dynamic movements are very different from static movement. Calculate the speed between the fingers and the palms. If the total cost of removal is greater than the specified amount, the hand moves.
- Otherwise, starts to recognize the static hand gestures. The studied multi-touch tables or development of DMI's innovative application, such as Mike's Waits "Hands" 8, built in the 1980's.
- In addition, many researchers have carried out a new analysis of new technologies and DMI
- The study measures the characteristics of music accuracy, such as rhythm, latency and accuracy, only

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with Wii Remote, only the Wii sensor bar and existing with multi-touch multi-platform platforms.

- Others reviewed piano movements closer to the user with inertial sensors.

The paper performs preliminary Leap Motion sensor analysis and analysis as a tool for building a DMI. List the traditional bands that your device can identify. After studying the accuracy and latency of these actions. As part of the review process, we also offer a first case study that incorporates Leap Motion on a virtual musical keyboard.[1]

• D. The leap motion sensor as controller of new digital musical instruments:
  - Creating new interface interfaces allows you to create new digital music instruments. The integrated interface simulates an octave from a piano and allows the user to play it in a jogging control. The method is extremely difficult at the right time, the latency of latency is a parameter.
  - A DMI is an interactive artifact used for musical purposes to share the input (control of the action) from the output using mapping strategies to link. Some projects show the impact of new DMI build interfaces. Leap motion is one of the latest technological advances. DMI can cause the creation.[2]

III. METHODOLOGY

A. Methodology overview

The Space Mouse is a new hand movement gesture capture sensor developed by Leap Motion. It is basically developed for capture hand gesture and finger position spot in interactive software applications. Up to this point, only insufficient data on the basic software’s mathematical or geometrical frameworks has been available.

![Figure 2](image)

Figure 2 showing an infrared image of the Leap motion controller hardware setup. inside the hardware three infrared emitters, the device build with two IR cameras. As stated by the leap motion developer, the detector precision in position capture is about 0.01mm. previous research has shown that an precision of under 0.2mm for static setups and of 0.4mm for dynamic setups was capture in realistic scenarios.

The accuracy and reliability of the Leap motion controller were analyzed for static and dynamic scenarios using a high accuracy optical capture system as the ground truth. All measurements were captured in an environment with a slandered temperature of 22 °C and an construction intensity of approximately 500 lux, a proper legal requirement for the tracking workspace. The sampling frequency of the following reference developed system was set to 500 Hz.

B. Requirements.

In order for Space Mouse to be as efficient and accuracy as possible, we determined a list of requirements to access or control the application:

1) Implement hand gestures that are intuitive to users.
2) Provide an intuitive flow of capture movements

Software requirements,

- Net beans
- C#
- LeapC

Then, our research team moved focus on decide to get a list of requirements necessary to analyze the strengths and weaknesses of using gesture application:

1) Develop more innovative application, similar to the Space Mouse Desktop gesture application, using the Leap motion controller.
2) Achieve user learn to compare and evaluate and capture the different new gesture Desktop application technologies.

IV. IMPLEMENTATION OF GESTURES

In order to find hand gestures that were familiar and user friendly to the user, we researched existing gestures for Windows and other platform applications. We also got resources from “leapmotion.com”, This site help us to all leap motion developers, who is skillful in the zone of innovative technologies in Human Computer Interaction for suggestions of important
hand gestures. After this resources what we got, we chose to develop Space Mouse using C# and Java platforms to capture the gestures that were intuitive and natural way to access computer by the to the user provide priority to those that were already developed using the Leap Motion device. Once we gather our list of hand gestures we implemented the Windows gesture application and completed. We researched highly to find how windows application interacted with hand gestures and Leap Motion. Once we understood that, we captured each gesture to a specific function, thus creating our final gesture application.

V. GESTURES AND PROBLEMS

The gestures use in the application are Circle Gesture, Swipe Gesture, Key Tap Gesture, and some custom gesture.

A. Circle gesture
The Circle Gesture is the first gesture to be implemented. This gesture can be seen below in Figure 4.

Circling clockwise with one finger is use to scroll down, and circling counterclockwise is use to scroll up in Web browser, in Video player we used Circling clockwise with one finger is use to Volume increase, and circling counterclockwise is use to volume decrease and Image viewer used Circling clockwise with one finger is use to Zoom in, and circling counterclockwise is use to Zoom out. In this project to map the circle gesture to a different action because it would be more intuitive to be used for circling an area than for zooming in and out.

B. Swipe gesture
The Swipe Gesture, as seen in Figure 5 below, is use to next and back in Web browser, Forward and Backward in Video player and Next and Previous in Image viewer. A number of challenges while implementing this gesture. First, the Leap Motion device would often read one swipe to be multiple swipes, thus zooming in or zooming out to a much higher degree than the user have intended in the Space Mouse.

C. Key tap gesture
The Key Tap Gesture, as seen in Figure 6 below, was first used as a ‘click’ function to allow users to select a windows application specially used in paint tools selection.

D. Screen tap gesture
The Screen Tap Gesture, as seen in Figure 6 below, is first use as a means to tap on a windows application. However, it is that the Key Tap Gesture would be more intuitive than using Screen Tap Gesture.
Then use Screen Tap Gesture as a click hold function. In order to click in, users would tap on the right side of the screen, and to zoom out, users would tap on the left side of the screen. That Screen Tap Gesture would not be used in all application because the gesture is not familiar and less responsive than the other gestures but we used this gesture on paint application because in paint application Screen tap gesture is very impotent for drawing images.

VI. RESULTS AND DISCUSSION

Application

Screenshots of interfaces of various Components of Space Mouse Finger Gesture System, Test plans and Test results are included to as evidence.

A. Web browser application

Every people who is using Web Browser can use these Application. These interfaces completely entertain the people with a new environment and give a new experience in efficient and user-friendly manner.

B. Paint application

Every people who is using Paint can use these Application. These interfaces completely entertain the people with a new environment and give a new experience in efficient and user-friendly manner.

C. Image viewer application

Every people who is using Image viewer can use these Application. These interfaces completely entertain the people with a new environment and give a new experience in efficient and user-friendly manner.

D. Video player application

Every people who is using Video player can use these Application. These interfaces completely entertain the people with a new environment and give a new experience in efficient and user-friendly manner.

VII. CONCLUSION AND FUTURE WORKS

A. Conclusion

Based on the statistical analysis most of the youngsters are using computers daily. And there are watching videos frequently. Most of the peoples are never used 3D mouse before. Some peoples faced difficulties for handle the mouse. Most of the people are very interesting about space mouse. They haven’t seen Space mouse before. So they required to test the 3D mouse before the feedback about it.
B. Limitations
Deployment of Space mouse System carries some limitation constraints which should be taken into consideration. The limitations are as follows,

- Need pure gesture capture device (LMC)

C. Recommendation
Project team have listed some user guide lines to cope up with the above discussed limitation constraints. Recommendations listed by the project team are,

- Leap motion controller.
- Connect with a USB cable.
- Also can use VR mount to improve reality.

D. Future work
Space mouse covers a very large scope with an ultimate goal of user friendly gesture control environment. Till the Goal is met numerous number of research paths will be open to researchers. This research area will stay fresh with the rise modern technologies. Project team has identified following as immediate set of future works which may interest researchers in this area.

- Integrating full gesture control system.
- Providing customize gesture application to user.
- Developing with multi-platform support.
- Expanding the system targeting entire computer world.

ACKNOWLEDGEMENT
The project team of "SPACE MOUSE" would like to declare our honest sense of gratitude to our institution – Sri Lanka Institute of Information Technology (SLIIT). We are acutely beholden to whose help, stimulating suggestions, knowledge, experience, and courage helped us in all the times of study and analysis of the project in the pre and post research period. Also very special thanks to Mrs. Nipunika Vithana for their endless support given at times of difficulty as well as to our seniors and the lecture panel. The completion of this undertaking could not have been possible without the participation and assistance of so many people whose names may not all be enumerate

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Identifying the Most Influential Construction Management Tasks in Improving the Construction Performance of High-Rise Building Projects in Jakarta

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Abstract – As a growing metropolitan city, Jakarta has to provide for the growing needs of its inhabitants for facilities and city infrastructures. Facing the fact that land for new constructions is limited, the construction of high-rise buildings becomes one of the most possible alternatives. However, the construction of high-rise buildings is more complicated compared to low-rise buildings in general. Considering the complexities and the impact of the construction to its environment, most high-rise building owners prefer to utilize the service of a construction management consultant to ensure the performance of the construction project, as measured in time, cost, or design specification.

This research aims to analyze the role of construction management (CM) consultants in improving the construction performance of high-rise building projects in Jakarta, with a specific objective to identify the tasks of CM consultants that most significantly influence the projects’ performance. This research was started with literature study followed by field study to collect primary data from respondents. Data collected from questionnaires completed by the respondents then processed and analyzed using SPSS with regression method.

It is expected that the findings of this research would give a better understanding about the role of CM consultants in improving the performance of high-rise building construction projects in Jakarta. Recommendations given as the result of this research are expected to be beneficial for all parties involved in the high-rise building construction projects – especially building owners and CM consultants – in Jakarta or other similar areas.

Index Terms-Construction Management, Construction Management Tasks, Construction Project Performance, High-Rise Building, Jakarta.

I. INTRODUCTION

As the capital of Indonesia, Jakarta is growing fast, in the number of its inhabitants as well as the variety of activities it has to accommodate. The growing need for buildings increase the price of land in Jakarta, not only in the business centers, but also in the residential areas. With these facts, vertical building, especially high-rise building, becomes a reasonable option for both the government – in providing facilities for the various activities of its inhabitants – and building owners – as a solution to the limitation related to construction site, either the available area or the cost of the land.

High-rise building, however, has its own uniqueness and challenges compared to one-story or low-rise buildings. It is considered more complex and has bigger and broader impact, financially and environmentally. To better manage the project and control potential risks, most owners choose to employ construction management (CM) consultants. The CM consultants are teams that have specific skills in managing a construction project. They plan, monitor, control, and involved in the implementation or execution of the plan. Therefore, CM consultants have a significant role in determining the success of a project.

The task of CM consultant is to accompany and advise its client from the beginning phase of the project (concept and feasibility study), prepare the next phase (design and engineering), control the construction phase, and monitor until the next phases: operational and utilization. In general, the job description of a CM consultant can be briefly explained as translating the owner’s needs and aspirations into the design, construction, and utilization of the building. This is done by accompanying the design consultant in the design process, and supervising and accompanying the contractor in the construction phase.

So it is clear that, for the owner, the main purpose of utilizing the services of a CM consultant is to improve the performance of the project – measured in time, cost, and quality or specifications of the project – by implementing a good administration system. If the role of the CM consultants is played fully without compromising the standards, it is expected that the objective can be achieved well. However, preliminary observation – from literature, previous researches, and direct observation in high-rise building projects – showed that a lot of construction projects in which CM consultants were involved still faced problems with its time, cost, and quality performance.

This phenomenon has attracted the interest of the researchers to analyze how CM consultants’ role in high-rise building projects can improve the performance of the project. More specifically, which of the various tasks of the CM consultants that most significantly influence the construction performance of high-rise building projects in Jakarta. The research’s results are expected to benefit the
The Role and Tasks of Construction Management

1. **Construction Management**

   The Construction Management Association of America (CMAA) defines construction management (CM) as “a service that uses specialized, project management techniques to manage the planning, design, and construction of a project, from its beginning to its end.” It also clarify that “the purpose of CM is to control a project's time, cost and quality” (CMAA, 2007).

   Even though the construction managers do not perform the actual construction tasks within the projects’ life cycle, they have an important role to control the project’s time, cost, and quality. To do this, the CM team – consists of specialists in different aspects of construction project management – systematically applies the full range of management function – plan, do, control, act – in the project under their responsibility with an objective to optimally achieve the project’s goal and purposes.

   Over the years, the role of CM has grown along with the development of the construction industry and became more complex just as the projects they manage. This development requires new approaches and studies in the area of construction management in order to cope with the industry’s changes and keep its effectiveness in performing its role.

2. **The Role and Tasks of Construction Management**

   In its publication, An Owner’s Guide to Construction Management, CMAA (2007) explains that the role and responsibility of CM includes effective budgeting, better control of work scope, optimizing project scheduling options, best use of the project team’s individual skills, avoid delays, changes, and claims as much as possible, improve quality of design and construction, and optimizing flexibility in supplier contract options.

   During the construction phase, CM must focus on improving and expediting the construction process through professional planning and monitoring. The goal is the success of the project, i.e. optimized cost, time, and quality of the project. It is important that before the construction phase is started the CM has developed a complete construction management plan and procedures that specify clearly the roles, responsibilities, and authorities of each of project’s teams during construction.


   The following table is tables of the roles and tasks of Construction Management in the construction phase of a construction project taken from several literature:

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>X1</td>
<td>Pre-construction meeting</td>
</tr>
<tr>
<td>X2</td>
<td>Leading and performing the work defined in the project management plan and implement approved changes to achieve the project’s objectives</td>
</tr>
<tr>
<td>X3</td>
<td>Tracking, reviewing, and reporting project progress against the performance objectives defined in the project management plan</td>
</tr>
<tr>
<td>X4</td>
<td>Reviewing all change requests; approving changes and managing changes to deliverables, organizational process assets, project documents, and the project management plan; and communicating their disposition</td>
</tr>
<tr>
<td>X5</td>
<td>Direct and coordinate each of the professionals and contractors in fulfilling the project’s requirements</td>
</tr>
<tr>
<td>X6</td>
<td>Finalizing all activities across all of the Project Management Process Groups to formally complete the phase or project</td>
</tr>
<tr>
<td>X7</td>
<td>Coordinate all drawings in every scope of works provided by the design consultants</td>
</tr>
<tr>
<td>X8</td>
<td>Monitor the record drawing process monthly during construction</td>
</tr>
<tr>
<td>X9</td>
<td>Monitoring the status of the project and product scope and managing changes to the scope baseline</td>
</tr>
<tr>
<td>X10</td>
<td>Identify long lead materials and equipment, and coordinates scheduling, on-site delivery, and installation and start-up requirements for these material and equipment</td>
</tr>
<tr>
<td>X11</td>
<td>Survey the site situation, work space distribution and construction area arrangement to provide construction plan</td>
</tr>
<tr>
<td>X12</td>
<td>Record and review all extra and/or additional work submitted by contractor</td>
</tr>
<tr>
<td>X13</td>
<td>Supervise the quantity of work parts according to contract</td>
</tr>
<tr>
<td>X14</td>
<td>Verify that office facilities and site work required for general acces and utilities to all on-site organizations are provided</td>
</tr>
<tr>
<td>X15</td>
<td>Preliminary schedule</td>
</tr>
</tbody>
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Table 1. Roles and tasks of Construction Management in the construction phase
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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<tbody>
<tr>
<td>X16</td>
<td>Inform, adjust, and distribute master schedule</td>
</tr>
<tr>
<td>X17</td>
<td>Monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan</td>
</tr>
<tr>
<td>X18</td>
<td>Report early about possibilities of delays and propose solutions to prevent or handle the delays</td>
</tr>
<tr>
<td>X19</td>
<td>Propose to the owner things that have to be done in order to assure that work duration is achieved or accelerated while maintaining the quality of work</td>
</tr>
<tr>
<td>X20</td>
<td>Schedule short term work activities</td>
</tr>
<tr>
<td>X21</td>
<td>Schedule report</td>
</tr>
</tbody>
</table>

**Cost Management**

| X22 | Perform component studies on materials, systems, equipment, and accessories, to ensure that economical and competitive components are selected consistent with the construction budget |
| X23 | Progress Payment |

**Quality Management**

| X24 | Auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used |
| X25 | Monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes |
| X26 | Assist the owner in managing and controlling field work |
| X27 | Supervise quality of materials, workforce, cost, including tools/equipment test, work methods and results to meet contract |
| X28 | Give directions to contractor about work methods and other related things in order to assure work quality and smoothness |
| X29 | Plan and coordinate field tests |
| X30 | Review design to verify consistency with design criteria, regulatory requirements and constructability consideration |
| X31 | Final inspection and punch list |
| X32 | Monitor the acceptance and performance testing to see that it is conducted in accordance with contract requirements |
| X33 | Issue final completion certificate |
| X34 | Give advises on regulatory conditions that are not written in the contract documents |

**Human Resource Management**

| X35 | Confirming human resource availability and obtaining the team necessary to complete project activities |
| X36 | Improving competencies, team member interaction, and overall team environment to enhance project performance |
| X37 | Tracking team member performance, providing feedback, resolving issues, and managing changes to optimize project performance |
| X38 | Put project supervisors continuously during construction until hand over |

**Communication Management**

| X39 | Creating, collecting, distributing, storing, retrieving and the ultimate disposition of project information in accordance with the communications management plan |
| X40 | Monitoring and controlling communications throughout the entire project life cycle to ensure the information needs of the project stakeholders are met |
| X41 | Progress meeting and special meeting |
| X42 | Write and submit monthly report, CM report, and final report to the owner |
| X43 | Responsibility for establishing a management reporting system to keep the various team members informed on project status |
| X44 | Write warning letters about inappropriate works and provide solution to the problem |

**Risk Management**

| X45 | Implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project |
| X46 | Review data collected from preliminary site visit to assess sufficiency of the information on existing condition and any additional information |
| X47 | Prepare project health and safety program |

**Procurement Management**

| X48 | Review and follow up sufficiency and completeness of contract documents |
| X49 | Managing procurement relationships, monitoring contract performance, and making changes and corrections as appropriate |
| X50 | Completing each project procurement |
| X51 | Monitor and control procurement of important building equipments to assure it comes on time according to contract |

**Stakeholder Management**

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Communicating and working with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle

Monitoring overall project stakeholder relationships and adjusting strategies and plans for engaging stakeholders

Contract administration

Permit, insurance, labor affidavits, and bonds

Field reporting

Safety Management

Emergency response coordination

Compliance agencies

Contractor safety enforcement and compliance

Safety coordination meetings

Safety committee

Safety audit

Provide monthly report to the owner containing the status of the program and of accident frequency and severity

Sustainability

Pre-Construction conference

Construction planning and scheduling related to sustainability

Inspection and testing consistent with the project management plan

Reports and recordkeeping

Request for information about sustainability

III. RESEARCH METHODOLOGY

The tasks of CM according to its role, as elaborated in table 1, provides the independent variables for the research. The independent variable is the project performance. These variables are arranged in a questionnaire and distributed to eligible respondents, that is, construction professionals having knowledge and experience in high-rise building projects in Jakarta. Selection of respondents are based on work experience, job position, and educational background. Data collected from questionnaires completed by the respondents then statistically processed using SPSS.

Correlation analysis are done to measure the level of relationship between independent variables to the independent variable. The correlation factor, r, shows the level of relationship and varies from 0 to 1 or -1, with 0 shows no correlation, 1 perfect positive correlation, and -1 perfect negative correlation. Intercorrelation analysis is conducted to check the presence of strong linear correlation among independent variables.

Factor analysis is employed to find factors that are able to explain the relationship of different independent variables observed. Variables grouped in a factor have a relatively strong correlation with other variables within the factor and relatively weak correlation with variables in other factors.

Reliability test is then performed to measure the internal consistency, that is, how closely related a set of items are as a group. The coefficient of reliability or consistency is expressed in standardized Cronbach’s alpha. Regression analysis is then conducted, to find the relationship between or influence of the independent variables to the independent variable. The research method and stages is presented in picture 1.
IV. ANALYSIS AND DISCUSSION

Questionnaires were distributed to 49 respondents, and 33 or 67% were completed. This showed a good participation level. All respondents were construction professional with work experience in high-rise building projects in Jakarta. Respondents’ choices of answers in the questionnaire provide inputs on their perception about the tasks performed by CM and their impact to the project’s performance.

Most respondents (63.64%) were project managers, while 30.30% were site managers and 6.06% were operational directors. Most of them held a bachelor degree (81.82%), while 9.09% diploma-3 degree, 6.06% masters’ degree, and 3.03% graduated from senior high school. Most of the respondents (42.42%) had worked in construction projects for 11-15 years, while 27.27% 5-10 years, 21.21% 16-20 years, and 9.09% over 20 years. These facts about the respondents showed that all respondents of this research held a significant position in their job, were well educated and had significant work experience in construction projects, ensuring the respondents capabilities of providing sound information through the research questionnaires.

Based on the project location, most respondents worked in construction projects in South Jakarta (54.55%), while 21.21% in West Jakarta, 12.12% in Central Jakarta, 9.09% in East Jakarta, and 3.03% in North Jakarta. Construction projects consisted of buildings with 21-30 stories (42.42%), 13-20 stories (33.33%), 8-12 stories (18.18%), and more than 31 stories (6.06%). The buildings function as office (30.30%) apartment (21.21%), hotel (12.12%), shopping mall (9.09%), while the others (15.15%) function as mixed use, hospital, and other functions.

The research questionnaire consisted of 67 independent variables and 1 dependent variable. After correlation and intercorrelation tests, 19 independent variables were selected to be analyzed further using factor analysis. Four stages of tests were performed, including KMO and Bartlet, matrix anti image, total variance explained, and component matrix. All 19 variables met the requirements and qualified for further analysis. There were 5 factors identified: 1) component I consisted of X18, X36, X45, X38,
X24, X14; 2) component II consisted of X5, X13, X44, X12, X52, X43; 3) component III consisted of X50, X67, X48, X14; 4) component IV consisted of X48, X42, X43, X9; and 5) component V consisted of X9, X3, and X33.

Reliability test performed to the five factors gave results as follows: components I and II had very high reliability (Cronbach’s alpha 0.814 and 0.845); components III, IV and V had high reliability or consistency with Cronbach’s alpha of 0.752, 0.717 and 0.699. All components were qualified for regression analysis.

The regression analysis resulted in 6 independent variables that significantly influence the dependent variable. Those independent variables were: 1) review and follow up sufficiency and completeness of contract documents (X48); 2) control changes of project scope (X9); 3) report early about possibilities of delays and propose solution and steps that have to be taken to avoid or handle delays, e.g. schedule revision (X18); 4) completing each project procurement (X50); 5) communicate and work with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle (X52); and 6) request for information about sustainability (X67).

### Model Summary

<table>
<thead>
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<th>Model</th>
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<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
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</tr>
</tbody>
</table>

- a. Predictors: (Constant), VAR00048
- b. Predictors: (Constant), VAR00048, VAR0009
- c. Predictors: (Constant), VAR00048, VAR0009, VAR00018
- d. Predictors: (Constant), VAR00048, VAR0009, VAR00018, VAR00050
- e. Predictors: (Constant), VAR00048, VAR0009, VAR00018, VAR00050, VAR00052
- f. Predictors: (Constant), VAR00048, VAR0009, VAR00018, VAR00050, VAR00052, VAR00067

Regression analysis results showed that together the 6 variables had significant positive impact to the performance of the project and could explain changes in the independent variables with 78.4% contribution (adjusted R square). The regression model is as follows:

\[
Y = -0.117 + 0.219 X48 + 0.236 X9 + 0.306 X18 + 0.264 X50 + 0.224 X52 - 0.187 X67
\]

The coefficient of variable X48 (review and follow up sufficiency and completeness of contract documents) is 0.219 which means X48 determinant variable have positive effect to change project performance, variable X9 (control changes of project scope) is 0.236 which means X9 determinant variable have positive effect to change project performance, Variable X18 (report early about possibilities of delays and propose solution and steps that have to be taken to avoid or handle delays, e.g. schedule revision) is 0.306 which means X18 determinant variable have positive effect to change project performance, Variable X50 (completing each project procurement) is 0.264 which means X50 determinant variable have positive effect to change project performance, Variable X52 (communicate and work with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle) is 0.224 which means X52 determinant variable have positive effect to change project performance, Variable X67 (request for information about sustainability) is 0.187 which means X67 determinant variable have positive effect to change project performance.

CM task in reviewing and following up the sufficiency and completeness of contract documents (X48) contributed 42.3% of changes in project performance in the regression model, with t=2.768 (>1.70329) and significance 0.010 (>0.05). CM task in controlling the project’s scope (X9) contributed 13.5% with t=2.875 and significance 0.008 (<0.05).

Early report to owner about possibilities of delays and provide solutions to avoid or handle delays (X18) became the third task of CM used in the regression model that contributed 7.1% to the changes, with t=3.954 and significance 0.001 (<0.05).
of CM to complete every procurement of the project (X50) contributed 9% to changes in the dependent variable, with t=4.088 and significance 0.000 (<0.05).

Communication and team work with all project stakeholders during the project life cycle (X52) contributed 4.3% with t=3.026 and significance 0.006 (<0.05). Requesting additional information about project’s sustainability (X67) contributed 2.6% with t=2.068 and significance 0.049 (<0.05).

V. CONCLUSION

The role of CM is perceived by the respondents as significant in improving the performance of high-rise building projects in Jakarta. Of the 67 tasks of CM used in this research, 6 were considered as having the most significant influence on the performance of high-rise building project in Jakarta, especially during the construction phase.

The 6 CM tasks that build the linear regression model are: 1) review and follow up sufficiency and completeness of contract documents (X48); 2) control changes of project scope (X9); 3) report early about possibilities of delays and propose solution and steps that have to be taken to avoid or handle delays, e.g. schedule revision (X18); 4) completing each project procurement (X50); 5) communicate and work with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate stakeholder engagement in project activities throughout the project life cycle (X52); and 6) request for information about sustainability (X67).

Two of the 6 CM tasks are related to procurement management – X48 and X50 – with a significant contribution to the explanation of changes in independent variable, so it can be inferred that procurement management plays a significant role in improving the performance of high-rise building projects in Jakarta. Therefore, giving more attention to CM tasks in its role in procurement management and performing those tasks better may also improve the performance of high-rise building projects in Jakarta. However, this research has its own limitations, i.e. the projects and respondents were limited, as well the time and budget to conduct the research. Therefore, it is advised that further researches within this area may be conducted, in order to get a better and more complete understanding about the tasks of CM in improving project performance.

VI. RECOMMENDATION

The research findings provide recommendations, especially for owners and CM consultants, to improve construction performance in the future projects, especially high-rise buildings constructed in Jakarta. The recommendations are as follows:

1. CM needs to be more detailed in reviewing, planning, and explaining construction contracts documents, including the completeness of drawings, contract clauses, and clarity of wordings.
2. Scope of work and other things related to scope must be explained and clarified in details, and recorded in written documents. Changes in scope of work must be anticipated so as to ensure that project performance is not compromised.
3. Control of schedule must become the focus of everyone responsible for the project. Control can be done through identification, analysis, providing solutions, as well as developing easy and clear system to avoid delays in the construction phase.
4.

VII. References


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Raspbian Magic Mirror-A Smart Mirror to Monitor Children by Using Raspberry Pi Technology
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Abstract- It is a universally accepted truth that raising a child is an extremely responsible task. One of the major problems faced by parents/guardians nowadays is monitoring their children while they are away at work. To monitor them constantly, there should be a system that can be easily handled, user friendly and smart in accordance with the rapid advancements in technology. Though the applications of Internet of Things (IoT) are diverse, this system is based on IoT which will be implemented by using Raspberry pi technology. It is a smart mirror which will possess the ability to display advanced details and connect with the user’s smart phone by using an Android application. Even though many smart mirrors have been developed previously, they had only a few features such as displaying the date, time, weather and news feeds. But the Raspbian mirror which is demonstrate in this paper is much more interactive and advanced and will primarily target working parents which will receive notifications from the users through their smart phones. The Raspbian magic mirror will display useful information such as the date, time, weather and daily reminders, but it will also help parents to monitor their children and assist them with their studies, and to organize their daily routines. In the case of teenage children, parents could use this mirror to assign them household chores as well. This device could of course be used as an ordinary mirror including all the above features that make day to day life easier and faster, which is an integral part of home automation as well.

Keywords: Internet of Things (IoT), Raspberry Pi, Home Automation, Mirror, Android

I. INTRODUCTION

In today’s complicated world, efficient parenting becomes more important, and parents and guardians must educate and bring up their children in a technologically advanced environment. Children need the guidance of their parents more than ever. Yet, in today’s busy world, where both parents are normally employed, or in the case of single parents, this is quite challenging. However, this problem could be overcome through a revolutionary device called the Raspbian Magic Mirror that can be implemented using Raspberry pi technology, which will be the subject of our research based on IoT.

The smart mirrors introduced by tech companies’ offer many services in addition to playing the conventional role of a looking glass. They act as digital screen and display important information such as reminders, news feeds, calendar, time and weather forecasts. However, the smart mirror as proposed by our research differs from current products since it targets families and provides an interactive platform for parents/guardians to monitor their children while they are away at work, to enable them to assist them with their studies and to make sure their children are safe at home, in addition to the features available in other smart mirrors. This reduces the time available for them to communicate with their children and to make sure that they are safe. It will also enable teenagers to make responsible at their work. This will be especially useful in the case of differently abled children, since they would require more adult supervision and attention from their parents. The main focus is to save the time of working parents, enable efficient parenting and make day to do life easier and faster which is an integral part of home automation as well. Raspbian Magic Mirror is a smart mirror which will possess the ability to display advance details and connect with the user’s smart phone by using an Android application.

Since the Mirror is the first device of its kind to be introduced to the Sri Lankan market, it will enable us to rapidly gain market share and achieve and maintain the status of market leader in Sri Lanka. So far, Raspberry technology is currently not popular within the Sri Lankan market, we believe the introduction of an interactive device of this nature will improve the popularity of Raspberry technology and assist in the development of various other useful applications using this technology. In Section 2, will discuss the existing literature that is available with similar studies from other parts of the world.

II. BACKGROUND AND RELATED WORK

Since this research is based on IoT using Raspberry pi technology, the background study was conducted to identify existing similar systems in order to get a better result. Raspberry technology has been used in many advanced applications with advanced results. This review mainly covers the methodology followed in the background study, including the advantages and disadvantages of the system.

One is about a smart mirror which is an interactive system which possesses limited features such as displaying the date, time, and current weather condition and outside temperature and news feeds. However, it can simply display the information which is available on the Internet and cannot connect with the smart phones using an Android application. This smart mirror lacks many features and people cannot send notifications to the mirror, which is its main disadvantage which has not been resolved until now [1].

The existing research which is about an Environment Monitoring System can remotely monitor environmental parameters such as temperature, humidity, amount of CO2 in air and many more in a given environment at any scale using sensors such as DHT11 Digital Humidity and Temperature Sensor, ADIS16220 Digital Vibration Sensor and LPG Gas Sensor - MQ-6. Raspberry-pi used as the main board and sensors will collect all the real-time data from this environment and this real-time data will be fetched by the web server and displayed. This system can monitor most
of the parameters in the environment and it is capable of many other practical uses including monitoring of temperature and humidity in a house, outbuilding, greenhouse, or even a museum [2]. Mendrela et al. [3] present a Patient Monitoring System which can be used to wirelessly monitor patients. The physiological parameters such as temperature, blood pressure, ECG and level of saline are measured through WSN (Wireless Sensor Nodes) using sensors such as Temperature sensor- LM 35, Blood pressure sensor, Level Detector, ECG electrodes and RF modules. This will improve the normal life of patient by reducing the risk of infection and severe conditions when the doctor or nurse is not nearby. But the major problem of this system is the difficulty to monitor symptoms that are not externally visible such as depression and mental disorders [3].

V. Ramya et al. [4] discussed a secure and energy efficient Wireless Industrial Automation system which is based on Raspberry pi technology. It controls industrial devices, manages power utilities and also monitors the employee activities. These are all done through Wi-Fi network with help of server PC. This server PC is password protected and it can be opened only by the authorized person. They have been mainly focused on reducing the power consumption and to alert the people about the critical situations in the industry. This system prevents more accidents and provides more security and privacy to the organizations like industry, education and hospitals.

This is a system using Raspberry pi on children tracker application is for children safety protection. This system for guidance the user to detect the coordinate of their children. In system development part, this communication process is started from the system able detect the children coordinate and send it to the user web server. Raspberry Pi is the main controller of this system. Over all the system is user friendly and it allows to track the child anytime anywhere in any weather condition [5].

Home automation is one of big area of Internet of Things (IoT) gives huge benefits and also give little bit disadvantages. PIR sensor, Temperature sensor , Smoke or gas detector sensor, Heater and water level sensor all sensors together create proper understanding about how manage the system. Smita et al. [6] presents the application of IoT for Smart Home Automation system which includes a Raspberry Pi as a processing unit for data which is extracted from various sub-systems like, Temperature sensing system, Automatic light system, Cooling system, and Gas detection system, Water level sensing system, Motion detection system and Lights on and off system. With low cost raspberry pi module implement the intelligent processes through ARM1176JZFS processor and connected decisions and monitoring through the internet [6].

Accessing interconnected devices using internet through TCP/IP concept is most secured and efficiency way. It may depend on measuring sensors data, controlling home appliance, monitoring live status of devices and etc. [7]. This research introduces methodology for developing embedded web server system which uses SOC platform that can remotely acquire and control data for those people having the disabilities like elderlies, visually impaired, hearing impaired. This project uses hardware as Raspberry and TCP/IP, which provides high bandwidth, economy and compatibility. TCP/IP allows the different computing devices to access the web page which provides greater security, the user can browse web page from different area using the home area network/internet.

Fuead et al. [8] present a device which will accommodate the egg hatching procedure without the usual process. In addition to that, a monitoring system has also been developed so that the user can have continuous accesses to the device. Most importantly, its purpose is to create an environment where the egg incubation process occurs in a more orderly and safe manner. This system ultimately has managed to provide an optimum environment for the egg-hatching process. It enables to control the heat, moisture and humidity of the incubator and rotate/spin the egg tray for every six hours. But if there is at least one issue in a node, sits for whole system [8].

The research ‘Smart Helmet’ is an Intelligent Safety system for Motorcyclist using Raspberry-Pi [9]. It extracts moving objects and classifies them as a motorcycle or other moving objects. From the noticed motorcycles it detects motorcycle riders and determines that they are wearing helmets or not. The system classifies the head as wearing a helmet or not using KNN based on features derived from 4 sections of segmented head region. The benefits of introducing this system is improving safety and reduce accidents, especially fatal to the motorcyclist, reducing workload of Traffic Policemen. And also the system is low costly and less complexity. But its performance can be limited at several weather conditions and also this system is developed for Small area [9]. Another system based on ZigBee telecommunication mesh wireless network and Raspberry Pi control card is realized for a complete remote management of an isolate high efficiency street lightning system. The system uses devices and sensors to manage the single street lamppost and to send information by a ZigBee TCL network to a central lamppost equipped with a Raspberry-Pi control Card able to collect and elaborate information. [10].

The system as the name indicates “Android based home automation” Controls Home appliances via Android device using Wi-Fi as communication protocol and Raspberry Pi as server system [11]. A novel architecture for a home automation system is proposed using the relatively new communication technologies. A user-friendly interface for the android device allows the user to communicate with the Raspberry Pi server. This system is scalable and cost effective, portable and have a wide range of capabilities. Also, its decreases the installation cost and effort, providing security and authentication, and the additional vendors can be easily added to the system [11].

The preparing the project charter, WBS and the Gantt chart represent proposed project plan for development of the magic mirror by planning time and scheduling the time duration of the research is considered to be the first step to implement this system.
Preparing the budget comes as the next step of the planning where it provides a financial framework to the research and managing a reasonable expenditure within a scheduled time period is the main target of the project.

And the next step is the feasibility analysis. The main reason to do a feasibility study in the beginning of the project is to find out if this project is technically achievable and also economically profitable within the estimated cost.

**Analysis**

Requirement gathering, and analysis step have been allocated a large amount of days, because it forms all the development steps and all expected processors will depend on it. It has main two approaches as primary and secondary data. Where in primary data, specific questionnaires that indicates the goals of the system were made and distributed within a sample of sixty population to get their responses to make conclusion with that. The initial sample size was 70 and after the questionnaire was conducted the response count was from 66 individuals. The analyzed data demonstrates that due to parents’ busy social life style it has affected the Child behavior, Social life style, Collaboration, Physical health, Technology factors and the time management of monitoring the children by the parents.

The secondary data consists of the information, specifications and the limitations that would be gathered by going through the former research papers that has done through the same research stream. By that it would help the research group to get a better idea to implement the system by avoiding the former issues that research groups have being faced.

According to that, gathering and analyzing data has been a crucial and very important phase of this project since it helped to narrow down the requirements and elaborate the requirements narrowed down. Through the questionnaire the project team has being able to recognize the target users, the user expectations from the application. The application will be designed to a specific group of parents with necessary resources required from the application. Recourses vary from financial to non-financial factors such as education, living environment, and life-style. It is safe to expect the application to be a success because overall analysis of the gathered data provides positive results on having users with the need of such application and willing users to accept such help.

**Design**

Designing the system comes as the next phase where it looks forward to do the designing of the system which includes Mirror’s design, User interface design and Mobile application design.

Fig 1 depicts the High-Level Architecture diagram of Raspbian Magic Mirror at this phase and Fig 2 depicts the Hardware design diagram of Raspbian Magic Mirror sketched at this phase.

Designing these three main sections act an important role because an attractive mirror makes users attract towards it making it expose to the marketing level. And user interfaces and the mobile application must be eye touching.

**Implementation**

Once the system design is received the implementation phase begins as the most time allocated phase. It consists of two main
sections such as hardware implementation and software implementation.

At the hardware implementation, the physical mirror body is designed with the Two-way mirror, LED Monitor and the Raspberry Pi Circuit. Coding the program is done at the software implementation where it again classified as front end programming and back end programming. Database is also implemented and integrated to the same system within this phase.

**Software Platforms and Languages:**

- Application Running on Raspberry Pi: Electron Framework which is used JavaScript, HTML5 and Node JS
- Mobile Application: Android Framework using Java Language
- Web Application: Angular JS
- Database: MongoDB that is using Non-Structured query language

**Testing**

Testing is the last phase that helps to evaluate the quality of the program and also for improving it, by identifying defects and problems. Also, it verifies and validate that the program has meets its requirements. Testing is done in three ways such that unit testing, integration testing and system testing respectively.

Unit testing comes under black box technique method and the individual units/ components of a software are tested. In the integration testing individual software modules are combined and tested as a group. Software testing where a complete and integrated software is tested. It evaluates the system's compliance with the specified requirements.

**IV. RESULTS AND DISCUSSION**

Section 4 discusses the results and their discussion that the research team achieved from the research project. The important implications of the research findings, regardless of the statistical significance of this research are discussed below. Further, Identifying the defect and limitation of this project can be useful for future researchers in order to continue their research.

The purpose of this project was to develop a Smart Mirror which is fully functional monitoring system for parents, where helps the parents to remind/encourage (to-do-list) their children in studies and extracurricular activities and get them to work by sending notification. It will be very easy for the parent to monitor their children while they are in the work. The system consists of two areas such as Smart Mirror and the android application.

The basic object of the Mirror is to view the task (reminder) which is send by the parents and to send a reply to the parent by the voice command whether the task is done or not. And the android application will be used to send tasks and monitor the children. It will make the child more interested in doing their home works and day to day activities.

Fig 4. below shows design and hardware implementation of the Raspbian Magic Mirror.
There were many technical problems that are faced by the research team during the development. The most critical issue was the network failure when testing the functionalities. It was overcome by a proper WI-FI connectivity. And also, the IP addresses were changed when the system has turned on in each time before the team has hosted it in a server. The team has faced many challenges when developing the system such as to find a two-way mirror in Sri Lanka. Therefore, team has ordered it from e-bay to overcome it. The development of the mirror could have much easy if the screen of the mirror is touch screen one.

The Reliability of the system depends on the accuracy rate of the system. According to the test cases done, the main functionalities worked properly. There were only few defects found when testing the functionalities. But the team has managed to solve the defects up to some level. In the final evaluation the accuracy rate of the system is about 90 % and the 10% is rely on the network signal strength.

V. CONCLUSION AND FUTURE WORK

It is a universally accepted truth that raising a child is an extremely responsible task. One of the major problems faced by parents/guardians nowadays is monitoring their children while they are away at work. The Raspbian Magic Mirror system provided comprehensive solution to the working parents. The Smart mirror which is fully functional predicting system for parents, to remind/encourage (to-do-list) their children in studies and extracurricular activities and get them to work by sending notification. The accomplished work will be verify by sending a voice note through the mirror to their parents. The smart mirror will display addition details such as weather, time, date, calendar with updates. Developing a mobile application to control the mirror. The team uses Raspberry Pi technology, to implement a mirror with the intention of enable an efficient parenting. Finally, the project successfully achieved to fulfil all the objectives of this system and hope this research would be of benefit. The research team hopes that this study will be helpful for the researchers who are interested in the topics like children monitoring system, tracking system as well as systems that are related to IOT. It will also give better ideas and more knowledge to implement similar kind of projects.

During the development of this project, the following are the limitations identified:

- To use the system users must have an Android mobile phone with the application installed.
- If the Internet connection is down, the system won’t be able to continue the connectivity and the data won’t be stored in the database.
- Data transaction may disconnect when the server goes down.
- Because of the internet problem, the data transaction from the mobile application to the database and database to the mirror may get slow.

This paper proposed a real world Raspbian Magic Mirror scheme which is implementing in existing by the research team. In future, researchers with related area of interest can deploy the proposed scheme and carryout addition performance such as procedure the system with the other language. Applying to real world context will lead to accurate scalability in accurate parenting analyzing Raspbian Magic Mirror.

ACKNOWLEDGMENT

The project team of "Raspbian Magic Mirror" would like to declare our honest sense of gratitude to our institution – Sri Lanka Institute of Information Technology (SLIIT). We are acutely beholden to whose help, stimulating suggestions, knowledge, experience, and courage helped us in all the times of study and analysis of the project in the pre and post research period. First, we thank our Head of Academics, Dr. Yasas Jayaweera for creating such an opportunity for the students to broaden their frames of skills. We are gratified with their efforts. Our sincere gratitude also goes to our subject lecturers as well as the seniors and specially the lecturer in charge for the research subject, and supervisor Ms. Gayana Fernando, who have immensely supported us to perform in our maximum level and to achieve our research goal. The completion of this undertaking could not have been possible without the participation and assistance of so many people whose names may not all be enumerated.

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Bridging the Gap: Disparity among Cultures and OCB

Melisa Garcia, Toni DiDonna, Ivan Santos, Yaris Gonzalez and Waleska Garcia

Albizu University

Abstract- Organizations throughout the world are faced with understanding the importance of having a culturally diverse workforce. Research on Organizational Citizenship Behavior (OCB) may hold the key to cultivating the next generation of proactive and involved workers, yet the literature on the cultural components of OCB is lacking. This potential inspired the purpose of this study, to add to the literature of cross-cultural differences as it relates to the display of OCB. Participants were recruited through a convenient snowball sampling method and limited to employed individuals 18 years or older. The participants were asked to complete a set of demographic questions in addition to Likert scale type questions from an instrument designed to quantify levels of OCB activity. A total of 417 respondents completed the survey. Participants were predominantly Hispanic (N = 343) and over 30 years of age (N = 254). Results indicated no significant differences between Immigrants and Nonimmigrants; nor between Hispanics and Non-Hispanics on reported levels of OCB. Results also indicated that there are differences in levels of OCB among certain Hispanic nationalities. The study contributes to existing literature by providing more understanding and insight on ethnic and racial differences that may influence OCB.

Index Terms- organizational citizenship behavior, OCB, race, ethnicity, Hispanics, culture.

I. INTRODUCTION

Culturally diverse workforces have become a competitive advantage for businesses in the 21st century. Globalization and immigration have been two of the driving forces behind the need for diversity in the workplace. A culturally mixed workforce can bring both opportunities and challenges to employers. The main benefit of cultural diversity in the workforce is the added value that emerges from blending new ideas, contrasting perspectives, and different skills and talent. Thus, understanding these cultural differences sometimes becomes a challenge for organizations. Regardless of the challenges, the efforts to achieve diverse workforces in organizations continues to grow. The research team set out to explore interactions between cultural and ethnic diversity and another driver of organizational effectiveness, Organizational Citizenship Behaviors (OCB). OCB are identified as behaviors which promote the efficacy of the organization, are discretionary, and are not recognized by the formal reward system (Organ, 1988). These behaviors have been shown to correlate to different aspects of organizational success (Podsakoff & Mackenzie, 1994). The literature has shown support for cross-cultural differences within OCB (Ayatollahi & Ayim, 2015). As such, the purpose of this study is to explore OCB differences between ethnic groups and varying Hispanic nationalities. The following sections detail the fundamentals of OCB and highlights the existing literature knowledge on potential ethnic and cultural components of it.

II. ORGANIZATIONAL CITIZENSHIP BEHAVIOR: CONSTRUCT HISTORY & VALUE

Overview of OCB. The construct of OCB was born out of a need from employers to identify behaviors outside of the job requirements that have positive effects on organizational effectiveness (Organ, 1997). Organ (1997) shares that employee assessments at the time were too narrow in their scope, focusing strictly on duties of the role and not the employee. Organ (1988) addressed what he felt was missing in his seminal work on OCB as behaviors that promote efficacy of the organization, are discretionary, and are not recognized by the formal reward system.

The definition has three major components that helps differentiate this construct from similar ones such as contextual performance and prosocial organizational performance (Organ, 1988). Firstly, the behavior must not be required in the job description and the lack of engagement in the behavior would not result in punishment. Secondly, the behavior must not be recognized in the formal reward system; that the employees engaging in the behavior should not expect to be given a guaranteed material or social reward for the action. Lastly, is the notion that over time engagement in the behavior will improve the effectiveness and productivity of the organization.

Dimensions of OCB. Smith, Organ, & Near’s (1983) publication prior to the Organ’s (1988) monograph provided an early framework which helped to operationally categorize citizenship behaviors. In the publication one of the two dimensions, Altruism, concerns itself with all discretionary non-rewarded behaviors that provide assistance to others in the organization with relevant tasks. This can include helping a fellow employee unload equipment in the parking lot or taking on one of their assignments if they appear overworked. The other major dimension, generalized compliance, relates to behaviors that adhere to the current rule structure and behavioral norms of the organization. This can include consistently being on time, not taking unexpected time off, and not using company equipment and paid time for anything other than organizationally relevant tasks. Smith et. al. (1983) dimensions were later explicated and expanded on by Organ (1988) to create five new dimensions, altruism, conscientiousness, civic virtue, courtesy, and sportsmanship that are still used to this day to assess OCB engagement.

Organ (1988) kept altruism as a dimension with no changes to its definition. Generalized compliance was converted...
to conscientiousness, which included not only following rules and norms but also the degree to which one exceeds them such as, staying past normal hours and producing beyond expectations.Courtesy is much like its literal definition of behaving in a polite and respectful manner towards others. Behaviors high in “courtesy” concern themselves with decreasing the probability of conflict with others and includes actions such as maintaining constant communication with departments and individuals that may be affected by their actions prior to engaging in them. Civic virtue concerns behaviors that show an employee’s identification with and desire to be connected to the activities of the organization. This could include volunteering for meetings, participating in company events, and proudly upholding company policies. Lastly, sportsmanship is characterized by an employee’s ability to adjust and comply with circumstances and changes that the individual may not agree to without complication. This is evident in employees who are unlikely to complain and are willing to endure inconvenient challenges for the sake of the organization such as making due with an internet interruption or broken air conditioning.

Williams and Anderson (1991) sought to further group the dimensions with OCB-I and OCB-O. Courtesy and altruism, as behaviors that benefit individuals, are placed in the OCB-I category. Conscientiousness, civic virtue, and sportsmanship, as behaviors that benefit the organization, are in turn placed in the OCB-O category.

**Economic motivation and value of OCB research.** The strongest motivator for the research and implementation of OCB related interventions is the evident connection with organizational effectiveness. In a review of findings published after his seminal work, Organ (1997) determined that while the latter research done was mostly cross-sectional, the majority was supportive of the notion that OCB and organizational effectiveness are positively correlated. Podsakoff and Mackenzie (1994) found a positive correlation between OCB and improved individual level performance while Nielsen, Hrvnak, and Shaw (2009) found a strong positive relationship at the group level. Research has also shown that OCB can improve individual productivity (Turnipseed, 2002). Walz and Niehoff (2000) found that the altruism dimension was significantly related to several key performance indications in the service industry such as customer satisfaction and operational efficiency.

**OCB Today.** Throughout the years, the construct of OCB has gained more attention from research and practitioners (Florman, 2012). The history of research on OCB shows that during the 80’s, only approximately 10 journal articles examined OCB. However, that figure rose to 181 journal articles during the 90’s. More recently, from years 2000 to 2005, 243 peer reviewed scientific articles investigated citizenship behavior (Florman, 2012). The increase in journal articles studying the construct of OCB shows a trend in interest on OCB (Florman, 2012). According to Florman (2012), OCB will continue to be of interest for future research. Organ (1997) suggests, OCB is a construct that can change often and the definition of what constitutes OCB behaviors can change on a regular basis depending on who is measuring the construct.

OCB is sometimes linked to contextual performance. Contextual performance is referred to as the extra-role behaviors employees’ display at work. This concept was created to distinguish extra-role behaviors from in-role behaviors (Organ, 1997). In-role behaviors such as job duties are categorized under task performance. Task performance is limited by job descriptions (Organ, 1997). There has also been an interest in measuring OCB work behaviors and understanding what motivates employees to display OCB behaviors. This interest is due to research that has demonstrated that supervisors include and weigh task and contextual performance almost equally when evaluating employee performance (Borman & Motowildo, 2009). Such research findings make the construct relevant to organizational performance. Although contextual performance is not a synonym for OCB, it contains elements of the behaviors measured by the construct. As a result, researchers have continued to focus studies on understanding how workplace attitudes and behaviors influence employee outcomes.

**III. CULTURE AND OCB**

**Culture.** In (1952) Kroebber and Kluckhohn collectively defined culture in 164 different ways. The various definitions of culture were organized into the following broad categories: content, social tradition/heritage, normative/rules/ways of doing things; psychological/problem solving adjustment, culture in patterns and organizations, genetics and metaphorical definitions of culture. Defining culture is complicated as there are many definitions of culture. The review of the literature views culture as emerging adaptive interaction between the human and the environment (Cohen, 2009). Cohen (2009), further explains that culture also consists of shared elements which are disseminated across different time periods and generations. A most recent definition of culture (Fiske, 2002) tell us that it is socially developed and manifests itself in society in forms such as symbols, practices, values, norms, and institutions. Triandis (1994), argued that cultures are not the same as countries. Triandis (1994), defined culture as a syndrome of patterns of shared beliefs, norms, attitudes about values for those in that time period who spoke the language and resided in the same geographic location. Research evidence suggests that individuals define and view OCB in various ways (Kwantes, Karam, Kuo & Towson, 2008). Many psychologists who have studied the interest of culture have primarily focused on the differences between Western and Eastern world views in terms of individualism versus collectivism (Cohen, 2009).

**Culture as OCB antecedent.** Research implications suggest there is evidence of the various way individuals define, view and measure OCB (Morrison 1994; Vandenberg, Lance & Taylor, 2005). The variations of how OCB is viewed can be seen in how individuals may perceive specific behaviors as extra-role and others consider it in-role behaviors. Kwantes et. al. (2008), affirmed that one possible contributing factor behind the disparity is related to the effect of culture and other culture (i.e. social beliefs) related variables. Triandis (1994) concluded that social cultures help shape, perception, expectations and behavioral norms. Turnipseed (2002), concluded that ethics and individual values also play a role in whether or not an employee will display OCB behaviors. Additionally other factors to consider (i. ethics/personal values/norms) and individual belief systems may influence how employees view OCB and the extent of how much OCB behaviors may be expressed at work by the...
Individualism, Collectivism and OCB. Our culture plays an important role in our behaviors. One of the most popular studies of cultural values at organizations is Hofstede's (1980). This model serves as the foundation and guide to compare the components of different cultures. Hofstede's (1980) seminal work identifies the basic differences in which individuals define their own worlds. The work created by Hofstede (1980) consists of a group of dimensions that describes the differences between the various cultures and clarifies the reasons for such differences (Cohen & Avrahami, 2006). One of these dimensions is collectivism vs. individualism.

Individualism is defined as the degree to which people give priority to their own interests over those of their group to which the individual belongs to. Individualist value self-reliance and tend to evade or disregard the benefit of the group if it is not in accordance with one’s best interest (Cohen & Avrahami, 2006). On the contrary, collectivism is a cultural characteristic in which the focus is on the best interest of the group and not the individual. The prosperity of the group supersedes the wants of the individual. The groups tend to be close and cohesive. Employees with collectivist traits tend to be more committed to the company because of their connections with the employer and their colleagues rather than the actual work, incentives, or compensation (Cohen & Avrahami, 2006). Collectivism has been linked to OCB as collectivistic employees tended to show OCB more than individualistic employees (Cohen & Avrahami, 2006). According to a research conducted by Gomez (2003) the Hispanic culture is described as having collectivist principles and behaviors. The loyalty of the groups surpasses the personal and often conflicts are avoided to benefit the group (Cohen & Avrahami, 2006). Therefore, it is hypothesized that there is a difference in OCB levels between Immigrants and Nonimmigrants. It is further hypothesized that Hispanics will report higher levels of OCB than Non-Hispanics; and that Hispanic nationalities will differ on reported levels of OCB.

IV. METHOD

Participants
A sample of 417 participants from South Florida and Puerto Rico was collected using a convenience sampling method. Participants recruited for the study were eighteen years or older and limited to current full or part-time employment. The participants consisted predominantly of females 269 (64.5%) and 148 males (35.5%). The participants’ age ranged from 19 - 74 years old. The mean for female respondents was 38.03 and 35.87 for male. The mode age of the sample was 23 (SD = 12.80) years. The participants educational background consisted of a mean score of 15.55 of at least a High School degree or 2 years of college. Participants held a median educational attainment level of a Bachelor’s Degree, (M = 16, SD = 2.78). Participants in the sample size were categorized into four ethnic identities: White/Non-Hispanic, Hispanic/Latino, African American or other. The majority of the respondents were Non-Immigrants (N = 261, SD = 8.398). There were a total of 156 (N = 156, SD = 8.310) immigrants who responded to the survey. The majority of the respondent were Hispanic/Latino 82.3 % (N = 343); White/Non-Immigrants 10.6 % (N = 44); African American 3.4% (N = 14) and Others 3.8 % (N = 16). The distribution of Hispanic nationalities were predominantly Cuban (N = 144). The remaining sample size consisted of Colombians (N = 57), Puerto Ricans (N = 35), Venezuelan (N = 31), and other Hispanic groups (N = 76).

Materials and Procedures
A survey was created in English for purpose of this non-experimental design using Google Forms. Participants received a recruitment message by either text, email, or a social media post (e.g. Facebook or LinkedIn) informing the purpose and intent of the research. Before participants completed the survey, they were provided with the informed consent form that contained detailed information concerning the survey. The time to complete the anonymous survey was estimated to be ten to fifteen minutes. The survey included a demographic questionnaire in a multiple choice and fill-in answer format. The survey contained a total of 26-items. Participants completed a self-report questionnaire via the Internet through a Google Forms Survey. Respondents for this study were not compensated for their participation. The informed consent form explained and ensured participants responses to the questionnaire were completely anonymous. Respondents were informed that their participation is completely voluntary and that there are no known risks to the study. Participants had the right to withdraw their participation at any time without penalty. Contact information for the researchers was provided in the informed consent form and at the end of the survey, should participant have any questions or comments. The researcher obtained results via Google Forms software which were then exported to SPSS for computation.
Instrumentation
The participants were asked to complete a self-report questionnaire measuring the construct of Organizational Citizenship. The construct was measured using existing reliable and validated scales.

Organizational Citizenship Behavior (OCB). OCB was examined using the Organizational Citizenship Behavior Scale developed by Spector, Bauer and Fox (2010). The scale is comprised of ten items that measure the frequency of exhibiting OCB behaviors in the workplace (See Appendix D). The responses are rated based on a 5-point Likert-type scale ranging from 1 (never) to 5 (extremely often or always). This instrument has a coefficient alpha reliability of .80 (Spector, Bauer, & Fox 2010).

V. RESULTS

ANOVA
To compare the levels of reported Organizational Citizenship Behavior amongst the Hispanic groups (N=343) the researchers used a one-way ANOVA. The groups (Total N=343) were identified under Cubans (M = 33.70, SD = 8.14), Colombians (M = 29.04, SD = 8.36), Puerto Ricans (M = 32.03, SD = 6.18), Venezuelans (M = 30.55, SD = 9.22), and all other Hispanics under the grouping “Other” (M = 31.24, SD = 7.76). Pre-Test conditions for normality, sample size (n), and homogeneity of variance were satisfied for all groups. Results were significant (α = .05, p = .004). Findings supported the hypothesis that there is a significant difference between the groups (Table 6). A Sidak post-test was run to identify which groups had the statistically significant difference. The post test revealed that participants of Cuban nationality had a significantly higher level of reported OCB behavior than those of Colombian nationality (α = .05, p = .002); 4.66 points greater.

Independent Sample t-test
An Independent sample t-test was implemented by the researchers to examine if Hispanics (M = 31.92, SD = 8.16) and Non-Hispanics (M = 32.77, SD = 9.66) differentiated on levels of reported OCB behavior (Total N=417). Pre-Test conditions for normality, sample size (n), and homogeneity of variance were satisfied for all groups. The results for the independent samples t-test (Table 5) showed that there is no statistically significant difference between the groups (α = .05, p = .060).

An Independent sample t-test was implement by the researcher to examine if immigrants (M = 31.22, SD = 8.31) and Non-immigrants (M = 32.59, SD = 8.39) differentiated on levels of reported OCB behavior (Total N=417). Pre-Test conditions for normality, sample size (n), and homogeneity of variance were satisfied for all groups. The results for the independent samples t-test (Table 4) showed that there is no statistically significant difference between the groups (α = .05, p = .541).

VI. DISCUSSION
The literature review suggests that currently there is a lack of research studying the relationship between culture and Organizational Citizenship Behavior (OCB). More specifically, there are gaps in the literature for research studies addressing the possible influence of nationality and immigrant status on OCB. According to Kwantes, Karam, Kuo and Towson (2008), there is an insufficiency of empirical research directly examining work performance, OCB and culture-related variables. This research study aimed to explore the possible relationship between some of these variables with the goal of contributing to close the existing literature gap.

The central finding of this study is that there is no difference between U.S. Immigrants and U.S. Nonimmigrants and the frequency in which they exhibit OCB. The results suggest that both groups are equally likely to engage in OCB. This finding also fails to support the first hypothesis, which predicted that there would be a difference between Immigrants and Nonimmigrants and their reported OCB levels. Further findings show that there is no difference between Hispanics and Non-Hispanics and the frequency in which they exhibit OCB. This finding fails to support the second hypothesis, which predicted that the Hispanic culture would report higher levels of OCB as compared to Non-Hispanics. This finding also contradicts the literature review. According to Hofstede (1980), most Hispanic countries are collectivistic and as such; its members value the opinion of the group they belong to more and will make the well-being of the group their priority. On the other spectrum, there are individualistic societies. In individualistic societies members tend to take care of themselves and their immediate family members only (Hofstede, 1980). The existing literature may lead one to conclude that Hispanic cultures would be more likely to exhibit OCB. However, the results indicate that this difference does not exist within this sample.

The third hypothesis was supported by the data. Research findings suggest that there is a difference between two of the Hispanic groups and the reported levels of OCB. In this sample, Cuban respondents reported higher OCB levels as compared to Colombian respondents. This finding is consistent with the existing literature review. Cubans are considered a collectivistic-oriented culture (Schneider, Gruman, & Coutts, 2012), and Colombians are amongst the most collectivistic cultures in the world (Hofstede Insights, 2017). Nevertheless, Cuba, with its communist government, forces its members to work together for the greater good of the country regardless of what their individual needs are. Therefore, the social experiences of Cubans are structured around social groups, which causes the culture to be ultra-collectivistic (Schneider, Gruman, & Coutts, 2012). Research has shown the importance of exploring OCB in the workplace. The findings from this study suggest that cultural differences could influence workplace behavior. Therefore, understanding, respecting, and embracing cultural differences in the workplace can be of benefit to organizations and serve as a tool in obtaining positive outcomes and outputs. Enhancing the study of culture will have greater implications for future research on OCB. One suggestion for future research is to replicate this study by conducting a longitudinal study where the demographics include National and International participants.

VII. LIMITATIONS
The study was conducted using a convenience snowball sampling method. Therefore, the results cannot be generalized to
the entire population. Subsequent limitations are geographic. The majority of the participants primarily reside in Florida and Puerto Rico; as such, this sample does not represent the entire U.S. adult population. Additionally, our Immigrant sample was predominantly Hispanic (89.9%). Also, the age mode was 23. Furthermore, although 423 participants completed the survey, 6 respondents failed to meet the inclusion criteria.

REFERENCES


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Second Author – Toni DiDonna, Albizu University
Third Author – Ivan Santos, Albizu University
Fourth Author – Yaris Gonzalez, Albizu University
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Appendix

Table 1 Descriptive Characteristics - Age

**AGE**

**Statistics**

What is your age in years? [I am "______" years old]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
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</tr>
<tr>
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</tr>
<tr>
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<tr>
<td><strong>Mean</strong></td>
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<tr>
<td><strong>Median</strong></td>
<td>34.000</td>
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<td><strong>Mode</strong></td>
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<td><strong>Std. Deviation</strong></td>
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<tr>
<td><strong>Range</strong></td>
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<tr>
<td><strong>Minimum</strong></td>
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</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>74.0</td>
</tr>
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</table>
Table 2 Descriptive Characteristics - Education

Years of Formal Education

Statistics

How many years of formal education have you completed?
(If you finished high school you would answer 12, if you have bachelor's degree you would answer 16, a doctoral degree would be 20) [ I have "___" Years of formal education ]

<table>
<thead>
<tr>
<th>N</th>
<th>Valid</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Mean 15.553

Median 16.000
Table 3 Descriptive Characteristics - Race/ethnic identity

Race

What best describes your racial/ethnic identity?

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
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</thead>
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<td>10.6</td>
<td>10.6</td>
<td>10.4</td>
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<tr>
<td>Hispanic Latino</td>
<td>343</td>
<td>82.3</td>
<td>82.3</td>
<td>92.8</td>
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</table>
Table 4 Results - T-Test for Immigrant/Non-Immigrant

<table>
<thead>
<tr>
<th>Group Statistics</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCB Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>261</td>
<td>32.59</td>
<td>8.398</td>
<td>.520</td>
</tr>
<tr>
<td>Yes</td>
<td>156</td>
<td>31.22</td>
<td>8.310</td>
<td>.665</td>
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</table>

What best describes your racial/ethnic identity?

<table>
<thead>
<tr>
<th>Category</th>
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<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
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</thead>
<tbody>
<tr>
<td>Black/African American</td>
<td>14</td>
<td>3.3</td>
<td>3.3</td>
<td>96.2</td>
</tr>
<tr>
<td>Other</td>
<td>16</td>
<td>3.8</td>
<td>3.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>417</td>
<td>100.0</td>
<td>100.0</td>
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</tbody>
</table>
### Levene's Test for Equality of Variances

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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>t</td>
<td>df</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.375</td>
<td>.541</td>
<td>1.616</td>
<td>415</td>
<td></td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### t-test for Equality of Means

<table>
<thead>
<tr>
<th>OCB Index</th>
<th>Equal variances assumed</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sig. (2-tailed)</td>
<td>Mean Difference</td>
<td>Std. Error Difference</td>
<td>95% Confidence Interval of the Difference</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.107</td>
<td>1.368</td>
<td>.847</td>
<td>-.296</td>
<td></td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.106</td>
<td>1.368</td>
<td>.844</td>
<td>-.293</td>
<td></td>
</tr>
</tbody>
</table>

**t-test for Equality of Means**

95% Confidence Interval of the Difference

Upper
Table 5 Results - T-Test for Hispanic Non-Hispanic

### Group Statistics

<table>
<thead>
<tr>
<th>What best describes your racial/ethnic identity?</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCB Index</td>
<td>74</td>
<td>32.77</td>
<td>9.336</td>
<td>1.085</td>
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<tr>
<td>Hispanic</td>
<td>343</td>
<td>31.92</td>
<td>8.167</td>
<td>.441</td>
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</table>

### Independent Samples Test

<table>
<thead>
<tr>
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<th>t</th>
<th>df</th>
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<tbody>
<tr>
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<td>.060</td>
<td>.787</td>
<td>415</td>
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<tr>
<td>Equal variances assumed</td>
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<td>.722</td>
<td>98.523</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Independent Samples Test

## t-test for Equality of Means

<table>
<thead>
<tr>
<th>OCB Index</th>
<th>Equal variances assumed</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>Mean Difference</td>
</tr>
<tr>
<td>OCB Index</td>
<td>.432</td>
<td>.846</td>
</tr>
<tr>
<td></td>
<td>.472</td>
<td>.846</td>
</tr>
</tbody>
</table>

## Table 6 Results - ANOVA for Hispanic Nationalities

### Descriptives

<table>
<thead>
<tr>
<th>OCB Index</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval for Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>Cuban</td>
<td>144</td>
<td>33.70</td>
<td>8.147</td>
<td>.679</td>
<td>32.36</td>
</tr>
<tr>
<td>Colombian</td>
<td>57</td>
<td>29.04</td>
<td>8.362</td>
<td>1.108</td>
<td>26.82</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td>35</td>
<td>32.03</td>
<td>6.186</td>
<td>1.046</td>
<td>29.90</td>
</tr>
<tr>
<td>Venezuelan</td>
<td>31</td>
<td>30.55</td>
<td>9.226</td>
<td>1.657</td>
<td>27.16</td>
</tr>
<tr>
<td>Other</td>
<td>76</td>
<td>31.24</td>
<td>7.768</td>
<td>.891</td>
<td>29.46</td>
</tr>
</tbody>
</table>
Test of Homogeneity of Variances

OCB Index

<table>
<thead>
<tr>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.829</td>
<td>4</td>
<td>338</td>
<td>.123</td>
</tr>
</tbody>
</table>

ANOVA

OCB Index

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1025.554</td>
<td>4</td>
<td>256.388</td>
<td>3.977</td>
</tr>
<tr>
<td>Within Groups</td>
<td>21788.475</td>
<td>338</td>
<td>64.463</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22814.029</td>
<td>342</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Multiple Comparisons

Dependent Variable: OCB Index

Sidak

(I) With which of the follow Nationalities do you most identify with? (J) With which of the follow Nationalities do you most identify with? | Mean Difference (I-J) | Std. Error | Sig. |
<table>
<thead>
<tr>
<th></th>
<th>Cuban</th>
<th>Colombian</th>
<th>Puerto Rican</th>
<th>Venezuelan</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuban</td>
<td></td>
<td></td>
<td>4.666*</td>
<td>1.256</td>
<td>.002</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td></td>
<td></td>
<td>1.673</td>
<td>1.513</td>
<td>.957</td>
</tr>
<tr>
<td>Venezuelan</td>
<td></td>
<td></td>
<td>3.153</td>
<td>1.590</td>
<td>.389</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td>2.465</td>
<td>1.138</td>
<td>.271</td>
</tr>
<tr>
<td>Colombian</td>
<td>Cuban</td>
<td></td>
<td>-4.666*</td>
<td>1.256</td>
<td>.002</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td></td>
<td></td>
<td>-2.993</td>
<td>1.724</td>
<td>.582</td>
</tr>
<tr>
<td>Venezuelan</td>
<td></td>
<td></td>
<td>-1.513</td>
<td>1.792</td>
<td>.994</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td>-2.202</td>
<td>1.407</td>
<td>.717</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td>Cuban</td>
<td></td>
<td>-1.673</td>
<td>1.513</td>
<td>.957</td>
</tr>
<tr>
<td>Colombian</td>
<td></td>
<td></td>
<td>2.993</td>
<td>1.724</td>
<td>.582</td>
</tr>
<tr>
<td>Venezuelan</td>
<td></td>
<td></td>
<td>1.480</td>
<td>1.980</td>
<td>.998</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td>.792</td>
<td>1.640</td>
<td>1.000</td>
</tr>
<tr>
<td>Venezuelan</td>
<td>Cuban</td>
<td></td>
<td>-3.153</td>
<td>1.590</td>
<td>.389</td>
</tr>
<tr>
<td>Colombian</td>
<td></td>
<td></td>
<td>1.513</td>
<td>1.792</td>
<td>.994</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td></td>
<td></td>
<td>-1.480</td>
<td>1.980</td>
<td>.998</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td>-.688</td>
<td>1.711</td>
<td>1.000</td>
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<tr>
<td>Other</td>
<td>Cuban</td>
<td></td>
<td>-2.465</td>
<td>1.138</td>
<td>.271</td>
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<tr>
<td>Colombian</td>
<td></td>
<td></td>
<td>2.202</td>
<td>1.407</td>
<td>.717</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>----------</td>
<td>------</td>
<td>------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puerto Rican</td>
<td>-.792</td>
<td>1.640</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venezuelan</td>
<td>.688</td>
<td>1.711</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Effect of the Government policy in reducing interest rate of Micro Loan (KUR) on migration of Non KUR Loan

Rojali Rokhman H*, Hermanto Siregar**, Tubagus Nur Ahmad Maulana**

*School of Business, Bogor Agricultural University (IPB), Indonesia  
** Department of Economics, IPB, Indonesia

Abstract- This study aims to analyze the influences of three factors: (1) interest rate of KUR Micro loan, (2) interest rate of Non KUR loan and (3) proportional migration of outstanding and borrower bank XYZ, on migration of non KUR loan. Analytical method used is multiple linear regression. The result s of the study showed that all the three independent variables have significant negative effect on migration both of outstanding and borrower. The effect of Non KUR loan interest rate on migration differ from the hypothesis. This can be explained because of the difference in the maximum amount of loan that can be borrowed. Non KUR loan product is a credit granting service with the amount of loan up to 200 million, whereby the KUR Micro loan plafond is only up to 25 million. Therefore, it is expected that if there is an increase in interest rate of Non KUR loan will not cause migration.

Index Terms- interest rate, KUR Micro loan, Non KUR loan, migration, borrower, and data panel.

I. INTRODUCTION

1. Background

The role of banks in economic development is to channel funds for economic activities (or provide loans for enterprises). One type of loans which is very common in Indonesia is loan for small and medium enterprises (UMKM). The development of micro small and medium enterprises plays an important role in the Indonesia’s economy. admissions in The role of UMKM is considered important in the process of national economic recovery both in order to encourage economic growth and in the absorption of manpower. The following figure of credit distribution and economic growth in the period 2011 to March 2017 taken from the Indonesian Banking Statistics (SPI) period 2017

In an effort to increase the real sector, to alleviate poverty alleviation and to empower UMKM, the Government implemented an economic policy to reduce interest rate of People Business loan (KUR) into single digit. The micro rate was initially stable at 22% but later in 2015 fell to 12%. The government then reduced it even further to 9% in 2016.

XYZ Bank, among several others banks, focuses its business on UMKM segment. XYZ bank is the most prominent bank for micro credit lending. Thus, the effect of interest rate changes will have an impact for XYZ bank; both in the amount of distribution and the number of micro credit borrowers. By looking at the importance of micro credit lending rate interest, the authors are interested in choosing the title "Effect of the government policy in reducing the interest rate of micro loan (KUR) on migration of Non KUR Loan"

2. Research Questions

The problem commonly faced in the process of developing UMKM is an access to business capital, in particular loan from banks. Many of UMKM businesses have difficulty in obtaining bank financing. Complex processes and collateral issues are common reasons why many small businesses often unsuccessful in obtaining commercial bank loan. Considering these reasons, the government of Indonesia launched the People Business Loan Program (KUR) in order to bridge the interests between banking industry on one side and micro businesses on the other side, especially for micro businesses that are feasible from a business point of view but are not bankable. Based on data of the realization of KUR (Figure 2), Micro loan distribution during the period 2011-2016 exceeded the target set by the government.

The policy of the government as mentioned earlier is expected to have an effect of the distribution of KUR Micro loan. Based
on the explanation of existing problems, the research questions are twofold:

a. What is the development of migration of KUR Micro loan and Non KUR migration on all Bank XYZ regional offices over the past 3 years?
b. How large is the effect of, KUR Micro loan rate and Government policy on the development of Non KUR migration, on outstanding amount and the number of borrowers?

3. Research Objectives

   Based on the background and research questions that have been formulated above, the purposes of this research are as follows:

a. To analyze the development of migration of KUR Micro loan and Non KUR migration in all XYZ bank regional offices during the last 3 years
b. To analyze the effect of KUR Micro loan interest rate and Government policy on the development of Non KUR migration seen from the outstanding amount and the number of borrowers.

4. Research Benefits

   The results of this study are expected to provide benefits, for both researchers and practitioners as follows:

a. Researchers:
   1. The results of this study are expected to broaden the reader's knowledge about the effect of KUR Micro loan rate on the development of Non KUR migration at XYZ bank
   2. The results of this study can be used as a reference for further research.

b. Practitioners:
   1. For investors, creditors, market analysis or other stakeholders, the results of this study can be used as one of the parameters to evaluate the performance of a bank
   2. For Bank Indonesia or the relevant ministry as regulator in determining monetary policy or other policies related to KUR Micro loan rate.

II. LITERATURE REVIEW

According to Sukirno (2005), demand is the amount of goods demanded on a particular market with a certain price level at a certain level of income and in certain periods supported by purchasing power. The demand of a person or a society of a product in the market is determined by many factors. According to Manurung and Pratama (2004), there are several factors that can affect the demand of a good, namely:

1. Price of the good itself
   If prices of goods become cheaper, then consumer demand for goods will increase. On the other hand, if prices of goods become more expensive, then consumer demand will decline. KUR Micro loan rate is an approximation of the price of the good in this research.
2. Price of Other Related Items

   Prices of other goods (substitution products) may also affect demand. The price of substitution product is this research is approximated by Non KUR loan interest rate.

3. Consumer tastes or habits

   Consumer tastes or habits can also affect the demand for a good. Consumer tastes are influenced by changes in consumer income, environmental changes, and other factors. Proportional of Non KUR loan migration to KUR Micro loan consumer is a proxy of consumer tastes or habit.

A. People Business Loan (KUR)

   People Business Loan (KUR) is a program that belongs to the poverty reduction and Micro Small Business Empowerment Program Group. KUR can be a credit scheme or working capital financing with maximum repayment terms up to 3 years (working capital loan) or up to 5 years (investment loan). The minimum amount that can be borrowed is 5 million while the maximum loan amount is up to 25 million IDR.

   The objective of the KUR program is to accelerate the development of economic activities in the real sector; more specifically in the context of poverty alleviation as well as the expansion of employment opportunities. In more detail, the objectives of the KUR program are as follows:

a) Accelerate the development of the Real Sector
b) Improve access to financing for UMKM & Cooperatives
c) As an effort to overcome / alleviate poverty

   When the first time it launched, KUR Micro loan rate was 22% and then lowered to 12% effective in 2015. Year after (in 2016), the KUR Micro loan rate was reduced even further to 9% effective, based on regulation of the ministry of economic coordination number (Permenko) number 13, 2015.

B. Non KUR Loan

   Non KUR loan of XYZ bank is a general, individual, selective, and fair-interest credit that aims to develop / improve viability of microenterprises with relatively easy and simple procedures. Non KUR loan is denominated in rupiah and is the credit scheme that provides the highest spread for XYZ bank. Non KUR loan is the first commercial credit scheme where the source of funding comes from deposits received by each of XYZ Bank's branches without subsidies from other parties.

   The Maximum amount of Non KUR loan is IDR 200 million. The sources of loan repayment are the cash flow of the business and / or the borrower's fixed income. Non KUR loan consists of: Working Capital Loan, Investment Loan, and Consumer loan. The interest rate is determined by flat rate system calculation. Target of Non KUR loan are entrepreneurs and consumer with permanent income.

   The Non KUR loan provides many benefits and anyone who meets the criteria can apply for the loan. Interest rate given by XYZ bank from 2014 to 2017 has been constant at 22% effective. This rate is inversely proportional to the BI rate in which BI rate has been steadily decreasing from 7.5% to 6.5% from 2014 to 2017. Thus, it implies that the risk of the Non KUR rate has increased during those period if its rate compared to the BI Rate.
C. Proportional Migration from Non KUR loan to KUR Micro loan

Consumer behavior is a process through which a person / organization searches, buys, uses, evaluates and disposes of products or services after being consumed to meet its needs.

In relation to that, and in the context of loan, it can be deduced that an increase in number of borrowers who applied for the KUR Micro loan would caused an increase in migration from Non KUR loan to KUR Micro loan. Therefore, a proportional analysis of Non KUR migration to micro credit is required. In contrast, the less migration from Non KUR loan to KUR Micro loan, the demand for Kur Micro loan will fall, which indicates that the proportional factor will affect the outstanding amount and credit debt of KUR Micro loan. To manage potential problems that might occurred, good credit management is required.

D. Interest Rate & Loanable Fund Theory

The theory of loanable funds is commonly used to explain changes in interest rates (Madura, 2001). In loanable funds theory, the interest rate is determined by the amount of supply and demand for loan. Similar to goods and services, the loanable funds market works through supply and demand mechanisms in the money market. Interest rates are the price indicators of loanable funds.

A bank is an intermediary institution that collects funds from communities and channels them to communities in the form of credit. Bank products in the form of collecting funds and lending, often termed as loanable funds. For supply of loanable funds, the products offered by banks are deposit products, such as: demand deposits, savings deposits, and time deposits. While on loanable funds demand, the product offered by banking is credit.

The theory of loanable funds explains why interest rates rise or fall. The focus of this theory is on supply and demand for loanable funds. The supply curve for loanable funds (Sf) has a positive slope, whereas the demand curve for loanable funds (Df) has a negative slope. The intersection between Df and Sf determines the interest rate on the equilibrium condition for the amount of funds lent. The Sf and Df curves are not constant but change due to changes in the factors that influence them.

Hypothesis.
The hypotheses that we developed are as follows:
H1: An increase of KUR Micro interest rate negatively affects migration from Non KUR loan to KUR Micro loan
H2: An increase of Non KUR interest rate positively influences migration from Non KUR to KUR Micro loan
H3: An increase Proportional of KUR migration positively affects migration from Non KUR to KUR Micro loan
H4: No Government policy negatively affects migration from Non KUR loan to KUR Micro loan

III. RESEARCH METHODS

A. Types, Data Sources and Research Models

Data used in this research is secondary data from 2014 until 2017 from source (BPS, Bank Indonesia and internal XYZ bank). The model for this study is as follows:

Model 1 : Outstanding Migration of KUR Micro loan

\[ Y1_{it} = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \epsilon_1 \]

Model 2 : Migration Borrower KUR Micro loan

\[ Y2_{it} = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \epsilon_2 \]

Wherein :
- \( Y1_{it} \) Model 1 = Non KUR outstanding migration to KUR Micro loan
- \( Y2_{it} \) Model 2 = Non KUR borrowers migration to KUR Micro loan
- \( a \) = constants
- \( b_1, b_2, b_3, b_4 \) = Expected parameters
- \( X_1 \) = Interest Rate KUR Micro loan
- \( X_2 \) = Non KUR loan Interest Rate
- \( X_3 \) = Proportional migration of KUR Micro loan to total migration
- \( X_4 \) = Dummy
- \( \epsilon_1 \) dan \( \epsilon_2 \) = Standard error

B. Time and Location Research

The study was conducted for 5 months, from March to August 2017 at the headquarters of XYZ Bank.

C. Processing and data analysis

We processed data using SPSS program. Regression test and panel data regression analysis were carried out using Eviews software. The effect of KUR Micro loan interest rate, Non KUR loan interest rate and proportional migration of KUR Micro loan to total migration were analyzed using panel data regression method.

D. Stages of Panel Data Regression

1. Estimation Model Determination

In order to obtain the best estimation model, we compared three different models that are Common Effect Model or Pooled least Square (PLS), Fixed Effect Model (FE), Random Effect Model (RE)

2. Determination of Estimation Method

To select for the best model, it is necessary to test the assumption of presence or absence of correlation between regressor and individual effects, then other tests including Chow test, Hausman test and langrange test Multiplier

3. Testing Assumptions and Conformity Model

The data that are used in the regression model must be tested first to check for any possibility of deviation of classical assumptions including the Normality Test, Multicollinearity Test, Autocorrelation Test and Heteroskedasticity Test

4. Interpretation

We interpret the results of each regression model based on the signs of the coefficients.
IV. RESULTS AND DISCUSSION

A. Development of Non KUR Loan Migration and KUR Micro Loan at All Offices of XYZ Bank

XYZ bank is a leading commercial bank and one of the state owned banks which prioritizes its services to micro, small and medium enterprises and have mission to support the improvement of communities’ economies. In the micro business segment, XYZ bank is a market leader in the industry and it has branches in all areas of Indonesia; including remote cities and villages.

Micro Credit is a credit channeled through XYZ bank with credit schemes that include Non KUR loan and KUR Micro loan. Non KUR loan is the main source of profit for XYZ Bank. Every year, Non KUR loan grows steadily, partly due to the continuous improvement of XYZ Bank services, the development of economic activities in villages and small towns, as well as the loyalty of small entrepreneurs to banks.

With changes of interest rate policy, the borrowers will switch to credit schemes that offer lower interest rate. This will lead a migration from Non KUR loan to KUR Micro loan, both in terms of outstanding and number of borrowers. For instance, during the last three months, there have been migration from Non KUR loan to KUR Micro loan as indicated by Tabel 1:

<table>
<thead>
<tr>
<th>No</th>
<th>Area</th>
<th>Average Borrower Migration</th>
<th>Average Outstanding Migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aceh</td>
<td>645</td>
<td>13,506,650,000</td>
</tr>
<tr>
<td>2</td>
<td>Bandung</td>
<td>5,435</td>
<td>119,584,225,000</td>
</tr>
<tr>
<td>3</td>
<td>Banjarmasin</td>
<td>1,446</td>
<td>33,777,225,000</td>
</tr>
<tr>
<td>4</td>
<td>Denpasar</td>
<td>1,934</td>
<td>42,035,625,000</td>
</tr>
<tr>
<td>5</td>
<td>DKI Jkt 1</td>
<td>372</td>
<td>8,850,500,000</td>
</tr>
<tr>
<td>6</td>
<td>DKI Jkt 2</td>
<td>1,466</td>
<td>35,851,750,000</td>
</tr>
<tr>
<td>7</td>
<td>DKI Jkt 3</td>
<td>992</td>
<td>22,678,653,275</td>
</tr>
<tr>
<td>8</td>
<td>Jayapura</td>
<td>282</td>
<td>8,218,250,000</td>
</tr>
<tr>
<td>9</td>
<td>Lampung</td>
<td>1,683</td>
<td>40,980,125,000</td>
</tr>
<tr>
<td>10</td>
<td>Makassar</td>
<td>3,256</td>
<td>80,923,834,979</td>
</tr>
<tr>
<td>11</td>
<td>Malang</td>
<td>4,764</td>
<td>89,876,387,500</td>
</tr>
<tr>
<td>12</td>
<td>Manado</td>
<td>1,072</td>
<td>23,312,555,000</td>
</tr>
<tr>
<td>13</td>
<td>Medan</td>
<td>1,606</td>
<td>35,178,945,000</td>
</tr>
<tr>
<td>14</td>
<td>Padang</td>
<td>1,458</td>
<td>33,569,275,000</td>
</tr>
<tr>
<td>15</td>
<td>Palembang</td>
<td>2,516</td>
<td>58,039,347,591</td>
</tr>
<tr>
<td>16</td>
<td>Pekanbaru</td>
<td>598</td>
<td>13,787,250,000</td>
</tr>
<tr>
<td>17</td>
<td>Semarang</td>
<td>3,824</td>
<td>75,881,798,500</td>
</tr>
<tr>
<td>18</td>
<td>Surabaya</td>
<td>2,284</td>
<td>44,956,825,000</td>
</tr>
<tr>
<td>19</td>
<td>Yogyakarta</td>
<td>5,015</td>
<td>101,317,574,250</td>
</tr>
</tbody>
</table>

Based on Table 1, the region that has the least outstanding migration is Jayapura while the region with the largest outstanding migration is Bandung. From the perspective of number of borrowers, the smallest and largest areas are Jayapura and Bandung respectively.

B. Analysis of the Effect of Interest Rate of KUR Micro Loan on the Development from Non KUR Loan Migration to KUR Micro Loan Viewed from Outstanding Number and Number of Borrowers

1. Outstanding Migration of KUR Micro Loan

Based on the results of Chow-F test and Hausman test, we chose Fixed Effect model. The result of Fixed Effect model is presented in the table 2.

Table 2 Fixed Effect Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>35.92217</td>
<td>1.788757</td>
<td>20.0822</td>
<td>0.0000</td>
</tr>
<tr>
<td>X1</td>
<td>-17.2582</td>
<td>1.402195</td>
<td>-12.3079</td>
<td>0.0000**</td>
</tr>
<tr>
<td>X2</td>
<td>-77.41418</td>
<td>10.46484</td>
<td>-7.397551</td>
<td>0.0000**</td>
</tr>
<tr>
<td>X3</td>
<td>3.45488</td>
<td>0.197516</td>
<td>17.4916</td>
<td>0.0000**</td>
</tr>
<tr>
<td>Dummy</td>
<td>-21.0453</td>
<td>0.065409</td>
<td>-321.7516</td>
<td>0.0000**</td>
</tr>
</tbody>
</table>

The classical assumption test is performed before doing data processing on the regression model to get the equation / model which is Best Linear Unbiased Estimator (BLUE).

1. Normality Test Analysis, with probability value of 0.4212 that is greater than alpha of 0.05 indicates that the error terms follow normal distribution assumption.

2. Multicollinearity Test Analysis. We can concluded that there is no multicollinearity problem in this research. This is based on evidence that the all correlation coefficients between variables are below 0.8 (Gujarati, 2006).

3. Autocorrelation Test Analysis. Durbin Watson value equals 1.60 value is within the range of no autocorrelation criteria. Thus, there is no correlation between error terms.

4. Heteroscedasticity Test Analysis. Because the value of Residual Sum Squared after weighted of 31.14597 is less than the value before weighting (31.20729), it can be concluded that there is no problem of heteroscedasticity.

Based on table 2 above, R-square equals 0.998 which means 99.8% of the proportion of diversity of outstanding migration...
variables can be explained by the three independent variables (interest rate of KUR Micro loan, Non KUR loan interest rate and Proportion of migration KUR Micro loan). The rests of 0.2% are explained by other variables outside the model. The final equation of the model is as follows:

\[ Y \text{ outstanding} = 35.92217 - 17.25820 \, X_1 - 77.41418 \, X_2 + 3.563077 \, X_3 - 21.04530 \, X_4 \]

2. Migration of borrower KUR Micro loan

Based on the results of Chow-F test and Hausman test, Fixed Effect model was chosen. The result of Fixed Effect model is presented in the table 3.

Table 3 Fixed Effect Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>10.85388</td>
<td>1.689483</td>
<td>6.424381</td>
<td>0.0000</td>
</tr>
<tr>
<td>X_1</td>
<td>-10.40948</td>
<td>1.329609</td>
<td>-7.828978</td>
<td>0.0009**</td>
</tr>
<tr>
<td>X_2</td>
<td>-27.75961</td>
<td>9.871997</td>
<td>-2.811955</td>
<td>0.0054**</td>
</tr>
<tr>
<td>X_3</td>
<td>3.563077</td>
<td>0.187184</td>
<td>19.03514</td>
<td>0.0000**</td>
</tr>
<tr>
<td>Dummy</td>
<td>-4.613011</td>
<td>0.060945</td>
<td>-75.69091</td>
<td>0.0000**</td>
</tr>
</tbody>
</table>

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean dependent</th>
<th>S.D. dependent var</th>
<th>Sum squared resid</th>
<th>Durbin-Watson stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>0.989829</td>
<td>0.0054**</td>
<td>31.48018</td>
<td>1.481653</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.988826</td>
<td>0.0054**</td>
<td>31.48018</td>
<td>1.481653</td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.375722</td>
<td>0.0054**</td>
<td>31.48018</td>
<td>1.481653</td>
</tr>
<tr>
<td>F-statistic</td>
<td>986.4741</td>
<td>0.0054**</td>
<td>31.48018</td>
<td>1.481653</td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
<td>0.0000</td>
<td>0.0054**</td>
<td>31.48018</td>
<td>1.481653</td>
</tr>
</tbody>
</table>

Unweighted Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean dependent</th>
<th>S.D. dependent var</th>
<th>Sum squared resid</th>
<th>Durbin-Watson stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>0.984271</td>
<td>0.0054**</td>
<td>31.48018</td>
<td>1.47454</td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>31.61189</td>
<td>0.0054**</td>
<td>31.48018</td>
<td>1.47454</td>
</tr>
</tbody>
</table>

Description: **) significant at 5% level; *) is significant at the level of 10%

The classical assumption test is performed before doing data processing on the regression model to get the equation / model which is Best Linear Unbiased Estimator (BLUE).

1. Normality Test Analysis, with probability value of 0.8470 that is greater than alpha of 0.05 indicates that the error terms follow normal distribution assumption.
2. Multicollinearity Test Analysis. Because all correlation coefficients between variables are below 0.8, it can be concluded that there is no multicollinearity (Gujarati, 2006).
3. Autocorrelation Test Analysis. The value of Durbin Watson is equal to 1.48 and is not within the range of no autocorrelation therefore the hypotheses of no-autocorrelation can not be accepted.
4. Heteroscedasticity Test Analysis. Because the value of Residual Sum Squared after weighted of 31.48018 is less than the value before weighted (31.48018), it can be concluded that there is no problem of heteroscedasticity.

Based on table 3 above, R-squared equals 0.989 which means 98.9% of the proportion of diversity of outstanding migration variables can be explained by the independent variable of interest rates KUR Micro loan, Non KUR loan interest rate and Proportion of migration KUR Micro loan. The rest of 1.02% are explained by other variables outside the model. The final equation of the model panel data is as follows:

\[ Y \text{ borrower} = 10.85388 - 10.40948 \, X_1 - 27.75961 \, X_2 + 3.563077 \, X_3 - 4.613011 \, X_4 \]

The Effect of KUR Micro Loan Interest Rate on Outstanding and Borrower Migration at XYZ Bank

The microcredit interest rate affected significantly both on the outstanding migration and on the migration of borrower. The coefficient value of -17.3 means that if interest rate of KUR Micro loan increases by 1 percent, it will reduce the outstanding migration by 17.3 percent whereby the coefficient value equals -10.4 implies that an increase of interest by 1 percent will cause a fall in borrower migration by 10.4 percent. These results are consistent with the hypotheses that are developed and in line with the theory of loanable funds which states that the higher loan interest rate, will result in the decreasing demand for loanable funds or fall in credit migration. When applying for a KUR Micro loan, prospective customers will consider the interest rate of the KUR Micro loan set by the bank. This is related to the ability of prospective borrowers in paying the price to be issued on loan from the bank. Generally, prospective borrowers are more interested if the bank offer low interest rates. So here, the interest rate of credit has an influence in migration of KUR Micro loan by banks.

Influence of Non Kur Interest Rate to Outstanding and Borrower Migration at XYZ Bank

The effect of Non KUR interest rate on the outstanding migration and on the migration of borrowers differ from the hypotheses. The sign of each coefficient is negative which implies that an increase in non KUR Micro loan rate will lead to a decrease in the number of outstanding migrations. This can be explained as follows. Comparing the migration from Non KUR loan to KUR Micro loan with KUR Micro loan Distributions (as shown in Figure 4) that has an inverse relation, we can interpret that any increase in outstanding of KUR Micro loan and number of borrowers of KUR Micro loan are not affected by the migration but by the willingness of the borrowers.

![Distribution of KUR Vs. Migration KUR](www.ijsrp.org)
Non Kur loan to KUR Micro loan are as follows:

a) Non Kur loan products are credit granting services with the plafond is up to 200 million IDR, whereas the maximum amount that can be borrowed for microcredit loan is only 25 IDR. Therefore, if there is an increase in Non KUR interest rate, it relatively will not lead to an increase in outstanding migration.

b) Because of certain requirements that must be fulfilled to be eligible as KUR’s borrowers, hence an increase of non KUR interest rate will not cause an increase in outstanding migration.

The Proportional Influence of Migration to Outstanding and Borrower Migration at XYZ Bank

Increased proportion of Non KUR has a positive effect both on the outstanding migration and the migration of borrowers. These findings are consistent with the hypothesis which implies that increasing number of borrowers who know the movement of products due to the change of taste will trigger the migration of outstanding and borrowers.

Dummy's Influence on Outstanding and Borrower Migration at XYZ Bank

The average of outstanding migration and borrowers will be smaller by 21,04530 and 4.613011 times when the government implemented policy of no KUR lending; during the period where the interest rate of KUR had been reviewed. This suggests that intervention by the Government affects the migration of borrowers.

Managerial Implications

Based on the results of the research, it can be formulated the following managerial implications:

1. XYZ Bank Management

   1.1. The bank has to anticipate a decline in interest rates for KUR Micro loan in order to avoid large migration of outstanding and customer of Non KUR Micro loan. Some strategies that might be implemented are as follows:

a) The banks shall maintenance and improve its services in order to preserve and enhance the willingness to pay of borrowers.

b) The banks should provide some benefits for Non KUR loan products so that the borrowers are more comfortable with Non KUR loan credit and at the same time improve its marketing strategy.

   1.2. As migration is not affected by an increase in KUR interest rates, other factors outside the interest rate should be a priority for management in maintaining the retention and acquisition level of Non KUR loan borrowers. As for some things that need to be done in improving customer retention and acquisition either existing program or new program is as follows:

   a) Increase incentives for borrowers if interest payments are paid timely.

   b) Creating coaching services business clinic for the borrower if the borrower is experiencing problems in paying off the loan.

   1.3. The proportionate increase in migration significantly affects the outstanding migration and the number of borrowers so banks need to create innovative products that can maintain the consistency of Non KUR borrowers.

2. Government

   2.1. Government policy related to the decrease of interest rate of micro lending then the Government should also make policy about decreasing of funding interest rate, so that bank NIM's quality can be well maintained.

IV. CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions
The conclusions that can be drawn from the results of research and discussion are as follows:

a. The Regional office which has the highest numbers of migration outstanding and borrower is Jayapura, whereas Bandung has the lowest numbers of migration outstanding and borrower.

b. Based on the results of the two panel data regression models, it can be inferred that loan outstanding migration and borrower migration from Non KUR loan to KUR loan are influenced significantly by KUR loan rate, Non KUR loan rate, proportional migration. The effects of both Non KUR loan rate and proportional migration to loan migration are positive whereby the KUR loan rate has a positive effect on loan migration.

2. Recommendations
Based on the conclusions of the above research, suggestions that can be given are as follows:

a. XYZ Bank needs to continuously innovate its Non KUR loan in order to reduce loan migration.

b. In order to maintain net interest margin, Bank Indonesia's needs to develop a policy in reducing not only lending rates but also funding rates of banks.

   c. This research can be analyzed further by adding other variables such as level of bank competition and Non-bank financial institutions (Fintech).

REFERENCES


ke-3. West Sussex (GB): John Willey & Sons, Ltd.


The Impact of Microfinance in Improvement of Livelihoods Conditions of Rural Women's in Sinnar State - Dindir Locality – Sudan

Adam Adoma Abdalla

University of Sinnar, Faculty of Agriculture, Department of Agricultural Economics and Rural Development, Abu Nama, Sinnar State

Abstract- The objective of this research is to assess the impact of the funds offered by the Microfinance institution in Sudan and administrated jointly between the Sudanese Agricultural Bank (ABSUM) and the International Fund for Agricultural Development (IFAD) on the development of rural women in Dindir locality in Sinnar state. Specific objectives were set to identify the socioeconomics characteristics of the beneficiaries (loan receivers), assess the effect of microfinance on increasing the cultivated land and animal holding, assess the effect of microfinance on improving the productivities, identify the benefits generated by the microfinance on crop production, identify the benefits generated by the microfinance on the livestock production, determine the types of most effective loans offered by microfinance, assess the overall revenue of microfinance compared to revenue prior to microfinance, and to assess the effect of microfinance on the life of the beneficiaries. The study has been conducted early 2017. The methodology used for this research was the direct interviews of the beneficiaries using structured questionnaire prepared specially for this purpose. Stratified random sample technique was used for the selection of sample. A statistical formula was used for determining the sample size. The collected data were tabulated and analyzed using Excel package facilities to produce tables and graphs. The analyzed data has concluded into a number of findings included: The microfinance has reflected a number of impacts on the livelihood of the respondents included: little impact on the area cultivated by different crops, significant increase in the number of animal holdings for different animal species, significant increase productivities of different cultivated crops and animal species, remarkable increment of the revenues of respondents on both farming and livestock with extra increase on farming revenues, significant improvement on the livelihood of the respondents with regard to potable water, connection of electricity, and acquirement of gas cookers.

Index Terms- Microfinance, Dindir, women, Sinnar state, Adam Adoma

I. INTRODUCTION

Microfinance has evolved as an economic development approach intended to benefit low income people and helps in poverty reduction. The term refers to the provision of finance services generally including saving, credit, and insurance and payment services. Microfinance aims at designing and providing access to suitable financial instrument for persons hitherto excluded from conventional and formal financial system. The excluded people tend to be the worst off section of any society. The power people are particularly women in poverty, (predominately in the formal sector) living mostly in rural areas, but also urban slums, migrants, habitations, resettlement neighborhoods for displaced (Unicons, 2006). Microfinance arose in 1980s after many started to question the viability and effectiveness of subsidizes, state-delivered credit to poor farms. In mid 1980's the subsidized target credit model supported by many donors was the object of steady criticisms because most programs accumulated large loans losses and required frequent recapitalization to continue operation. It became more and more evident that market –based solution were required. This has led a new approach that considered microfinance as an integral part of the overall financial system. Emphasis shifted from the top-down rapid disbursement of subsidized loans to target population towards the building up of the local sustainable institutions to serve the poor.

II. OBJECTIVES

The main objective of this research is to assess the impact of the funds offered by the Microfinance and administrated jointly between the Sudanese Agricultural Bank (ABSUM) and the International Fund for Agricultural Development (IFAD) on the development of rural women in Dindir locality in Sinnar state.

Sub objective of the Research were as follows:-

1. To identify the socioeconomics characteristics of the beneficiaries (loan receivers).
2. To assess the effect of microfinance on increasing the cultivated land and animal holding.
3. To assess the effect of microfinance on improving the productivities.
4. Identify the benefits generated by the microfinance on crop production.
5. Identify the benefits generated by the microfinance on the livestock production.
6. To determine the types of most effective loans offered by microfinance.
7. To assess the overall revenue of microfinance compared to revenue prior to microfinance. To assess the effect of microfinance on the life of the beneficiaries.

III. RESEARCH METHODOLOGY

The methodology used for this research was the direct interviews of the beneficiaries using structured questionnaire prepared specially for this purpose. Stratified random sample technique was used for the selection of sample. A statistical formula \( n = N/1+N(e^2) \), Yamane and Taro. (1967). was used for determining the sample size, this has resulted into a total of 338 households was determined as sample size for this study. For actual selection of those households, the entire area was divided into two main areas East Dindir and West Dindir, another step involved the determination of the villages were those households are residing. Thirty villages were determined for the conduction of the study. The entire sample size was allocated to the two main areas and the villages proportionally according to population size. The households were selected in each village were selected using random selection technique. The respondents were questioned about their socio-economic characteristics, aspects related to their farming and animal holdings with regard to use of microfinance and the outcome of those activities and the impact of the outcome of their activities on their life, etc

IV. STUDY AREA

Sinnar state is located in the south east of Sudan, the study area (Dindir locality) is located in south east of the state and adjacent of the border with Ethiopia and characterized by relatively rich rainfall. Sinnar state was selected for the purpose of this study for many reasons. Firstly: the microfinance was implemented in this state for five years consecutively. Secondly: the whole beneficiaries were women. Thirdly: the area has been described by severe backward of women in many aspects including poverty and illiteracy. Fourthly: the study area is accessible.

V. SAMPLE SIZE

The sample size was obtained by the following formula:

\[
(1) \quad ss = Z^2 \times (p)\times(1-p)
\]

\[
(2) \quad \text{Sample size} = \frac{ss}{1 + \left(\frac{ss-1}{\text{pop.}}\right)}
\]

\[
Z = Z \text{ value (e.g. 1.96 for 95% confidence level). }\; P = \text{Percentage picking a choice, expressed as decimal (0.5 used for sample size needed).}
\]

\[
c = \text{Confidence interval, expressed as decimal (e.g., .05 = \pm 5)}. \; \text{pop} = \text{Population}
\]

The sample size was determined by the desired level of precision. Scientifically, it is known that the degree of precision increases as sample size increases. Also the level of precision can be increased by strata issuing more homogeneous sub-samples (Abdalla, H. S., 2008).

VI. ANALYSIS TECHNIQUES

The data which had been collected using structured questionnaires have been initially tabulated using Excel sheet for capturing the data. The tabulated data has been analyzed using Excel package techniques for producing averages, graphs and comparison of the results. The analyzed data were sorted into the two main areas of the study area for comparison. The analysis had included the averages of land and animal ownerships, the productivities of the area cultivated and the livestock species; it also included the revenues of both farming and livestock per household in Sudanese pounds and impact on the livelihood of the beneficiaries.

VII. RESULTS

This chapter focuses on the analysis of the primary and secondary data, but the main emphases were devoted towards the analysis of the primary data which was included socio-economic characteristic of the respondents (age, educational level, marital status of the respondents and the family size) and the household economic activities which was dominated by the farming of different crops and rearing of domestic animals.

<table>
<thead>
<tr>
<th>Socio-economic Characteristics of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents Ages</td>
</tr>
</tbody>
</table>

Table 1. Respondent's distribution by age

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency</th>
<th>Percentage%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young(20-40)</td>
<td>196</td>
<td>57</td>
</tr>
<tr>
<td>Middle(41-60)</td>
<td>110</td>
<td>33</td>
</tr>
<tr>
<td>Old(Greater than 60)</td>
<td>33</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>388</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field (field survey (2017).

Table 1 is presenting the distribution of respondent ages. In order to get clear picture about the structure of the population in the study area, the respondent’s ages have been categorized into three categories mainly included young age farmers, middle age farmers, and old age farmers. This classification was based on the fact that the age is an important factor for the adoption of

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new technologies, improvement of productivities and the potentiality of participating in the programme activities (Hassan2002). In addition to that is to examine importance of different ages in the proper utilization of the funds.

As it has been illustrated in table 1, the majorities (90%) of respondents were a combination of young's and middle age, while the old age respondents were by far the minority; they are only 10% of the total respondents. This high number of young and middle age respondents indicates that the most of farmers in the study area were in the age of economic production, potentially have good awareness that allow them to access and adopt the new technologies, and have good responses to change for improving their living conditions

### Educational Levels of Respondents

**Table 2. The educational levels of respondents**

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>275</td>
<td>81.3</td>
</tr>
<tr>
<td>Elementary</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>Secondary</td>
<td>28</td>
<td>8.2</td>
</tr>
<tr>
<td>Above secondary</td>
<td>5</td>
<td>1.5</td>
</tr>
<tr>
<td>Total</td>
<td>338</td>
<td>100</td>
</tr>
</tbody>
</table>


Table 2 is presenting the educational level of respondents. Number of years of attending formal education could be an important factor in accelerating the rate of adoption of new technologies and the farmer’s awareness and access to social and economic services (Hassan2002). According to table 2, this table has indicated that the illiteracy rate is very high among the population under the study. Almost 81% of the respondents were illiterate or without formal education, while only about 19% of respondents had different level of formal education of whom 9% were obtained elementary educational level, 8.2 % obtained secondary and only 1.5 % were managed to progress above secondary school level. The high percentage of illiteracy among the respondents could indicate the level of challenges facing the participants in order to achieve the programme benefits which assumed to determine standard of living.

### Marital Status

**Table 3. Distribution of respondents by material status**

<table>
<thead>
<tr>
<th>Status</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>293</td>
<td>87</td>
</tr>
<tr>
<td>Single</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td>Divorced</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>338</td>
<td>100%</td>
</tr>
</tbody>
</table>


The marital status is quite essential in the rural areas, especially with regard to household management and the diversification of income for the family. As it has been illustrated in table 3, about 87% of the respondents were married. There is high potentiality that the married respondent could have larger household size than those not married. The increasing number of the family members is the sign of the availability of labor within the family, which they could contribute for increasing the family income and the improvement of the household livelihood status.

### Family Size

**Table 4. Family Size**

<table>
<thead>
<tr>
<th>Family size</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small size(1-5)</td>
<td>98</td>
<td>29</td>
</tr>
<tr>
<td>Medium (6-10)</td>
<td>199</td>
<td>59</td>
</tr>
<tr>
<td>Large(11 and more)</td>
<td>41</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>338</td>
<td>100</td>
</tr>
</tbody>
</table>


Table 4 is presenting the average family of respondents. Family size consists of all family members living in one house and sharing the family resources, the household members include the household head, and the other members which might include the couple in case of married, the children, and any other members living within the house premises and sharing the available resources. The
Household size is a crucial issue in development programme planning as the services that any programme planning, as the services that any programme can distribute is ought to be based on the number of family for whom the living condition is to be improved, and then adjust the programme activities accordingly (Nasr dine 2002).

Table 4 shows that the total respondents have been dominated by medium age category. The average family size was estimated as eight family members per householders.

### Households Economic Activities

Table 5. Households Economic Activities

<table>
<thead>
<tr>
<th>Activities</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming and Animal rearing</td>
<td>290</td>
<td>86</td>
</tr>
<tr>
<td>Employment</td>
<td>48</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>338</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>


Table 5 is showing the different activities for the different households. The table has indicated that about 86% of the respondents were engaged in farming or rearing of domestic animals or both activities, about 14% of the respondents were found to be with regular jobs.

### Household’s Economic status

#### Household’s Economic Status prior to use of Credit

Crop Production

The most crops of cultivated by the householders were included sorghum, sesame, groundnut and etc (Hassan2012).

Table 6. Crop Production Status prior to use of Credit

<table>
<thead>
<tr>
<th>Crops</th>
<th>Area cultivated in Ha</th>
<th>Yield in ton per Ha</th>
<th>Revenue in SDG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Dindir</td>
<td>East Dindir</td>
<td>West Dindir</td>
</tr>
<tr>
<td>Sorghum</td>
<td>0.43</td>
<td>0.44</td>
<td>0.44</td>
</tr>
<tr>
<td>Sesame</td>
<td>0.43</td>
<td>0.42</td>
<td>0.16</td>
</tr>
<tr>
<td>Groundnut</td>
<td>0.42</td>
<td>0.43</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.30</strong></td>
<td><strong>1.30</strong></td>
<td><strong>0.73</strong></td>
</tr>
</tbody>
</table>

Source: Field survey 2017

Table 6 shows the area cultivated in hectares per household and yield in tons per hectare, and total revenue per crop and per household for all the cultivated crops in the two regions in the study area in 2012. This is indicating the status prior to use of credit. On average the total area cultivated by different crops including sorghum, sesame, and groundnut was approximately 1.3 hectares in both administrative units, while the yield was estimated at about 0.73 and 0.71 tons per hectare in West and East Dindir administrative units respectively. And also the total revenue per household was estimated approximately 1400 Sudanese pounds.

### Livestock Production:

Livestock Production status prior to credit

Table 7. Average Production of Milk in liters per Animal per day prior to microfinance.

<table>
<thead>
<tr>
<th>Animals</th>
<th>Ownership of different animal species</th>
<th>Yield milk(liter) per household</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal species</td>
<td>West Dindir</td>
<td>East Dindir</td>
<td>West Dindir</td>
</tr>
</tbody>
</table>

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Table 7 is showing the ownership of different animal species by household. Cattle was dominated the different animal species in both administrative unit. On average there are about eight cows per household. This is followed by sheep on average about five sheep per household, the least ownership was goats, and there are only about two gats per household. On relation to animal products, there are about three liters per household from the cattle; which means that only about half a liter per cow per day. But about the production of milk by sheep and goats was very low and only about quarter of liter of milk per sheep or goat per day. The low productivities of animal has affected the overall revenue of from animal production. On average there are only about five hundred per household.

<table>
<thead>
<tr>
<th></th>
<th>Cattle</th>
<th>Sheep</th>
<th>Goats</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>7.7</td>
<td>4.8</td>
<td>1.8</td>
<td>4.3</td>
</tr>
<tr>
<td>%</td>
<td>5.5</td>
<td>0.6</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Value</td>
<td>460.1</td>
<td>35.8</td>
<td>9.4</td>
<td>505.41</td>
</tr>
<tr>
<td>$</td>
<td>464.1</td>
<td>39.2</td>
<td>9.3</td>
<td>512.6</td>
</tr>
</tbody>
</table>

Source: Field survey 2017.

Table 8 is determining the institutions that contributed in financing farming and animal production through microfinance approach over time in the study area, also indicated the objectives of every institution behind the funding and communities benefited from the microfinance.

<table>
<thead>
<tr>
<th>Institutions</th>
<th>Object</th>
<th>Focus</th>
<th>Contribution%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudanese Bank(ABSUM)</td>
<td>Increasing income</td>
<td>Poorest households</td>
<td>50%</td>
</tr>
<tr>
<td>IFAD(ABSUM)</td>
<td>Reduce poverty</td>
<td>Poorest households</td>
<td>50%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Field survey 2017

Table 9 is indicating the development of microfinance overtime in the study area. It has been indicated that the funding was started since 2012 but it was in small scale; the size of households funded in 2013 was only represented about 12% of the households included in the sample size related to the study. The funding continued since 2012 in ascending manner. The largest group of households received microfinance was during the physical years 2015 and 2016 with 30% and 36% of the total sample size of the study. This is indicates the awareness of the communities by the usefulness of this type of funding in increasing their income and the improvement of their livelihood. The upcoming paragraphs would explain the impact of funding on the life of the communities dealt with microfinance.

<table>
<thead>
<tr>
<th>Year</th>
<th>No of financed households</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>40</td>
<td>12</td>
</tr>
<tr>
<td>2014</td>
<td>74</td>
<td>22</td>
</tr>
<tr>
<td>2015</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>2016</td>
<td>124</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>338</td>
<td>100</td>
</tr>
</tbody>
</table>


Table 10 is showing the allocation of funds to cultivated crops in the study area. The funding was most allocated to Sorghum, Sesame, and Groundnut with percentages 38%, 33%, and 29% respectively.

<table>
<thead>
<tr>
<th>Crops</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum</td>
<td>130</td>
<td>38</td>
</tr>
<tr>
<td>Sesame</td>
<td>110</td>
<td>33</td>
</tr>
<tr>
<td>Groundnut</td>
<td>98</td>
<td>29</td>
</tr>
</tbody>
</table>
Table 10 is presenting the allocation of funds between the different crops cultivated in the study area. Seemingly there is no significant difference in relation to the importance of the crops cultivated in the study area. It should be noted that sorghum was mainly cultivated for the household consumption, however; the surplus is also sold out in many occasions. The other two crops were included sesame and groundnut both of them were cultivated for the cash income purpose, nevertheless; 38%, 33%, and 29% of the funds were allocated for sorghum, sesame, and groundnut respectively.

### Crops Production

**Table 11. The Impact of Microfinance on Area Cultivated in 2016**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area cultivated in Ha</th>
<th>Yield in ton per Ha</th>
<th>Revenue in SDG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Dindir</td>
<td>East Dindir</td>
<td>West Dindir</td>
</tr>
<tr>
<td>Sorghum</td>
<td>0.44</td>
<td>0.45</td>
<td>0.86</td>
</tr>
<tr>
<td>Sesame</td>
<td>0.43</td>
<td>0.44</td>
<td>0.23</td>
</tr>
<tr>
<td>Groundnut</td>
<td>0.59</td>
<td>0.58</td>
<td>0.29</td>
</tr>
<tr>
<td>Total</td>
<td>1.45</td>
<td>1.47</td>
<td>1.38</td>
</tr>
</tbody>
</table>

Source: field survey 2017.

Table 11 shows the area cultivated in hectares per household and yield in tons per hectare, and total revenue per crop and per household for all the cultivated crops in the two regions in the study area in 2016. This is indicating the status prior to use of credit. On average the total area cultivated by different crops including sorghum, sesame, and groundnut was approximately 1.45 hectares and 1.47 hectares in West Dindir and East Dindir administrative units respectively, while the yield was estimated at about 1.38 and 1.35 tons per hectare in West and East Dindir administrative units respectively. And also the total revenue per household out of those cultivated crops was estimated approximately to be 4597 and 450 Sudanese pounds for West Dindir and East Dindir administrative units respectively.

### Analysis of Areas Cultivated

**The Impact of Microfinance on the Area Cultivated by Different Crops**

**Table 12. Average Area Cultivated, over years**

<table>
<thead>
<tr>
<th>Crops</th>
<th>Area Cultivates in Hectares</th>
<th>Percentage of increment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Dindir</td>
<td>West Dindir</td>
</tr>
<tr>
<td>Sorghum</td>
<td>0.44</td>
<td>0.45</td>
</tr>
<tr>
<td>Sesame</td>
<td>0.42</td>
<td>0.44</td>
</tr>
<tr>
<td>Groundnut</td>
<td>0.43</td>
<td>0.58</td>
</tr>
<tr>
<td>Total</td>
<td>1.30</td>
<td>1.47</td>
</tr>
</tbody>
</table>

Source: Field survey 2017

Table 12 is showing the comparison of area cultivated in 2012 prior to funding with area cultivated in 2016 after the funding for all cultivated crops. The increasing of area cultivated for sorghum was not significant in both administrative units; it was only about 2% in both of them. The area for sesame was only increased by 5% in West Dindir administrative. But the significant increasing was observed in cultivation of the groundnut, it has been increased by 35% and 40% for West Dindir and East Dindir administrative units respectively. But in general the area was increased by 13% and 12% in West Dindir and East Dindir administrative units respectively.

### The Impact of Microfinance on the Productivities of cultivated crops
Table 13. The yield in ton per hectare

<table>
<thead>
<tr>
<th>Crops</th>
<th>Yield in ton per hector</th>
<th>Percentage of increment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Dindir</td>
<td>West Dindir</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>2016</td>
</tr>
<tr>
<td>Sorghum</td>
<td>0.45</td>
<td>0.85</td>
</tr>
<tr>
<td>Sesame</td>
<td>0.14</td>
<td>0.22</td>
</tr>
<tr>
<td>Groundnut</td>
<td>0.12</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Source: Field survey 2017

Table 13 is showing yield of hectare per ton for different cultivated crops in the study area. Unlike the area cultivated, the average productivities for all cultivated crops have been increased significantly after the funding. The yield for sorghum was increased by 89% and 95% for West Dindir and East Dindir administrative units respectively; the yield for sesame was increased by 57% and 44% for West Dindir and East Dindir administrative units respectively; but the increase of yield for the groundnut was very remarkable in both administrative units; it was increased by 133% in West Dindir administrative unit and 123% in East administrative unit. The increasing of productivities for all crops was on the contrary for the average area cultivated it indicates that the funds were used for farming technologies such as improved seeds, pesticides, mechanized cultivation rather than for increasing the area cultivated. It also indicates that the microfinance has played very significant role in increasing the productivities; which means that increasing fund for an extra land cultivated in the future would guarantee the improvement of the livelihood for the communities using the microfinance and general development in the area and ultimately the alleviation of poverty of the population which is the objectives of the funding donors.

The Impact of Microfinance on the Revenues of Cultivated Crop per Household

Table 14. Outputs of cultivated crops over years

<table>
<thead>
<tr>
<th>Crops</th>
<th>Crop Revenue per household in Sudanese pounds</th>
<th>Percentage of increment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Dindir</td>
<td>West Dindir</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>2016</td>
</tr>
<tr>
<td>Sorghum</td>
<td>595</td>
<td>1675</td>
</tr>
<tr>
<td>Sesame</td>
<td>615</td>
<td>1959</td>
</tr>
<tr>
<td>Groundnut</td>
<td>193</td>
<td>867</td>
</tr>
<tr>
<td>Total</td>
<td>1402</td>
<td>4501</td>
</tr>
</tbody>
</table>

Source: Field survey 2017

Table 14 is clearly presenting the revenues of crops cultivated in the study in Sudanese pounds per household. It also attempting to describe the actual changes occurred as the result of using the microfinance. The table has indicated significant increase in the revenues of all crops in both administrative units. In West Dindir administrative unit it has been indicated the increase in the revenue of different crops was included 182% for sorghum, 219% for the sesame, and 349% for the groundnut; the overall increase was estimated at 221%. While in East Dindir the increase in the revenues was included 185% for the sorghum, 237% for the sesame, 382% for the groundnut, and 214% as overall increase in the revenues. These increments could only be attributed to the use of microfinance which tremendously increased the productivities which resulted in total production beside the stability of the area cultivated.

The Impact of Microfinance on Livestock Production

Livestock form an important component of the agricultural sector, with production mainly based on traditional pastoral systems (90% of the livestock in the country belong to the traditional pastoral production systems). The Ministry of Animal Wealth estimated the camels, cattle, sheep and goats population in 2004 with about 3.3, 38.3, 48.0 and 42.0 million heads respectively as well as 37.0 millions of poultry.

Livestock provide milk, meat, hides and skins, hair, manure, transport, subsistence and income...
generating for many households. The production of milk and meat by different classes of livestock is shown in Table 2. The contribution of agriculture sector to GDP in 1999 was accounted for 49.8%, of which 22.3% was from the livestock component. Live animals (especially sheep e.g. in 2003 some 1,351,685 live sheep were exported, meat and hides and skins are important items in the country’s exports (Table 2) and significantly contributes to foreign exchange earnings. Despite the significant roles played by animal production in Sudan but still government spent huge amounts of hard currencies for importing animal product to country this for example in 2013 imported considerable quantities of dairy products amounted to 66,104 tons of milk with cost about US$ 18,332,000. (Ministry of Animal Wealth Resources).

Table 15. Households with livestock in the study area

<table>
<thead>
<tr>
<th>Livestock</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow</td>
<td>125</td>
<td>37</td>
</tr>
<tr>
<td>Sheep</td>
<td>108</td>
<td>32</td>
</tr>
<tr>
<td>Goat</td>
<td>105</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>338</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Field survey 2016

Table 15 is presenting the household own different animal species in the study area. The table has indicated that 37% of the households own cattle, 32% own sheep, and 31% own goats. However, some of the households own the different of the animal species. This indicates that besides farming there are many household own livestock as another activity besides farming.

The Impact of Microfinance on Livestock Population & Production

Table 16. Average Animal Holdings per Household

<table>
<thead>
<tr>
<th>Crops</th>
<th>Number of Animal Heads per Household</th>
<th>Percentage of Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Dindir 2012</td>
<td>West Dindir 2016</td>
</tr>
<tr>
<td>Cattle</td>
<td>7.7</td>
<td>12.77</td>
</tr>
<tr>
<td>Sheep</td>
<td>4.8</td>
<td>4.86</td>
</tr>
<tr>
<td>Goats</td>
<td>1.8</td>
<td>2.09</td>
</tr>
<tr>
<td></td>
<td>West Dindir 2016</td>
<td>West Dindir 2016</td>
</tr>
<tr>
<td>Cattle</td>
<td>8</td>
<td>12.92</td>
</tr>
<tr>
<td>Sheep</td>
<td>5.5</td>
<td>5.04</td>
</tr>
<tr>
<td>Goats</td>
<td>1.08</td>
<td>2.06</td>
</tr>
</tbody>
</table>

Source: Field survey 2017

Table 16 is presenting the average animal holding per household in the two administrative units prior of microfinance funding and after the funding. There is no variation in the average of animal holding per household in the two administrative units. The current average animal holding per household is approximately thirteen cows, five sheep, and only tow goats. Different animal species have been increased tremendously in both administrative units with exception of sheep which only increased by 1% in West Dindir and decreased by 8% in East Dindir administrative unit. This is probably indicates that most communities tend to sold out sheep for their needs because the price of sheep is relatively higher compared to goats.

Milk Production

Table 17. The Status of Milk Production per Household over years

<table>
<thead>
<tr>
<th>Milk production per household in liters per day</th>
<th>West Dindir 2012</th>
<th>Percentage of increment</th>
<th>East Dindir 2012</th>
<th>Percentage of increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow</td>
<td>3.3</td>
<td>6.47</td>
<td>96%</td>
<td>3.4</td>
</tr>
<tr>
<td>Sheep</td>
<td>0.6</td>
<td>0.60</td>
<td>0%</td>
<td>0.5</td>
</tr>
<tr>
<td>Goat</td>
<td>0.4</td>
<td>0.41</td>
<td>2%</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Table 17 is showing the comparison of milk productivities prior to funding and after funding. Seemingly the milk production in the study area was almost generated from the cattle rather than sheep or goats. The milk production was increased by 96% in West Dindir administrative unit and by and 106% in East Dindir administrative unit. While the sheep milk was only increased by 22% in East Dindir, but the production of milk for goats was very little or not used for milk production.

The Impact of Microfinance on the Revenues of Livestock Production

Table 18. Productivities and Revenues of Animal Production

<table>
<thead>
<tr>
<th>Livestock</th>
<th>No. of animals</th>
<th>Yield of milk (liter) per household per day</th>
<th>Revenue per year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Dindir</td>
<td>East Dindir</td>
<td></td>
</tr>
<tr>
<td>Cattle</td>
<td>12.77</td>
<td>12.92</td>
<td>6.47 7.0</td>
</tr>
<tr>
<td>Sheep</td>
<td>12.77</td>
<td>12.92</td>
<td>0.60 0.61</td>
</tr>
<tr>
<td>Goat</td>
<td>2.09</td>
<td>2.06</td>
<td>0.41 0.49</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>4534 4956</td>
</tr>
</tbody>
</table>

Source: field survey

Table 18 is showing the average productivities of milk production per household per day, average animal holdings for all the different animal species, and average the revenue out of the animal production per household in 2016.

Table 19. Outputs of livestock Production over years

<table>
<thead>
<tr>
<th>Crops</th>
<th>Milk Revenues per household in Sudanese pounds</th>
<th>Percentage of increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>2278 4465 2371 4884 96% 106%</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td>53 52.3 44 54.2 0% 22%</td>
<td></td>
</tr>
<tr>
<td>Goats</td>
<td>16 16.7 18 18.1 2% -2%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2347 4534 2434 4956 93% 104%</td>
<td></td>
</tr>
</tbody>
</table>

Source: field survey

Table 19 is presenting the comparison of animal production revenues for the period prior to microfinance funding and after the funding. The study has indicated that there significant increase of the revenues out of the milk production. The revenue out of milk production was increase 96% in west Dindir and 106% in east Dindir. In consideration of the different animal species the overall increase of revenues of milk production was increased by 93% in West Dindir administrative unit and by 104% in East Dindir administrative unit for each household.

Overall Analysis of Microfinance Impact on the Beneficiaries in the Study Area

The below paragraphs are attempting to summarize the overall benefits generated by the funding of the microfinance on the life of the beneficiaries and the changes occurred in the community due to the use of the microfinance by some of the community members in the study area.
**Area Cultivated**

Figure 1. The Impact of Microfinance on Area Cultivated

Figure 1 is presenting the details of average holdings per household in the study area. The use of microfinance did not show significant increase in the area cultivated for all the crops with exception of groundnut area cultivated which was increased by 35% in West Dindir and 40% in East Dindir. Actually the original area cultivated in 2012 was approximately only half a hectare. Therefore, despite the significant increase in the percentage of the area cultivated by the groundnut but the area cultivated remained quite small. The increase in area cultivated by other crops was not exceeded five percent. The overall increment of the area cultivated was 13% West Dindir and 12% in East Dindir. It should be concluded that the funds allocated to farmers were not directed for increasing the area cultivated and it seems that it was directed for the other farming activities for increasing the productivity which looks positive sign that the traditional farmers think about increasing the productivity through best practices when they get resources.

**Animal Holding**

Figure 2. The Impact of Microfinance on Average Animal Holding per Household

Figure 2 is presenting the details of average animal holding per household in the study area. The average animal holding of different species per household prior to the introduction of the microfinance in the study area was about seven cattle, approximately five sheep, and about two goats in West Dindir administrative unit and about seven cattle, six sheep, and two goats per household in East Dindir unit. The introduction of the microfinance has increased the cattle by 66%, sheep by only 1% and goats by 16% in West Dindir administrative unit. Also in East Dindir unit has increased the cattle by
62%, sheep was decreased by 8%, and the goats increased by 91%. This is clearly indicating the usefulness of the microfinance for supporting the poor families. Apparently the majority of the communities prefer to keep the cattle for milk production and the sheep and goats for selling for different purpose, because the populations of the aforementioned animal species in most cases have not been increased but in some case decreased.

**Productivities:**

The productivities are meant by average yield per unit of production, in this regard it means the productivity of crop production unit for different cultivated crops in which ton per hectare was used for measuring the productivity and the animal production the average liters produced per day per animal for the different animal species had been used.

**Crops Productivities**

*Figure 3. The Impact of Microfinance on Average Productivities of Cultivated Crops in tons per hectare*

Figure 3 is presenting the details of average productivities of different crops cultivated in the study area. The microfinance has influenced the productivities of all cultivated crops in the study area. The influence was varying from crop to another, however; the increment of productivities was very significant and profitable to all farmers. Sorghum productivity was increased by 89% in West Dindir administrative unit and by 95% in East Dindir administrative unit. While increment in the productivities of sesame was slightly lower than sorghum but it was also noticeable, in West Dindir it was increased by 57% and in East Dindir by 44%. At the same time the increments for groundnut is also remarkable it reached 133% in West Dindir and 123% in East Dindir. The increments in the productivities of those crops are the main advantages of the microfinance. It should be noted that the area cultivated was almost remained unchanged or minor changes, but the real change was occurred in the productivities of crops which is matching the objectives of the donors (increasing income and reduction of poverty).

**Livestock Productivities**

*Figure 4. The Impact of Microfinance on Average Productivities of Milk Production in liters per Household*

Figure 4 is presenting the increment of milk production per household. The increase of milk productivities from cattle is quite remarkable; it has been increased by 96% in West Dindir and by 106%
in East Dindir which represent the core production of milk in each family. The productivities of milk from the other animal species were very low and the increments were not significant. This could be attributed to the fact that those other animal species (sheep and goats) were not supported by the microfinance. The major support was directed toward the cattle. Nevertheless, the production of cattle is compensating the production of the other species.

The Revenues

The Revenues of Cultivated Crops

Figure 5. The Impact of Microfinance on Average Revenue of Cultivated crops in Sudanese pounds per household

Figure 5 is presenting the increments in revenues of cultivated crops per household. Now it has become obvious that the introduction of microfinance on funding of farming activities of cultivated crops in the study area has significantly increased the farmer’s income out of the farming activity. The returns of sorghum and sesame have been almost increased by approximately 200% or more, while groundnut was increased by near 349% in West Dindir and 382% in East Dindir.

Table 20. Crops Revenues in Sudanese Pounds

<table>
<thead>
<tr>
<th>Crops</th>
<th>Crop Revenue per Household in Sudanese Pounds</th>
<th>Percentage of increment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td>2016</td>
</tr>
<tr>
<td>Sorghum</td>
<td>595</td>
<td>1675</td>
</tr>
<tr>
<td>Sesame</td>
<td>615</td>
<td>1959</td>
</tr>
<tr>
<td>Groundnut</td>
<td>193</td>
<td>867</td>
</tr>
<tr>
<td>Total</td>
<td>1402</td>
<td>4501</td>
</tr>
</tbody>
</table>

The Revenue of Milk Production

Figure 6. The Impact of Microfinance on Average Revenue of Animal Production in Sudanese pounds per household

Figure 6 is presenting the increments in revenues of milk production per household in the study area. It is clear that the percentage of revenue increments for animal production is lower than the
percentage of revenue increments of farming activity. The revenue of cattle milk was increased by 96% in West Dindir and 106% in East Dindir. But the low increments in the productivities of sheep and goats production have been reflected in the revenues of animal production, the revenue of those animal categories were not significantly increased with exception of sheep in East Dindir which increased by only 22%.

Table 21. Milk Revenues in Sudanese Pounds

<table>
<thead>
<tr>
<th>Animal species</th>
<th>Milk Revenues per household in Sudanese pounds</th>
<th>Percentage of increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West Dindir 2012</td>
<td>West Dindir 2016</td>
</tr>
<tr>
<td>Cattle</td>
<td>2278</td>
<td>4465</td>
</tr>
<tr>
<td>Sheep</td>
<td>53</td>
<td>52.3</td>
</tr>
<tr>
<td>Goats</td>
<td>16</td>
<td>16.7</td>
</tr>
<tr>
<td>Total</td>
<td>2347</td>
<td>4534</td>
</tr>
</tbody>
</table>

Overall Revenues

Figure 22. The Impact of Microfinance on the Overall Revenue of Farming and Livestock Production in Sudanese Pounds per Household

<table>
<thead>
<tr>
<th>Overall Revenues in Sudanese Pounds</th>
<th>West Dindir</th>
<th>East Dindir</th>
<th>West Dindir</th>
<th>West Dindir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>2012</td>
<td>2016</td>
<td>2012</td>
<td>2016</td>
</tr>
<tr>
<td>Farming</td>
<td>1402</td>
<td>4501</td>
<td>1462</td>
<td>4597</td>
</tr>
<tr>
<td>Livestock</td>
<td>2347</td>
<td>4534</td>
<td>2434</td>
<td>4956</td>
</tr>
<tr>
<td>Overall</td>
<td>3749</td>
<td>9035</td>
<td>3896</td>
<td>9553</td>
</tr>
</tbody>
</table>

| Increments percentages              | 241% | 245% |

Table 22 is presenting the overall revenue of both farming and livestock production of the household economy. The microfinance has increased farming revenue by 321% in West Dindir and 314% in East Dindir; it also increased the livestock revenue by 193% in West Dindir and 204% in East Dindir. This indicates that the microfinance in higher in farming compared to livestock. The overall influence of the microfinance has indicated that the revenue has been increased by 241% in West Dindir for both farming and livestock production and 245% in East Dindir.

The Impact of Microfinance on Improvement of Household’s Conditions

Table 23. Household’s Asset Improvement in West Dindir Administrative unit.

<table>
<thead>
<tr>
<th>Participation on community water sources</th>
<th>Before funding</th>
<th>After Funding</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>25</td>
<td>313%</td>
</tr>
<tr>
<td>Sending of children to school</td>
<td>3</td>
<td>16</td>
<td>533%</td>
</tr>
<tr>
<td>Connection of electricity to house</td>
<td>5</td>
<td>10</td>
<td>200%</td>
</tr>
<tr>
<td>Acquisition of Gas Cooker</td>
<td>20</td>
<td>120</td>
<td>600%</td>
</tr>
</tbody>
</table>

Source: field survey 2017.

Table 24. Household’s Asset Improvement in East Dindir Administrative unit.

<table>
<thead>
<tr>
<th>Participation on community water sources</th>
<th>Before funding</th>
<th>After Funding</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>15</td>
<td>750%</td>
</tr>
<tr>
<td>Sending of children to school</td>
<td>2</td>
<td>9</td>
<td>450%</td>
</tr>
<tr>
<td>Connection of electricity to house</td>
<td>3</td>
<td>40</td>
<td>133%</td>
</tr>
<tr>
<td>Acquisition of Gas Cooker</td>
<td>10</td>
<td>103</td>
<td>1030%</td>
</tr>
</tbody>
</table>

Source: field survey 2017.
It is highly expected that the improvement of the households returns would automatically get reflected into the life of the households and increases their assets specially those unaffordable items when the resources are limited. In addition to the analysis of the impact of microfinance on items directly funded, the study also attempted to study the change occurred in the livelihood level of the households. Tables 23 and 24 are presenting the level of improvements on the life of the communities in the study area. Three main items were investigated including the improvement of the water, education, and power. The study had indicated tremendous improvements on those items.

Potable Water
The communities in those areas are in most cases depending on shallow wells on their home consumption and watering of their animals. Due to increasing income of households as the result of funding; great numbers of households have managed to contribute with other for constructing communal shallow wells for their communities. This has increased the amount of water per household and shortened the distance for getting the water and time saving.

Education
The number of children sent to school has been increased by almost 500%. Indeed the original number of pupils enrolled in schools was quite low. However, that number has been increased tremendously. Funding the children was very laborious to most families; in most cases the drop out of schools was quite high.

Electricity Power
The rural communities in most case they were not able to use the essential facilities such as connection of water or power to their house. In this study the number of households who managed to connect power supply (electricity) to their houses has been significantly increased (see table 23 and 24). At the same time also the number of households who managed to own gas cooker has been increased. This is not only useful to their families, but it is quite useful for the environment, definitely it conserves the environment which is the source of life for those communities and mankind in general. Because in the absence of those facilities the communities are compelled use the forest for their relevant needs.

VIII. RECOMMENDATIONS
The study recommends the following:
1. Expansion of the micro-finance beneficiaries.
2. Extension of the project life span to cover other activities.
3. Encouragement of the communities to form their own cooperatives for lending.

Periodic evaluation of the project to measure the impact of the project on the beneficiaries and the community

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AUTHORS
First Author – Adam Adoma Abdalla, PH.D holder in Management of Resources, Assistant Professor in Agricultural Economics (Faculty of Agriculture, University of Sinnar, Sudan). He acquires multi-experiences in academic research, humanitarian and civil affairs, integrated development projects, and long experience in socioeconomic research related to conflict analysis, project management, and environmental issues.
Smart Assistance System for the Visually Impaired

Prof. Priya U. Thakare, Kote Shubham, Pawale Ankit, Rajguru Ajinkya, Shelke Om

Abstract- Physical movement is one of the biggest challenges for the visually impaired. People with complete blindness or low vision often have a difficult time in self-navigating unfamiliar environments. Traveling or simply walking down a crowded street may pose great difficulty. So, many people with low vision tend to bring a sighted friend or family member for assistance. It also becomes difficult for them to keep a track of their routine environments .This system proposes conglomeration of technologies like Image processing, Speech processing etc, so the problems faced by blind people can be reduced to certain extent. Object recognition methods in computer vision , Image processing, Text to Speech conversion can be embedded in a single object : SMART GLASSES (spectacles).

Index Terms- Blind navigation, Image processing, Voice processing, Object recognition, object detection, Face recognition.

I. INTRODUCTION

Of the 36 million people around the world who are Visually impaired, from that about 15.0 million are found in India. India is now the world's largest number of blind visually impaired. India requires 2-2.5 lakh eyes every year, it has 109 eye banks manage to collect around of just 25,000 eyes, 30% of which can't be utilized. Many of the people cannot afford such eyes treatments. To be categorized as blind, there is a complete loss of vision. Blindness cannot be improved by simple visual aids such as glasses. For the indigents blindness is a drawback. So this paper present a system to aid the blind people. The Assistor Device is a device which is a passive type intelligent glasses that focuses on aiding the blind or people with low vision capabilities to move around from one place to another place without having to worry about anything around.

As a result, visually impaired people usually are dependent on other sensory information in order to avoid obstacles and navigate. For instance, the movement of dynamic hurdle produces noise allowing blind people to decide the approximate/rough location using their auditory senses. The additional use of tactile senses is required for precise obstacle position. For this purpose a white cane is usually used by visually impaired, which have 2 disadvantages. It is comparatively short and the detection occurs only by making contact with the obstacle which could sometimes may be harmful. Another popular navigation tool for blind people is a service guide dog. Compared to white canes, dog guides are able to detect obstacles as well as moving around them, however they are expensive and have a very less working life.

However, many obstacle detection and avoidance systems have been introduced during the last decade to assist visually impaired to navigate in known or unknown, indoor and outdoor environments. This navigation can mainly be categorized as vision enhancement, vision replacement and vision substitution. Vision replacement systems provide the visual cortex of the human brain with the information either directly or via the optic nerve. Vision substitution and Vision enhancement systems have almost same working principles with respect to environment detection process, however, each provides the environmental information differently. Vision enhancement puts the information in a visual manner, whereas vision substitution typically uses tactual or auditory perception or both.

We propose a Smart system to help such visually impaired people in their basic activities of life.

Our System mainly consists of two components:
1) Wireless Camera
2) Android Device

Our main objective is to simplify the system for the users and make interaction between the two entities as easy as possible. The entire project is dependent on the Smartphone App and its reliability. It performs all the computation and calculations. A separate database is designed, where the definition of the objects are found. In the system level we could say that the novelty lies in the real-time application working on the Smartphone.

II. LITERATURE SURVEY

There are a lot of devices which assist the visually impaired for navigation indoor and outdoor. All these devices rely mainly on Global Positioning System (GPS) alone, to navigate around.

1. A Stereo Image Processing System for Visually Impaired

The above paper proposes a system utilizes stereo vision, image processing methodology and a sonification procedure to support blind navigation. The developed system includes a wearable computer, stereo cameras as vision sensor and stereo earphones, all molded in a helmet.

Limitations:

- Size of hardware required is extensive and voluminous.
- Musical stereo sound for the blind’s understanding of the scene in front (No use of voice commands).


Two things are prominently used in this paper i.e. Mobile camera and laser. The laser and the mobile is kept at static distance. The image is captured from the camera and along with it the laser is also observed. Using the static distance and the
angle between the laser point and the camera the distance is measured.

Limitations:
- Distance between the camera and the laser must be constant.
- May not work efficiently on shiny surface as laser intensity may decrease.

2. Abandoned object detection via temporal consistency modeling and back-tracing verification for visual surveillance. This paper presents effective approach for detecting abandoned luggage in surveillance video. Here the camera is fixed at a position. Hence, the dataset of images captured is static. Therefore if any irregularity is observed in the surveillance the objects are detected.

Limitations:
- The surveillance is static
- Background should be known beforehand.

III. METHODS

A. Text-to-Speech

This module comprises of image and speech processing. The main aim of this module is to acquire a 3D world real image of any text constraints area and to convert this image into text followed by providing audio output using speech processing. We are implementing a dynamic system that makes use of Google API’s for conversion of Text to Speech dynamically provided that good internet connectivity is present. If a book or any write-up is held in front of the camera frame capture the image of the text to be read by the user by using the camera. For instance, if a book or any write-up is held in front of the camera frame capture the image of the text to be read by the user by using the camera. Send the data to the android device via Bluetooth. Match each and every letter and provide the output to the user i.e. the name of the recognized face if available in the dataset through the earpiece.

B. Object Recognition

Object Recognition is a process in which Real world objects are identified using Image processing. Object Recognition is an important process which will aid visually impaired persons to locate their frequently used day to day objects. It becomes a tedious task for visually impaired person to locate these objects. Our system gives sort of visual aid that dynamically identifies objects and locates them.

Our algorithm analyses the position of the object, size of the object, shape of the object, etc. For Example, a visually impaired person is sitting on his study table. He has multiple objects in front of him such as Water Bottle, Walking Stick, Fruits, etc. So our System will help him locate all his objects.

B. Face recognition

Some face recognition algorithms identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the

relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw.

These features are then used to search for other images with matching features. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face recognition. A probe image is then compared with the face data. One of the earliest successful system is based on template matching technique applied to a set of salient facial features, providing a sort of compressed face representation.

Recognition algorithms can be divided into two main approaches, geometric, which looks at distinguishing features, or photometric, which is a statistical approach that distills an image into values and compares the values with templates to eliminate variances.

IV. ALGORITHMS

5.1.1 Face Recognition

1) Prepare a dataset of known/recognized faces.
2) Reading this dataset in our program.
3) Calculate the eigenfaces from the dataset (Training set), keeping only m images that correspond to highest eigenvalues. These m images define the face space.
4) Calculate corresponding distribution in m- dimensional weight space for each known individual, by projecting their face images in face space.
5) Loading any image format (.bmp, .jpg, .png) from given source. Detecting the faces present in the images using the CascadeClassifier in opencv.
6) We will use Face Recognizer for face recognition.
7) Calculate set of weights based on input image and the m eigenfaces by projecting the input image onto each eigenface.
8) Determine if image is known or unknown by checking to see if the image is sufficiently close to face space.
9) Text to Speech conversion using known description of person and output through earpiece.

Object recognition
1) Prepare a dataset of known/recognized objects.
2) Reading this dataset in our program.
3) Loading any image format (.bmp, .jpg, .png) from given source. Detecting the objects present in the images using Edge detection, line detection, and pattern detection algorithms.
4) Extracted objects are then compared with the know dataset.
5) Decision is based on this comparison if the object is recognized or not.
6) Once the object is recognized its respective description is extracted.
7) Text to Speech conversion using known description of object and output is provided through earpiece.

Text-To-Speech
1) Loading any image format (bmp, jpg, png) from given source. Then convert the image to grayscale and binarise it using the threshold value.
2) Detecting image features like resolution and inversion. So that we can finally convert it into a straightened image for further processing.
3) Lines detection and removing. This step is required to improve page layout analysis, to achieve better recognition quality for underlined text, to detect tables, etc.
4) Page layout analysis. In this step we are trying to identify the text zones present in the image.
5) So that only that portion is used for recognition and rest of the region is left out.
6) Detection of text lines and words. Here we also need to take care of different font sizes and small spaces between words.
7) Recognition of characters. This is the main algorithm ; an image of every character must be converted to appropriate character code.
8) Saving results to selected output format, for instance, searchable PDF, DOC, RTF, TXT.
9) Text to Speech conversion using Google API’s and output through earpiece.

V. CONCLUSION

This paper puts forward a system which allows blind people or people with low vision to detect and avoid hurdles/obstacles was implemented as an android app. The obstacle detector/recognition application provides a high detection rate on selected surroundings. The limitations of the system is the stability of glasses and using an android phone. In order to improve the robustness of this system a powerful camera could be used, allowing an improved obstacle detection. The proposed system could be also applied to smart phones that have android OS and infrared emitter & sensor, thus enabling us to measure a depth map of the environment. This system could be advanced with GPS data, a trivial feature to most of the android smart phones. Additionally, if the processing performance is improved it will allow the processing of a higher frame resolution, and thus allow more precise acquisition of the environment.

ACKNOWLEDGEMENT

Special thanks goes to our guide, Prof. Priya U. Thakare for her constant guidance and support in our project. Her keen observation along with valuable guidelines and suggestions helped us in completing this particular task. We would also like to show our gratitude to Prof. Geeta Navale for allowing us to work on this project. Also their valuable advices guided us the most in completion of this task.

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Board diversity and earning management in companies listed in Indonesian stock exchange

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Abstract- This research aims to explore the relation between company’s board diversity and earning management in Indonesian Listed Companies. As independent variable, board diversity measured by index of variation of the diversity of gender, nationality, age, and educational background. While as dependent variable, earning management measured by discretionary accruals. This research also used company’s size and type of industry as controlling variable. Data collected from Indonesian Stocks Exchange (IDX) for the past 6 years using purposive sampling method producing 298 observations, then analyzed using multiple linear regressions. The result of the research shows that board diversity have negative effect on earning management, means the higher board diversity, the lower earning management. Other finding suggested that both industrial type and company’s size does not affect earning management. Therefore it is hope that this result can be used as a consideration to maximize the company good corporate governance practice.

Key words- Board diversity, earning management, Good Corporate Governance, index of variation

I. INTRODUCTION

In the last few years, cases related on deliberate errors in reporting financial condition attract public attention to the issues on how companies should be managed. Corporate scandals such as Maxwell Corporation in the UK in 1991, Enron in the United States in 2001, Wordcom in the United States in 2002, Parmalat in Italy in 2003, AIG in the United States in 2005, and Lehman Brothers in 2008, followed by the increase of shareholders’ activeness have encouraged better corporate governance practices.

The implementation of good governance can reduce the manager’s intention to make earning management. Earning management occurs when managers use the accounting policies and manipulate transactions to change financial statements with intention of either to mislead the users of financial statements related to important numbers in the report or to gain personal benefit by manipulating the reported accounting numbers [1]. Earning management is also defined as a deliberate misreporting of a company's financial statements which occurred through a deliberate mistreatment with the aim of deceiving the users of financial statements [2].

The manager has the intention to do profit manipulation due to several reasons, such as: (1) to maximize the value of the firm, (2) to increase compensation and job security, (3) to avoid the negative effect of profit change [1]. The implementation of good corporate governance by managers can reduce the intenton t o make Earnings Management.

Corporate governance describes the framework of how companies are directed and monitored, for example: through setting company goals and monitoring of performance in relation to the established objectives. Good corporate governance aims to encourage boards and management to achieve these objectives, which are, actually, the interests of the company and its shareholders [3].

This framework combines structural and behavioral components. The structural component involves the separation of roles between the commissioner and the director and the number of independent commissioners on the board. While the behavioral component, which is used when assessing the effectiveness of corporate decision making, includes the attendance of commissioners on the board’s meetings and the disclosure of
company’s remuneration. However, unlike traditional elements, board diversity and corporate codes of ethics are seen as indicators of independence and accountability of decision making.

Some researches that focus on diversity and its effects on earning management reveals a wide range of findings. Rose [4] who conducted research in Denmark, examined the relationship between gender diversity and Tobin's Q score found no significant relationship between gender diversity and the value of Tobin's Q. Rauf [1] who examined the relationship between corporate characteristics and council on earning management found that firm size has a positive relationship to earning management, operational cash flow negatively affect earnings management, and board and race size have no effect on earnings management. Buniamin [5] who investigated the relationship between board diversity as measured by the presence of women in councils on earning management in Malaysia, found that board diversity positively affects the accrual discretion in Malaysia. The research of Lakhal [6], who investigated the relationship of women in councils in France to earning management shows that women have a positive influence on the accrual discretionary. Bala [2] who conducted a study in Nigeria, found an inverse relationship between board characteristics and earnings management, while board composition and women are positively associated with the accrual discretion.

The results of those researches which are still various make the research concerning board diversity is still interesting to conduct. This research tries to see the effect of board diversity on the earning management in the company. In this research, the ‘board’ is defined as a combination of the board of directors and the board of commissioners. To measure board diversity we are using board diversity index, four criteria are used: gender, nationality, age, and educational background. Board diversity is assumed to be high if there is a high index on board diversity index or a high variation of gender, nationality, age and educational background of board members.

The presence of board diversity in good corporate governance mechanism represent the principle of accountability and independence of decision-making. This principle of accountability should then be able to reduce the manager's intention to make earning management. Based on the previous discussion, the earning management has the potential to become an agency problem as managers manipulate profits to mislead shareholders and to achieve their personal interests. Therefore the board has an important role in reducing the level of earning management. Some researches even show that good supervision by the board is able to maintain the credibility of the financial reporting process. In this research is then proposes research hypothesis, as follows H1: Board Diversity negatively affects earnings management as shown at Figure 1.

2. Research methodology
This research uses the quantitative and qualitative data in the form of secondary data which obtained by accessing the website www.idx.co.id and using the Indonesian Capital Market Directory (ICMD). Using the purposive sampling method founded 298 observations for the past 6 years. Based on the proposed research hypothesis, it is identified three variables used in this research, they are: Board Diversity as independent variable, earning management as dependent variable, as well as types and size of the companies as control variables.

The tests on the effect of board diversity on earning management are conducted by using multiple regression analysis. Multiple regression analysis is used to show the influence of independent variables to the dependent variable. Before conducting regression analysis, classical assumption test consisted of normality test, multicollinearity test, autocorrelation test, and heterokedasitas test are done. The result of the tests then used as the basis for making conclusions.
2.1 Description and measurement of research variables

2.1.1 Board diversity

What is meant by the board is the number of members of the board of commissioners and the board of directors. Board diversity is measured based on four criteria: gender diversity within the board, the presence of non-Indonesian members in the board, the age variations of board members, and their educational background.

Board diversity is assessed from the summation of those four criteria. The result is a score with a value range between 4 for the highest value and 0 for the lowest one. The criteria for each indicator are described as follows: (1) Gender diversity and the presence of non-Indonesian board members in the board are assessed by dummy, where if there is gender diversity or any non-Indonesian member in the board will be scored 1, otherwise it will be scored 0. (2) The age variation of board members is assessed using the standard deviation of the board member's age. The result is then divided into two groups, the group with a larger standard deviation value then scored 1, whereas the one with a small standard deviation will be scored 0. (3) Educational background is measured by, firstly, classifying educational background into accounting and finance, marketing management and strategic management, law, engineering, socio-economic and others. Then the company is divided into two groups, they are diverse and non-diverse. A company is said to be diverse when less than 40 percent of council members have the same educational background [7]. The diverse group will be scored 1, while the non-diverse will be scored 0.

2.1.2 Earning management

Analysis of earning management often focuses on management’s use of discretionary accruals. Existing models range from simple models in which discretionary accruals are measured as total accruals to more sophisticated models that attempt to separate total accruals into discretionary and nondiscretionary components [8]. In this research, earning management was calculated using Jones modified model use by Dechow [8]. The formula is

\[ NDA_t = \alpha_1(1/A_{t-1}) + \alpha_2(\Delta REV_t - \Delta REC_t) + \alpha_3(PPE_t) \]  

The estimates of \( \alpha_1, \alpha_2, \alpha_3 \) and nondiscretionary accruals during the estimation period are those obtained from the original Jones model

\[ TA_t = a_1(1/A_{t-1}) + a_2(\Delta REV_t) + a_3(PPE_t) + \nu_t \]  

2.1.3 Types of industry

There are differences in terms of rules that govern specifically how financial companies institutions are run. There are certain measures that financial institutions must meet which are not enforced for non-financial companies. These rules will increase the incentive of financial company to meet the requirement. Therefore the financial company tends to make earning management. To control the industrial effect of this research, dummy is used; the non-financial company will be scored 2, while the financial one will be scored 1.

2.1.4 Company size

Firm size is assumed to have a direct effect on financial performance, as large firms will get benefit from economies of scale, market power, and access to resources over small firms [9]. Large companies are considered to have lower intension to do earning management comparing to small ones. In this research the size of the company is measured using the logarithm of the total assets of the company, so the greater the total logarithm value of company assets the greater the size of the company.
3. Finding and discussion
After analyzing data using SPSS 21 for windows program, the result shown in Table 1 below

<table>
<thead>
<tr>
<th>Table 1. Multiple Linier Regression Result.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
</tr>
<tr>
<td>Diversity</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>Company’s size</td>
</tr>
<tr>
<td>Industrial types</td>
</tr>
</tbody>
</table>

Table 1 reveals that board diversity has significant effect to earning management. It can be concluded from the number of level of significance 0.029 under the level of α of 5%, while the direction of board diversity effect on earning management is negative as shown from the negative β. From the above result, it can be said that the research hypothesis is accepted. This means board diversity negatively affects earning management. The presence of board diversity in good corporate governance mechanism represent the principle of accountability and independence of decision-making. This principle of accountability able to reduce the manager's intention to make earning management.

This research finding is in accordance with Zwet’s [11] finding that stated board diversity affects earning management. Lakhal [6] also stated that women presence inside the company’s board can reduce earning management. Board diversity in company’s board as hypothesized in this research is able to reduce earning management. It can be predicted that the role of diverse board as monitoring mechanism is able to control management’s accounting policy so that it can reduce earning management.

Table 1 also shows that the controlling variables which are company’s size and industrial type do not significantly affecting the earning management. It is concluded from the sig number, respectively 0.804 and 0.480, which are higher than the significant level of 5%.

Other findings are that the company’s size and industrial type do not affect earning management. Both large and small companies have the same incentive to do earning management. The same finding can be applied to financial and non-financial companies. Both of them have the same incentive to do earning management. These results are in accordance with Kim’s [12] finding, stated that both large and small companies manage their earnings. While industrial type doesn’t significantly affect earning management. Nurdiana [13] also stated that size of company does not affect earning management. Alexander [14] claimed that industry type and size do not influenced earning management. Furthermore he stated that earning management does not depending on the size of company.

4. Conclusion
This research aims to find out the relation between high board diversity with the earning management. High board diversity measured by the variation of gender, nationality, age, and educational background of company’s board member, while earning management measured by discretionary accruals. The result of the analysis which use 298 observations from the past 6 years show that there is a significant negative effect of board diversity on earning management. This means the higher board diversity, the lower earning management practice is. Based on this finding, the board diversity can be used as a good corporate governance mechanism since it can reduce the earning management.

Other finding is that company size and industrial type do not affect the earning management. Big or small companies have the same incentive to do earning management. The same for industrial type, either financial or...
non-financial company have the same incentive to do earning management. Earning management does not depend on size or industrial type of company.

It is hoped that the results of this research can contribute to company decision makers in relation with the strategy of choosing board member as a new approach to maximize the company’s good corporate governance practice. Furthermore it can be used as consideration for the regulator regarding regulation on the good corporate governance practice.

References

Effect of Novel Insecticides against *Helicoverpa armigera* (HBN.) on Chickpea crop under Field Conditions

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**Abstract**- The study was carried out at pulse section of Agriculture Research Institute (ARI) Tandojam. Chickpea crop is significantly important and rich in protein considered as major pulse crop in Pakistan and its surrounding and is attacked by number of insect pests, especially pod borer. The results declared that the control plot showed maximum population of *Helicoverpa armigera* throughout the study period. Whereas, after spraying novel pesticide (Radiant) at 100 ml/acre, results were maximum found as (0.75, 0.70, 0.80/plant) after 24 hours, (0.86, 0.90, 0.91/plant) after 48 hours, (0.91, 0.97, 0.94/plant) after 72 hours, (1.03, 1.08, 1.14/plant) after one week and (1.41, 1.68, 1.98/plant) after two weeks. Whereas, after the spraying of (Belt) at 50 ml/acre results (0.75, 0.80, 0.75/plant) after 24 hours, (0.80, 0.75, 0.91/plant) after 48 hours, (0.86, 0.91, 0.96/plant) after 72 hours, (1.01, 1.10, 1.05/plant) after one week and (1.41, 1.71, 1.98/plant) after two weeks were depicted. The result further revealed that (0.75, 0.70, 0.75/plant) after 24 hours, (0.86, 0.80, 0.86/plant) after 48 hours, (0.96, 1.01, 0.89/plant) after 72 hours, (0.98, 1.17, 1.10/plant) after one week and (1.42, 1.68, 1.98/plant) after two weeks after the application of (Steward) at 90 ml/acre. In conclusion our study resulted that Radiant (Spinetorm) 100ml/acre, Belt (Flubediamide) 50ml/acre and Steward (Indoxacarb) 90ml/acre showed maximum control effect on the population reduction of *H. armigera* in Chickpea crop followed by Belt and Steward, respectively.

**Index Terms**- Novel Insecticides, *Helicoverpa armigera*, Chickpea, efficacy, Field Condition.

I. INTRODUCTION

In Pakistan Chickpea, *Cicer arietinum* L. is significantly important as major pulse crop. It is rich in protein, making it vulnerable to a number of insects, roots, leaves and pods of their attacks. Gram is the third most important food legume grown in 1 million ha with 9 million ton production (FAO, 2002). It is grown in over 45 countries in all continents of the world. It is a source of high quality protein for the people in developing countries. Gram is majorly cultivated in rain and irrigated areas of Punjab province, covers an area of 1.11 m ha and 475,000 tons of grain yield (Anonymous, 2008).

Gram pod borer, *H. armigera* Huber has great economic significance on most of the crop pests. This pest is a major constraint to chickpea production caused up to several rounds of insecticide applications 100% in spite serious losses. Sometimes, in severe cases, there may be a complete crop failure. *H. armigera* is highly polyphagous pests on a wide range of food, oil and fiber crops. Because of its wide host range, multigenerational, migratory behaviour, high fecundity and existing insecticide resistance; it has become a difficult pest to be controlled. Among the main host legumes, chickpea has been reported to be severely affected by this pest. It selectively fed when growing point, and cause significant yield losses genital area of the hosts. Pest status of this species has increased steadily over the past 50 years due to the diversification of agricultural ecosystems has launched a host of winter crops such as chickpea (Knight et al., 1980). Other crops like cotton, tobacco, tomatoes, corn, cabbage, peanuts and other pulses are also attacked by *H. armigera*. In 2-5 days, the eggs hatch the larvae bore pods. 40 pods can be damaged by single caterpillar. Fully mature larvae drop to the ground to pupate. It took 30-37 days for the completion of life cycle. In one year there are 5-7 generations (Malik, 1994).

The Gram pod borer population increased greatly during the pod formation stage (Patel and Koshiya, 1999) and caused substantial damage to pods, therefore, at this stage control measures become necessary. The pesticides play vital role for the reduction of this pest (Balasubramanian et al., 2001) only if the insect population crosses the economic threshold level (ETL) and control measures are taken when population exceeds ETL. For the control of *H. armigera* different studies were carried out around the globe for proper control of this pest. In view of the significance of this pest, we conducted the present study to test the different novel insecticides in the chickpea crop under field conditions at Tandojam.

II. MATERIALS AND METHODS

The present study was conducted to test the effect of novel insecticides against *H. armigera* (hbn) on chick pea (*C. arietinum* L.) under field conditions at the Village Pusia near Tandojam. The experiment was designed in Randomized Complete Block Design (RCBD) with 4 treatments and three replications. The variety namely (Cholla) was grown by drilling method of sowing with all slandered agronomical practices examined with each Plot size of 9.8×4.6 m. Three insecticides, Radiant (Spinetorm) 100ml/acre, Belt (Flubediamide) 50ml/acre and Steward (Indoxacarb) 90ml/acre were tested in this study. All insecticides were applied with knap sack sprayer machine commonly used in the study area. The further details of each insecticide are given in Table-1. The observations were taken before and after application of the sprays. The efficacy of the insecticides was recorded after 24hrs, 48hrs, 72hrs, one week and
two weeks after spray. For this purpose, 10 plants from each replication were randomly observed and pest population was counted. The observation was recorded at morning hours (8-10 am).

The data were statistically analyzed by analysis of variance (ANOVA) and (LSD) test was performed by measuring the means.

### Table-1 Insecticides with their trade, common names, group, Manufacturing and doses used in present study

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Common Name</th>
<th>Group Name</th>
<th>Manufacturing</th>
<th>Dose/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiant</td>
<td>Spinetorm</td>
<td>New Chemistry</td>
<td>Arysta Life Science</td>
<td>100ml/Acre</td>
</tr>
<tr>
<td>Belt</td>
<td>Fubediamide</td>
<td>Pyrethroid</td>
<td>Bayer Crop Science</td>
<td>25ml/Acre</td>
</tr>
<tr>
<td>Steward</td>
<td>Indoxacrab</td>
<td>New Chemistry</td>
<td>Duepond</td>
<td>175ml/Acre</td>
</tr>
<tr>
<td>Control</td>
<td>Without Pesticide</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### III. RESULTS

The present study was carried out to examine the effect of novel insecticides against *H. armigera* on chickpea crop under field conditions at Village Pussia near Tandojam, Sindh-Pakistan.

**First spray**

The pre-treatment and post-treatment after 24, 48, 72 hours, one week and two weeks results after the application of first spray of tested insecticides against gram pod borer are presented in Table-1. At pre-treatment observations the average populations of *H. armigera* on sub plots (T₁, T₂, T₃) and T₄ control were (2.08 ± 0.19), T₂ (2.12 ±0.2 ), T₃ (2.14 ±0.19 ) and control (3.13) per plant, respectively . The post treatment observations after 24 hours interval of insecticides application revealed that the average pest populations in T₁, T₂, T₃ were (0.75 ± 0.05),( 0.82±0.05),(1.00± 0.5) and (1.09) larvae per plant, respectively, which showed that the effect of these insecticides against *H. armigera* in ascending order was T₁ (Radiant) > T₂ (Belt) > T₃ (Steward) > T₄ (Control). Moreover, effectiveness of these pesticides varied with the time intervals, maximum effect was found after 72 hours of intervals. After 72 hours interval all pesticides lost their effectiveness. Consequently, the population of *H. armigera* started increasing. Overall performance of the pesticides revealed that Radiant performed well followed by Belt and steward. The LSD test showed that significant difference between all treatments with (P= 0.0000) value.
### Table-2  Average of the population of *Helicoverpa armigera* per plant after application of insecticides (First spray)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Pre-Treatment</th>
<th>Post-treatment</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>24 HRS</td>
<td>48 HRS</td>
</tr>
<tr>
<td>Radiant</td>
<td>2.08 ± 0.19</td>
<td>0.75 ± 0.05</td>
<td>0.86 ± 0.07</td>
</tr>
<tr>
<td>Belt</td>
<td>2.12 ± 0.2</td>
<td>0.82 ± 0.05</td>
<td>0.92 ± 0.07</td>
</tr>
<tr>
<td>Steward</td>
<td>2.14 ± 0.19</td>
<td>1.00 ± 0.05</td>
<td>0.99 ± 0.08</td>
</tr>
<tr>
<td>Control</td>
<td>3.13</td>
<td>1.09</td>
<td>1.44</td>
</tr>
</tbody>
</table>
Second Spray

The data on average population of *H. armigera* at pre-treatment and post treatment intervals of 24, 48, 72 hours, one week and two weeks are presented in Table-2. At pre-treatment observations the average populations of *H. armigera* on sub plots (T1, T2, T3 and T4) were (1.90±0.09), (2.01±0.09) (2.05±0.12) and (3.13) larvae per plant respectively. The post treatment observation after 24 hours interval of insecticides application revealed that the average pest populations in T1, T2, T3 and T4 were (0.4±0.0), 0.8, 0.9, and 1.09 larvae per plant respectively, which showed that the effect of these insecticides against *H. armigera* in ascending order was T1 (Radiant) > T2 (Belt) > T3 (Steward) > T4 (Control). It is noticed from this table that after 24 hours of insecticides application was found to be more effective against *H. armigera* than other insecticides. The post-treatment effectiveness of these pesticides varied with the time intervals, displayed the maximum effect at 72 hours intervals. After 72 hours interval all pesticides lost their effectiveness. Consequently, the population of *H. armigera* started increasing. Overall performance of the pesticides revealed that Radiant performed well followed by Belt and Steward. The overall mean population of *H. armigera* was 1.13, 1.31 and 1.51 per plant respectively. LSD test showed that significant difference between all treatments with (P= 0.0000) value.

**Table-3: Average population of *Helicoverpa armigera* per plant after application of insecticides (Second spray)**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>24 hrs</td>
<td>48 hrs</td>
</tr>
<tr>
<td>Radiant</td>
<td>1.90 ± .09</td>
<td>0.4 ± 0.0</td>
<td>0.07</td>
</tr>
<tr>
<td>Belt</td>
<td>2.01 ± 0.09</td>
<td>0.8 ± 0.7</td>
<td>0.05</td>
</tr>
<tr>
<td>Steward</td>
<td>2.05 ± 0.12</td>
<td>0.9 ± 0.0</td>
<td>0.05</td>
</tr>
<tr>
<td>Control</td>
<td>3.13</td>
<td>1.09</td>
<td>1.44</td>
</tr>
</tbody>
</table>

Spray 3

The average population of the pre-treatment observations of *H. armigera* on sub plots (T1, T2, T3) were (1.07± 0.15), (2.16± 0.19), (2.98± 0.18) and (3.13) larvae per plant, respectively. The post treatment observation after 24 hours interval of insecticides application revealed that the average pest populations in T1, T2, T3 were (0.8± 0.07), (0.75± 0.05), (0.95± 0.05) and (1.09) larvae per plant respectively, which showed the effect of these insecticides against *H. armigera* in ascending order was T1 (Radiant) > T2 (Belt) > T3 (Steward) > (Control). It is noticed from this table that after 24 hours of insecticides application Radiant was found to be more effective against *H. armigera* than other insecticides. The post-treatment effectiveness of these pesticides varied with the time intervals, displayed the maximum effect at 72 hours intervals. After 72 hours interval all pesticides lost their effectiveness. Consequently, the population of *H. armigera* started increasing. Overall performance of the pesticides revealed that Radiant performed well followed by Belt and Steward. The overall mean population of *H. armigera* was 1.13, 1.31 and 1.51 per plant respectively. LSD test showed that significant difference between all treatments with (P= 0.0000) value. From the results it is noticeable that Radiant performed better in the reduction of *H. armigera* population on chick pea crop followed by Belt and Steward throughout all the three sprays. Significant difference has been analyzed for variance between LSD tests and treatments, whereas the non-significant effects have been observed on efficacy of different insecticides at 24, 48 and 72 hours.
Table-4: Average population of *Helicoverpa armigera* per plant after application of insecticides (Third spray)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 hrs</td>
<td>48 hrs</td>
<td>72 hrs</td>
</tr>
<tr>
<td>Radiant</td>
<td>1.07 ± 0.05</td>
<td>0.8 ± 0.07</td>
<td>0.91 ± 0.08</td>
</tr>
<tr>
<td>Belt</td>
<td>2.16 ± 0.19</td>
<td>0.75 ± 0.05</td>
<td>0.97 ± 0.08</td>
</tr>
<tr>
<td>Steward</td>
<td>2.98 ± 0.18</td>
<td>0.95 ± 0.05</td>
<td>0.99 ± 0.08</td>
</tr>
<tr>
<td>Control</td>
<td>3.13</td>
<td>1.09</td>
<td>1.44</td>
</tr>
</tbody>
</table>
IV. DISCUSSION

The present study was carried out to examine the effect of novel insecticides against *H. armigera* on chickpea under field conditions. The efficacy of different treatments against *H. armigera* larvae was determined on the basis of number of larvae per plant. The data revealed that all the treatments were significantly superior over control. The maximum larval population was recorded (2.14, 2.08, 2.12) when crop was untreated. The minimum larval population was recorded (0.75, 0.70, 0.80/plant) after 24 hours, (0.86, 0.80, 0.91/plant) after 48 hours, (0.91, 0.97, 0.94/plant) after 72 hours, (1.03, 1.08, 1.14/plant) after one week and (1.41, 1.68, 1.98/plant) after two weeks of spray by Radiant. Mean while, (0.75, 0.80, 0.75/plant) after 24 hours, (0.80, 0.750.91/plant) after 48 hours, (0.86, 0.91, 0.96/plant) after 72 hours, (1.01, 1.10, 1.05/plant) after one week and (1.41, 1.71, 1.98/plant) after two weeks were observed after sprayed with Belt and (0.75, 0.70, 0.75/plant) after 24 hours, (0.86, 0.80, 0.86/plant) after 48 hours, (0.96, 1.01, 0.89/plant) after 72 hours, (0.98, 1.17, 1.10/plant) after one week and (1.42, 1.68, 1.98/plant) after two weeks sprayed by Steward were recorded. Our results are in agreement with Anis-ur-Rahman et al. 2006, who reported that indoxacarb as the most effective insecticides in reducing the larval population in chickpea crop. Wakil et al. 2006, who reported that indoxacarb was the most effective in reducing the larval population of *H. armigera* in sunflower. Karar et al. 2002 also reported that minimum larval population was recorded for lambda cyhalothrin in cotton crop. Yogeeswarudu and Venkata 2014, examine the efficacy of different insecticides. Indoxacarb 14.5 SC @ 0.5 ml was found best with minimum population of *H. armigera* larvae/five plants at first spray among all the treatments. Shahzad et al. 2003 conducted a trial for insecticides viz. cypermethrin (10 EC) at 350 ml/acre, endosulfan (35 EC) at 1000 ml/acre, lambda cyhalothrin (2.5 EC) at 250 ml/acre and chlorpyrifos (40 EC) at 800 ml/acre. endosulfan, lambdacyhalothrin, cypermethrin, in all the above mentioned aspect they proved the better comparison control.

Rashid et al. 2003, investigated the effect of insecticides i.e. Chlorpyrifos, (2500ml/ha), Endosulfan (2500ml/ha), Indoxacarb (425 ml gac-1), profenofos (2500ml/ha) and spinosad (200ml/ha) along with untreated check against gram pod borer (*H. armigera* Hubner). Among the various insecticides tested, Spinosad (Tracer) and Indoxacarb (Steward) were highly effective against gram pod borer while Endosulfan was found to be the least effective insecticides. Khan et al. 2009, conducted a trial against gram pod borer and to assess comparative efficacy of insecticides (Thiodan 40EC, Lorsban 40EC, Ripcord 10EC, Nurell-D (Chlorpyrifos + Cypermethrin 50 + 500 g/L EC) and Methomy 45 WP). Methomyl was found most effective against the tested pest under field conditions.

V. CONCLUSION

From the present research study, it was concluded that approaches for chemical management of *H. armigera* were found effective. The chemical insecticide Radiant 100ml/acre, Belt 50ml/acre and Steward 90ml/acre were found most effective in controlling *H. armigera* larval population, to reduce the pod infestation and also produce the maximum grain yield.

ACKNOWLEDGEMENT

We are thankful to Prof. Dr. Tajwer Sultanah Syed and Dr. Dr. Imran Khatri for their valuable guidance, criticism and encouragement to complete this study

REFERENCES


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Noise Mapping of the University of Agriculture Makurdi, Nigeria

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1,2,4Department of Mechanical Engineering, University of Agriculture, Makurdi, Nigeria.
3Transportation Secretariat, Federal Capital Development Authority, Abuja.

Abstract- University of Agriculture Makurdi, Benue State, Nigeria was mapped into eight noise zones using Google Earth zoomed to 50 meters above each of the locations and marked 001 - 008. At each of the locations, the noise level was recorded for 60 minutes at 5-6am, 1-2pm, and 7-8pm using a Calibrated B & K 2230 or Rion NL-11 Integrating Precision Sound Level Meters, and the experiment was repeated for fourteen days. The data generated was complied, the mean, mode, and standard deviation was calculated using SPSS version 17. Results showed that the University of Agriculture Makurdi has a mean of ±85 the noise level at convocation square and junior staff quarters was the highest at 90db, and the lowest of 52db at academic block B. Comparing with the standard noise level required for educational institution, University of Agriculture Makurdi requires immediate intervention to reduce the noise level to the acceptable limits for educational institutions.

Index Terms- Noise zones, noise level, acceptable limits.

I. INTRODUCTION

The noise level at the University of Agriculture Makurdi has a mean of ±85 the noise level at convocation square and junior staff quarters was the highest at 90db, and the lowest of 52db at academic block B. Comparing with the standard noise level required for educational institution, University of Agriculture Makurdi requires immediate intervention to reduce the noise level to the acceptable limits for educational institutions.

The World Health Organization (WHO) and the U.S. Environmental Protection Agency (EPA) recognize the harmful health effects of noise pollution. According to the Centers for Disease Control and Prevention, noise pollution is “an increasing public health problem” that can lead to a variety of adverse health effects, including hearing loss, stress, high blood pressure, interference with speech, headaches, disturbance of rest and sleep, productivity and mental health effects, and a general reduction in one’s quality of life.

In the learning context, noise affects the behavior and understanding of students, and very noisy places are unfavorable for learning and make teaching exhaustive (Hagen et al, 2002). Poor acoustical condition and high noise levels can cause many problems for the instructors and students. Besides the risk of hearing damage, noise may cause on memory, performance, headache, increase blood pressure, and disturbance with activities (Berghlund et al., 1990 and Fernandez et al., 2009). High sound levels not only affect the verbal quality of communication but also contribute to serious problems in the intellectual development of students, such as impaired learning, writing and speaking difficulties, limitations in reading comprehension and development of vocabulary (Berghlund et al, 1990).

Much of the quite extensive research evidence relating to the issue of noise in education has been produced by studies focussed on relating noise levels to particular outcomes. Notably, the results, using both experimental and observational methodologies, are remarkably consistent. The findings show that noisy conditions have direct negative effects on learning, particularly language and reading development, as well as causing indirect problems to learners through distracting or annoying them. Laboratory based cognitive psychology experiments have shown that noise affects performance on memory tasks, an effect which is at least partly explained by noise interfering with language processing. This suggests that it might be problematic to live in a generally noisy place, and real world research into the effects of chronic noise, experienced by people living near airports or busy roads, confirms this extrapolation (Haines, et al., 2001). A review of this area concluded that, ‘The evidence for effects of environmental noise on health is strongest for annoyance, sleep and cognitive performance in adults and children.’ (Stansfeld and Matheson, 2003; Evans and Hyyge, 2007). Of particular concern for education is the reliable finding, which fits with the laboratory results, that chronic noise exposure impairs cognitive functioning (Shield and Dockrell, 2003).

Koszarny showed that the noise level in study classrooms were in the range of an equivalent sound level of 60-95 dB(A) and the most frequent noise level was 80dB(A). Sound pressure

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level in corridors in break time in elementary schools was 85 dB(A) and for high schools was 77dB(A). Also studies have shown this index for classrooms with over 30 students was 3dB(A) higher than classrooms with 25 students or less (Koszarny, 1990 and 1992).

Noweir in a study of noise pollution in Jeddah schools found that the mean average Leq levels (60-89.2 dB(A)) highly exceeded the recommended levels (Noweir and Ikhwan, 1994). Zannin and Zwirtes in a study of public school classrooms found that the equivalent noise levels during class was 73.7- 74.0 dB(A) (Zannin and Zwirtes, 2009). Daily measurements of equivalent sound levels in Clark study in the classes (Leq during school day) ranged from 59 to 87 dB(A) (Clark, 2006).

World Health Organization (WHO) in the guideline for community noise has specified an appropriate background noise level for classrooms as 35dB (LAeq) during teaching sessions (WHO, 1999).

The tables below show the standards for environmental noise, dangers and permissible hearing length.

Table 1.0: Noise Level Standards.

<table>
<thead>
<tr>
<th>S/NO</th>
<th>POSSIBLE CAUSES</th>
<th>DECIBALS (db)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jet aircraft, 50 m away</td>
<td>140</td>
</tr>
<tr>
<td>2</td>
<td>Threshold of pain</td>
<td>130</td>
</tr>
<tr>
<td>3</td>
<td>Threshold of discomfort</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>Chainsaw, 1 m distance</td>
<td>110</td>
</tr>
<tr>
<td>5</td>
<td>Disco, 1 m from speaker</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>Diesel truck, 10 m away</td>
<td>90</td>
</tr>
<tr>
<td>7</td>
<td>Curbside of busy road, 5 m away</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td>Vacuum cleaner, 1 m distance</td>
<td>70</td>
</tr>
<tr>
<td>9</td>
<td>Conversational speech, 1 m distance</td>
<td>60</td>
</tr>
<tr>
<td>10</td>
<td>Average home</td>
<td>50</td>
</tr>
<tr>
<td>11</td>
<td>Quiet library</td>
<td>40</td>
</tr>
<tr>
<td>12</td>
<td>Quiet bedroom at night</td>
<td>30</td>
</tr>
<tr>
<td>13</td>
<td>Background in TV studio</td>
<td>20</td>
</tr>
<tr>
<td>14</td>
<td>Rustling leaves in the distance</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>Hearing threshold</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2.0: Environmental Noise Readings

<table>
<thead>
<tr>
<th>DECIBALS (db)</th>
<th>READING</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>Busy Street, Alarm clock</td>
</tr>
<tr>
<td>70</td>
<td>Busy Traffic, Phone ringtone</td>
</tr>
<tr>
<td>60</td>
<td>Normal Conversation at 3ft</td>
</tr>
<tr>
<td>50</td>
<td>Quiet Office, Rainfall</td>
</tr>
</tbody>
</table>

Table 3.0: Dangerous Levels of Sound and Effects.

<table>
<thead>
<tr>
<th>S/NO</th>
<th>DECIBAL (db)</th>
<th>EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>190</td>
<td>Heavy weapons, 10 m behind the weapon (greatest level)</td>
</tr>
<tr>
<td>2</td>
<td>180</td>
<td>Toy pistol fired close to ear (greatest level)</td>
</tr>
<tr>
<td>3</td>
<td>170</td>
<td>Slap on the ear, fire cracker explosion on shoulder, small arms at a distance of 50 cm (greatest level)</td>
</tr>
<tr>
<td>4</td>
<td>160</td>
<td>Hammer stroke on brass tubing or steel plate at 1 m distance, airbag deployment very close at a distance of 30 cm (greatest level)</td>
</tr>
<tr>
<td>5</td>
<td>150</td>
<td>Hammer stroke in a smithy at 5 m distance (greatest level)</td>
</tr>
<tr>
<td>6</td>
<td>130</td>
<td>Loud hand clapping at 1 m distance (greatest level)</td>
</tr>
<tr>
<td>7</td>
<td>120</td>
<td>Whistle at 1 m distance, test run of a jet at 15 m distance</td>
</tr>
</tbody>
</table>

Threshold of pain, and fast-acting hearing damage in short action is possible

<table>
<thead>
<tr>
<th>S/NO</th>
<th>DECIBAL (db)</th>
<th>EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>115</td>
<td>Take-off sound of planes at 10 m distance</td>
</tr>
<tr>
<td>9</td>
<td>110</td>
<td>Siren at 10 m distance, frequent sound level in discotheques and close to loudspeakers at rock concerts, violin close to the ear of an orchestra musicians (greatest level)</td>
</tr>
<tr>
<td>10</td>
<td>105</td>
<td>Chain saw at 1 m distance, banging car door at 1 m distance (greatest level), racing car at 40 m distance, possible level with music head phones</td>
</tr>
<tr>
<td>11</td>
<td>100</td>
<td>Frequent level with music via head phones, jack hammer at 10 m distance</td>
</tr>
<tr>
<td>12</td>
<td>95</td>
<td>Loud crying, hand circular saw at 1 m distance</td>
</tr>
<tr>
<td>13</td>
<td>90</td>
<td>Angle grinder outside at 1 m distance</td>
</tr>
</tbody>
</table>

Over a duration of 40 hours a weak hearing damage is possible

<table>
<thead>
<tr>
<th>S/NO</th>
<th>DECIBAL (db)</th>
<th>EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>85</td>
<td>2-stroke chain-saw at 10 m distance, loud WC flush at 1 m distance</td>
</tr>
<tr>
<td>15</td>
<td>80</td>
<td>Very loud traffic noise of passing lorries at 7.5 m distance, high traffic on an expressway at 25 m distance</td>
</tr>
<tr>
<td>16</td>
<td>75</td>
<td>Passing car at 7.5 m distance, unsilenced wood shredder at 10 m distance</td>
</tr>
<tr>
<td>17</td>
<td>70</td>
<td>Level close to a main road by day,</td>
</tr>
</tbody>
</table>
The aim of this study was to examine the effect of noise in some mapped up areas of the University of Agriculture, Makurdi on the academic performance and students’ health of the people in such areas.

### Table 4: Permissible hearing time frame

<table>
<thead>
<tr>
<th>S/No</th>
<th>Sound Pressure Level</th>
<th>Sound Pressure</th>
<th>Permissible Exposure Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>115 dB</td>
<td>11.2 Pa</td>
<td>0.46875 minutes (~30 sec)</td>
</tr>
<tr>
<td>2</td>
<td>112 dB</td>
<td>7.96 Pa</td>
<td>0.9375 minutes (~1 min)</td>
</tr>
<tr>
<td>3</td>
<td>109 dB</td>
<td>5.64 Pa</td>
<td>1.875 minutes (~2 min)</td>
</tr>
<tr>
<td>4</td>
<td>106 dB</td>
<td>3.99 Pa</td>
<td>3.75 minutes (~4 min)</td>
</tr>
<tr>
<td>5</td>
<td>103 dB</td>
<td>2.83 Pa</td>
<td>7.5 minutes</td>
</tr>
<tr>
<td>6</td>
<td>100 dB</td>
<td>2.00 Pa</td>
<td>15 minutes</td>
</tr>
<tr>
<td>7</td>
<td>97 dB</td>
<td>1.42 Pa</td>
<td>30 minutes</td>
</tr>
<tr>
<td>8</td>
<td>94 dB</td>
<td>1.00 Pa</td>
<td>1 hour</td>
</tr>
<tr>
<td>9</td>
<td>91 dB</td>
<td>0.71 Pa</td>
<td>2 hours</td>
</tr>
<tr>
<td>10</td>
<td>88 dB</td>
<td>0.50 Pa</td>
<td>4 hours</td>
</tr>
<tr>
<td>11</td>
<td>85 dB</td>
<td>0.36 Pa</td>
<td>8 hours</td>
</tr>
<tr>
<td>12</td>
<td>82 dB</td>
<td>0.25 Pa</td>
<td>16 hours</td>
</tr>
</tbody>
</table>

II. MATERIALS AND METHOD

Human activity area in the University of Agriculture Makurdi, Benue State, Nigeria was mapped into eight noise zones, using Google Earth at fifty meter above the ground. These noise zones include North Core, College of Engineering, Akawe Torkula Hall, Food Science and technology (FST) and College of Management Sciences, Senior Staff Quarters, Junior Staff Quarters, South Core, and South Core Hostels. From the eight locations, twenty nine points were identified for measurement. At each location, the noise level was recorded for 30 seconds using a Calibrated B & K 2230 or Rion NL-11 Integrating Precision Sound Level Meters. Measurements were taken approximately one meter away, with the microphone approximately 1.2 meters above floor level and varying values displayed in form of graphs obtained. Measurement was taken by 5-6am, 1-2pm, and 7-8pm, for fourteen days and the peak values (Max), the Dwell, the mean, and standard deviation calculated using SPSS 17.

III. RESULTS AND DISCUSSIONS

The results presented in figures 1-6 showed that noise in educational institutions has a negative impact on learning and academic achievement of students (Karen et al. 2015) in the University of Agriculture, Makurdi.

From the measurement of noise level meter in different locations of the University, the results showed that noise pollution does exist in all the locations and it is found that Staff Quarters and South Core are highly noise polluted locations with an average maximum noise level of 89.5 dB and 84.2 dB respectively as shown in figures 1 and 2. This was followed by FST/ College of Management Sciences, and College of Engineering with average maximum noise level of 81 dB each as shown in figures 3 and 4 respectively. Hostels and North Core are least according to the study with average maximum noise level of 79.7dB and 77.3dB respectively as shown in figures C and A, although all locations exceeds the tolerance level of noise pollution which clearly indicated that the environment is not suitable for teaching-learning process.
FIGURE 1: South Core

FIGURE 2: Staff Quarters
FIGURE 3: FST and College of Management Sciences

FIGURE 4: College of Engineering
IV. CONCLUSION

To conclude, there is sufficient evidence to suggest that chronic noise exposure at schools affects students’ health and performance. Since research results are consistent, it may be wise to apply the precautionary principle of environmental law for improving the school environment around noisy areas using the recommended WHO noise levels as guidelines (Berglund et al., 2000). To date, the potential negative and positive effects of interventions have not been thoroughly researched enough to provide policy makers with clear guidance. The development of future interventions and policies must be concurrent with a thorough research evaluation to determine the efficacy of the
intervention to reduce exposure and reduce the adverse health effects of noise on students.

There is a need to evaluate sound insulation programmes and policies to reduce noise exposure in a well controlled large scale study to determine the impact of these programmes on a range of performance and health effects associated with students’ noise exposure. Future studies need to evaluate the protective and restorative effects of accessibility to quiet zones (or options for protection of such quiet zones i.e. natural areas, parks, etc.) on students health.

However, educational institutes should have buildings that have sound insulation system and high fence using concrete walls which protect noise from outside. They should also be aware of plantation of trees and vegetation buffer zone because trees and vegetation can absorb 4dB-6dB noise intensity depending on their characteristics.

Students, Teachers and Public awareness would also be helpful in the reduction of noise level in educational institutes. Moreover a strict law concerning noise pollution in educational institutes should be implemented and also vehicular movement within or nearby the educational institutes should be restricted, while speed limit should be applied to vehicles near the educational institutes.

ACKNOWLEDGEMENT

The authors extend sincere gratitude to the university of Agriculture, Makurdi for cooperation in carrying out the research.

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Ethical Practices in C-Section Delivery and Prevalence of Post-Caesarian Complications in Pregnancy in Lahore

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Institute of Pharmacy, Lahore College for Women University
Lahore, Pakistan

Abstract-Background: caesarian section also termed as C-section may be associated with surgical site infection or in severe cases with systemic infections. Because of problem associated with C-section most of the people prefer natural vaginal birth. Ethical practice to perform C-Section involve consent of patient to perform C-section, providing information on benefits and risk associated with C-section.

Objectives: the aim of study was to observe the ethical practices in C-section delivery, prevalence of post-caesarian infections in pregnancy in Lahore and difference in public and private sector hospitals in C-section practice.

Methodology: cross sectional study was conducted using data collection form and face to face interview of patient health care provider, by visiting various public and private hospitals. The information includes vitals of patient, number of pregnancies, family history, cause of C-section and type of complication.

Results: the study showed that 100% received prophylactic antibiotics and aseptic swab procedure. Still occurrence of wound infection was 80% diagnosed by laboratory examination of pus. 75% cases of C-section were performed in multigravida women and 25% in primigravida women. 18% women were given adequate time for active labor. E. coli and S. aureus were found to be causative agent in 45% and 40% cases respectively. Foetal distress was leading cause of C-section covering 55% incidents and failure to progress labor being second leading cause with 25% cases.

Conclusion: All patients were provided with information about personal hygiene, benefits and risks of C-section. Despite providing prophylactic antibiotic most of the patients suffered from surgical site infections. Major causes of C-section were foetal distress and failure to progress labor. Mostly causative agents of infection were E. coli and S. aureus. Women with multigravida pregnancies were prone to C-section.

Index Terms: Ethical practices, prevalence, prophylactic antibiotics, surgical site infections.

I. INTRODUCTION

Pregnancy is a physiological condition spanning over period of nine months or thirty-six weeks during a woman carries a life i.e. fetus in her womb. [1] After completion of this period the baby is delivered through vagina naturally or by caesarian section. Caesarian section also called C-section is surgical procedure performed by incision in abdomen and uterus wall. C-section is often associated with complications like surgical site infections, tearing of scar, heavy blood loss, blood clots in lower limbs and lungs, and injury to other nearby organs like bladder. [2]

National institute for health and care excellence gave the guidelines for ethical practices in caesarian section to prevent or lessen the post caesarean infections. [3]

Generally, performance of C-section is not greeted because of its association with more complications than that are encountered in natural vaginal birth. Nevertheless, two school of thoughts exist regarding ethical practices in caesarian section, one believes that birth
being a natural process must be performed naturally through vagina and other opines that respecting human rights, desire of C-section must be entertained. American college of Obstetrician and Gynecology, and Italian law permits the conduct of caesarian section. [4]

Certain causes leading to C-section include placenta previa in which placenta lie low in uterus and cover the cervix that usually occur in third trimester, placental abruption that is separation of placenta from uteruses lining, uterine rupture, breech position, cord prolapse in which umbilical cord slips through cervix protruding from vagina, feotal distress due to lack of oxygen, slow labor, repeated caesarian, cephalopelvic disproportion, active genital herpes, gestational diabetes, preeclampsia, birth defects and multiple births. [6]

To prevent infection, prophylaxis treatment consisting of antibiotics must be given but co-amoxiclave must not be administered. [3] The most prevalent complication after C-section is infection which include urinary tract infection, bladder infection and thrush. Thrush is caused by a fungus candida albican. This fungus cause infection in people taking steroids or in immunosuppressive patients. Catheter used during hospital stay can cause urinary tract infections. These infections are caused by E. coli and are treatable. [7]

Surgical site infections are frequently encountered in C-section, the signs and symptoms of SSI include, high fever and lower abdominal pain. Some women are at high risk of infection, these include, obese patients, immunosuppressive patients, diabetics, women with chorioamniotis, women taking steroids and those with previous C-section. [7]

Surgical site infections are of two types i.e. cellulitis and abscess. Cellulitis is caused by staphylococcal and streptococcal bacteria. Cellulitis is characterized by swelling, warmth, redness without pus. Abscess is caused by same agents with same signs and symptoms except that pus is formed at the site of infection. [8,9]

Contaminated environment is major contributing factor in prevalence of infection. Prosthetic devices are also a cause of infection and thus must be contamination free. Infections can be prevented using effective antibiotic prophylaxis and by clean procedures. [7]

Preoperative medication in C-section includes, anesthesia, analgesics and antibiotics. Antibiotic administration at the time of incision largely prevent postoperative infections, however, certain unhygienic conditions may cause systemic and surgical site infections. [3,7]

II. MATERIALS AND METHODS

A cross sectional study was performed using data collection form during June to August, to observe the conduct of ethical practices in C-section, prevalence of infection and difference currency of C-section and infections in public and private sector. A questionnaire was designed encompassing the following features: patient demographics including age, weight, height, year of marriage, number of pregnancies, previous C-sections, family history, other aspects including provision of instructions to patient before C-section, cause of C-section, use of clean swab procedure, means of wound closure, time of active labor, time taken for surgery, diagnosis of causative agent, major causative agent, diagnosis of infection, type of infection, use of antibiotic prophylaxis.

Stud was conducted using convenient sampling technique involving 100 patients, in public and private hospitals by face to face interview of patients and health care providers and filling the questionnaire. 50 patients were taken from public and 50 patients from private sector. Sample included pregnant females, 18-40years of age. Patients with gestational diabetes and patients on any steroidal therapy were excluded from study.

III. RESULTS

The study was conducted in four hospitals of Lahore to determine conduct of ethical practices and prevalence of post-caesarian complications in 100 patients, 85% patients were informed about risk and benefits, surgical procedure(Fig.1). Directions about personal hygiene were given to 70% patients and instructions about removal of pubic hair that is not to use any chemical within seven days prior to C-section, were provided to 80% patients. (Fig.2) Aseptic swab procedure was performed in 100% patients. And all the patients were administered prophylactic antibiotics. (Fig.3). All incisions were closed by means of suture rather than staples i.e. 100%.

Only 18% patients were given time for active labor i.e. two hours and 82% were not given time for active labor at all or inadequate time that is less than 2 hours. (Fig.4). 75% cases of caesarian section involved multigravia pregnancies and 25% cases involve primigravia pregnancy. (Fig.5). C-section was performed due to, feotal distress in 55 patients, failure to progress in labor in 26 patients, breech position of fetus in 17 patients and cord prolapse in 2 patients. (Table.1)

None of the patients encountered post-partum hemorrhage, sepsis or thrombo-embolism regarding post-caesarian complication and 100% patients suffered from wound infection. (Fig.6). Among wound infections 75% were abscess and 25% were cellulitis.
Infection was detected within 10 days in 37%, within 7 days in 35%, within 5 days in 15% and within 3 days in 13% patients after discharge from hospital. (Fig.7).

Pus discharge found to be major indication of infection with frequency of 68 patients, swelling and redness being second major indication in 21 patients and abdominal pain in 11 patients. (Table.2)

In 76% cases, it took 60min for surgery and 45min in 24% cases. (fig. 8).

Infections were mostly caused by E. coli covering 45% and staphylococcus with 40% and 15% were polymicrobial. (Fig. 9).

Antibiotics used to treat infection include ceftriaxone plus gentamycin in 29% patients, Augmentin in 28% patients, Tanzo in 25% and amikacin plus ceftriaxone in 29% patients. (Table.3)

![Figure: Counselling regarding risks and benefits of caesarean section.](image-url)
Figure 2: Guidance for the removal of pubic hair.

Figure 3: Prophylactic administration of antibiotics.
Figure 4: Time of active labour

Figure 5: Number of pregnancies
Figure 6: Type of complication.

Figure 7: Occurrence of infection
Table 1: Reason for C-section

<table>
<thead>
<tr>
<th>Reason of caesarian section</th>
<th>Frequency (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foetal distress</td>
<td>55%</td>
</tr>
<tr>
<td>Failure to progress in labor</td>
<td>26%</td>
</tr>
<tr>
<td>Breech position of fetus</td>
<td>17%</td>
</tr>
<tr>
<td>Cord prolaps</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 2: Indication of infection

<table>
<thead>
<tr>
<th>Indication of infection</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pus discharge</td>
<td>68%</td>
</tr>
<tr>
<td>Swelling and redness</td>
<td>21%</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>11%</td>
</tr>
</tbody>
</table>

Table 3: Antibiotics used in treatment of infection

<table>
<thead>
<tr>
<th>Antibiotics used</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceftriaxone+ gentamycin</td>
<td>29</td>
</tr>
<tr>
<td>Augmentin</td>
<td>28</td>
</tr>
<tr>
<td>Tanzo</td>
<td>25</td>
</tr>
<tr>
<td>Amikacin+ ceftriaxon</td>
<td>18</td>
</tr>
</tbody>
</table>

IV. DISCUSSION
The study was purposed to determine the conduct of ethical practices in C-section and prevalence of post-caesarian infection in public and private sector in Lahore. C-section is performed due to some clinical indications as well as just per wish of mother. The study showed that all cases of caesarian section were performed due to clinical situations and none was an elective caesarian due to believe that it is not a normal process and cause more complications. This contrasts with a study in Brazil where mostly women prefer caesarian delivery and go for elective caesarian. [9]. In another study in Germany in 2012 less than 10% cases of caesarian involve medical conditions. [10]. A study in Lady Reading hospital Peshawar showed 78% cases due to medical cause and rest were elective. [17]

Beside women desire to deliver bay by caesarian, many medical situations lead to C-section. These conditions include foetal distress, failure to progress in labor, cord prolapse, placental disproportion. The survey indicated C-section largely due to fetus distress with 55%, failure in labor (26%), breech position (17%), cord prolapse being he least (2%).the results are somewhat closer to previously conducted study in New York city by Emma Barber on contributing factors to rising caesarian delivery which showed that C-section was performed mostly due to fetus distress in 32% cases and secondly due to labor arrest problems in 18% and other problems covering 1%. [11]. This study doesn’t match the figure stated in a study in Peshawar, Pakistan indication of C-section were foetal distress (17.1%), failure to progress (16.1%), breech position (9.8%). [17]. A study in a private teaching hospital reported the similar values as that of Peshawar. [18]

In our study women with multigravida pregnancies were more susceptible to caesarian section with 75% cases than primigravida with 25%. This result showed a remarkable deviation from previous study which showed 16% cases of multigravida. [11]. The study also differs from another study in Peshawar, Pakistan in 2016 where the incident of multigravida was 49.2% and primigravida was 40.7%. [16]

C-section is associated with complications such as surgical site infection or endometritis. In this study, all patients that is 100% patients suffered from SSI and none from endometritis among them only 6% in private hospitals. This is inconsistent with a study conducted in U.S on surgical site infection in caesarian delivery which reflected that incident of SSI were 2-7% of sample of 35% cases of post-caesarian complications and that of endometritis were 2-16%. [12]

Surgical site infections are of two type that are cellulites and abscess and caused by various microorganisms like E. coli, staphylococcus aureus, polymicrobial infections. According to this study E. coli was leading cause of infection with 43%, staphylococcal with 40% and 17% were polymicrobial infections. These values are in part closer to a previous study in Oman which indicated values as being E. coli (18.95%), S. aureuse (31.27%) and polymicrobial (19.9%). This difference indicates that in Pakistan, E. coli infections are more prevalent as compared to that in another region i.e. Oman. [13]

Another study in Thailand showed prevalent causative agent as being E. coli 15.3%, S.aureus 8.5% and P. aeruginosa 6.8%. Thus, the ratio of these causative agents in Pakistan is higher than that in Thailand too. [14]

Surgical site infections are detected mostly within 24 hours but in this study, all the infections occurred after discharge from hospital, 37% within 10 days, 35% within 7days, 15% within 5days and 13% within 3days. In previous study in Thailand only 27.6% cases of SSI were detected after discharge. [14]

In this study, all the patients i.e. 100% were administered preoperative prophylactic antibiotics mostly cefazolin or azithromycin in resistant patients while in a study in Thailand in 2004 antibiotic prophylaxis was given as 51.6% preoperative, 24.3% intraoperative and 24.1% postoperative, an entirely different trend than that in Lahore, Pakistan where antibiotics are given preoperatively. [14]

Sullivan studied the effect of first generation cephalosporin on post-caesarean infection and proposed that preoperative administration of cefazolin reduce the infectious morbidity. [19]

By the end of study, the public hospital switched to the use of alpha-guard as disinfectant for equipment, tubing, clothing and the frequency of post-caesarean infections decreased from 78.33% (n=55,39 patients in public hospitals in 60days) to 40%. Total prevalence of surgical site infection being 55.55% including both public and private sector. (n1=55,39 in public and n2=6 cases in private hospital).

Post caesarian infections are treated according to the causative agent, local resistance, and local prescribing trend. In this research study antibiotics were used alone as well as in combination. For S.aureus infections mostly Augmentin was used and to treat infection caused by E.coli third generation antibiotics i.e. ceftriaxone alone or in combination with gentamycin or amikacin was used. Similarly, in case of polymicrobial infection combination of cefalosporin and aminoglycosides was used. Ceftriaxone + gentamycin was bing used in 29%, Augmentin in 28%, Tanzo in 25%, and ceftriaxine+amikacin in 18% cases.

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In another study in Nizawa hospital in Oman antibiotic were prescribed as penicillines 14.21%, cephalosporins 22.74%, gentamicin 24.64% which are different from that in Lahore.

However, literature lack the proof about the contribution of means of removal of pubic hair in post-caesarian infections but some guidelines advise the avoidance of razor for hair removal and advocate use of clipper as by WHO. [20]. 20% women were given instruction about removal of pubic hair in our study and none of the previous study reported such parameter.

According to guidelines of National institute of health and care excellence, women must be provided with complete information about risk and benefits and procedure of surgery and instruction about personal hygiene. [15]. In our study 100% patients were counselled about risk and benefits and personal hygiene to avoid complication.

Longer time of surgery is a contributing factor in C-section and in this study 76% C-section were performed in 60min and 24% in 45min. This is supported by a retrospective study conducted in University of Pittsburgh in 2011 where mean operative time found to be 51min. [21]

V. CONCLUSION

There is no legislation regarding ethical practices in C-section and for elective C-section, however, C-section is performed some clinical situation none was elective. Standard guidelines for ethical practice and to prevent post-caesarean infections were followed including provision of information to mother about risk and benefits and hygiene and prophylactic use of proper antibiotics. Despite prophylactic use of antibiotics, use of suture and skin cleansing, incident of surgical site very high and was more prevalent in public hospitals. Cases of infection were reported late after discharge from hospital. Causative agents found to be *E. coli*, *S. aureus* and to some extent polymicrobial. These infections were being treated with third generation antibiotics, Augmentin and aminoglycosides. Wound infections were somewhat due to unclean environment of operation theatre and inadequately cleaned equipment. Cases of wound infections reduced after the use of alpha guard as disinfectant in operation theatre.

VI. ACKNOWLEDGMENT

This project got accomplished due to encouragement and prayers of our parents, we are indebted to them. We offer gratitude from core of heart to our great mentor Dr. Munnazza Ryaz and Dr. Mariam Zaka for guidance. Cooperation of staff of hospitals i.e. Services hospital, Jinnah hospital, Fatima Memorial hospital and Family hospital which made this study possible.

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E-Mart: Product Placement and Promotion System to Enhance Sales Promotion Effectiveness

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Abstract— Retailers in supermarkets lacks sufficient information at their fingertips when they are in need of determining the placement of products, designing promotion strategies and hence improving the profit of the supermarket and customer satisfaction. This study presents a web based system and an android application required by retailers to make their decision making process more feasible. A set of data items were obtained from a local supermarket and are mined from association rule mining method using Apriori algorithm in order to generate association rules. The system will predict the optimal price of a product using linear regression algorithm, when to host the next product promotion and which product should be promoted. The goal of this research was to design and implement a web based application to view required information on sales predictions and promotion dates in order to make the decision making process effortless for the retailers in supermarkets. A prototype application is designed and implemented using open source tools and technologies.

Keywords— Data mining, Association Rule Mining, Apriori, Linear Regression Algorithm, Web Application, Android Application, Profit optimization

INTRODUCTION

One of the main challenges for supermarkets is how to obtain important information from the product transaction databases and product feature databases, in order to increase their sales and profits. Using the association rule mining technique, informed decision can be made easily about product placement, pricing, promotion, profitability and also it can be used to find out whether there are any successful products that have no significant related elements. Complementary products can be placed in close proximity or it can be cross-sold. It is very important for retailers in supermarkets to be aware of customer needs and adapt to them. Association rule mining technique is one of the data mining methods focusing on discovering purchasing patterns by extracting associations from product transaction databases of supermarkets. This helps to determine the products which are bought together and to reorganize the supermarket layout, and also to design promotional campaigns such that the purchase of products can be improved [1].

This study is aimed at providing an integrated solution to assist retailers in supermarkets to;

1. Identify the products that are sold along with another product.
2. Figure out the least price a product can be sold and still gain a profit.
3. Predict the date to host the next promotion in the supermarket.
4. Predict the product to be promoted in the next promotion.

The implemented system, “E-mart” is a web based and an android application that assists product promotion in Supermarkets based on user buying patterns, profit margins, previous promotion experiences and how the goods must be arranged in a Supermarket. This system is mainly developed for supermarkets with a wide range of products and can be used specifically by retailers in supermarkets to promote supermarket products. This system helps the retailers to make decisions on how to arrange the shelves or floors in the supermarket, by generating association rules which predicts the occurrence of a certain item based on product combinations that occurs frequently in product transactions. Identifying such purchasing patterns and showcasing relevant products in shelves will persuade the customers to buy products which were not intended to buy before entering the supermarket premises. This facility will be beneficial for the retailers as well as for the supermarket in order to enhance their profits and customer satisfaction. The remainder of this research paper will be focusing on the past literature and inventions, system design and implementation, results and conclusion followed by future work of the implemented system.
II. BACKGROUND AND RELATED WORK

Numerous algorithms have been developed over the past several years to mine association rules in large databases. AIS algorithm [2], SETM algorithm [3] and FP-Growth [4] algorithm are few such algorithms which were used before the development of Apriori algorithm which was an influential algorithm for association rule mining. In 1994, R. Agrawal and R. Srikant proposed the Apriori algorithm [5]. The name “Apriori” was given to this algorithm due to the fact that it uses prior knowledge of frequent itemset properties. Apriori algorithm uses a bottom-up approach which is known as candidate generation and the breadth-first technique. This algorithm was developed in order to operate on an operational database of customer transactions. When compared to other algorithms, Apriori algorithm is easy to implement and its memory consumption is less. Linear regression is a statistical procedure for predicting the value of a dependent variable from an independent variable when the relationship between the variables can be described with a linear model [6].

Over the past few years, several researches and inventions were done based on product promotion systems. Android applications and web applications are client-server software applications where a user interface runs in a web browser. Use of these in product promotion has several advantages such as cost effective development, easy customizable, easier installation and maintenance, increased security, flexible core technologies, accessibility for a range of devices, and are accessible anytime, anywhere. Retailers in supermarkets can analyze the data with the help of these web and mobile applications to make predictions and decisions related to product promotions.

Chou and his colleagues in their article published in 2000, have proposed a computer implemented process to select prospective customers in relation to a particular product and to promote products without any need of marketing campaigns. This system was developed using data mining techniques [7]. In 2001, a wireless shopping device was invented by Hudda, Barghouthi and Aref which can be used to carry out customer transactions. Here, the retailers will have to store relevant information about their products, shopping lists, payment details and delivery addresses on the server. Then the server will trace the location of the device using GPS or RF triangulation which will then direct the customers to merchant locations to view the items to be purchased and also to notify the customers about promotional offers of desired products. This system allows customers to make use of several delivery options based on their preferences and will have access to various price-negotiation methods as well. This system is mainly developed for the customers to make their shopping experience more feasible [8]. Another invention has focused on providing automated speech driven query and response with business or event self-promotion features which are relative to businesses and events over ordinary wired or wireless telephone systems, PC systems, Personal Data Assistants (PDAs) and other communication and information appliances and devices [9]. In 2003, Victor Treyz and Susan Treyz designed a handheld computing device in order to provide customers with shopping assistance services. This device can be used to hold shopping lists, to display promotional offers related to the products in the shopping list, to obtain information about the products being sold in stores and also to receive transaction reminders and other messages. By monitoring the location of the handheld computing device, the relevant services will be provided to users. Also the device can communicate with the retail establishments with the aid of local wireless links [10]. Another article written by Weng and Liu, was based on several aspects of market basket analysis that have been studied in academic literature, such as using customer interest profile and interests on particular products for one-to-one marketing in order to improve sales [11]. Chen et al in 2004 researched on purchasing patterns in a multi-store environment to improve the sales. In this article, a new approach was proposed to performing market basket analysis in a multiple-store and multiple-period environment. An efficient algorithm was developed for extracting the association rules. With the help of this approach, a decision can be made by analyzing the purchasing patterns [12]. Boyd and his colleagues focused on product promotions in a business/ an organization. They developed a system to evaluate, analyze, develop and design promotions which will then provide recommendations for each promotion of a target product. And also it analyzes other competing products of the same seller as well as with other competing sellers [13]. Several other studies have been carried out based on the market basket analysis in order to find solutions for certain issues such as determining the placement of goods, designing sales promotions for different segments of customers to improve customer satisfaction and hence the profit of the supermarket are addressed here using frequent itemset mining [14]. Furthermore, Hui et al in 2013 has suggested mobile promotions to increase unplanned spending rather than using physical products in the store as external memory cues, encouraging shoppers to travel more of the store may increase unplanned spending. According to the findings of this research, targeted mobile promotions that are aimed at increasing in-store path length can result in an increased unplanned spending [15].

III. RESEARCH METHODOLOGY

In order to identify the required features for the E-Mart system, the authors conducted a survey where data was obtained through a questionnaire. This questionnaire was given to a sample of 30 individuals who are involved in the supermarket industry and the sampling technique used here was simple random sampling. These information obtained was then analyzed statistically and it was found that the respondents prefer a system which is accessible at anytime and anywhere. With the aid of
these information gathered, the authors decided to implement a product placement and promotion system.

Product transaction data required for the development of the E-Mart system was obtained from a local supermarket which was held in excel spreadsheets. The collected data was then preprocessed in order to make it feasible for the data mining tool to fetch the data. Since transactions with more number of products purchased will provide efficient information, transactions with one or two products are discarded. All the frequent itemsets are generated using Apriori algorithm and based on the confidence level of the frequent itemsets, association rules are derived. Highly informative frequent itemsets are effectively generated in the Apriori algorithm. The Apriori algorithm is given below.

**Apriori Pseudocode**

\[
\text{Apriori}(T, \varepsilon) \\
L_1 \leftarrow \{\text{large 1-itemsets that appear in more than } \varepsilon \text{ transactions}\} \\
k \leftarrow 2 \\
\text{while } L_{k-1} \neq \emptyset \\
C_k \leftarrow \text{Generate}(L_{k-1}) \\
\text{for transactions } t \in T \\
C_t \leftarrow \text{Subset}(C_k, 0) \\
\text{for candidates } c \in C_t \\
\text{count}[c] \leftarrow \text{count}[c] + 1 \\
L_k \leftarrow \{c \in C_k | \text{count}[c] \geq \varepsilon\} \\
k \leftarrow k + 1 \\
\text{return } \bigcup L_k
\]

E-Mart System is implemented with the aid of free and open source software tools. The system implementation process composed of data mining, web interface and android application. Therefore, different platforms are needed to implement the system. The database is implemented using MySQL Wamp Server database technologies. R studio is used for data mining related coding. Web interface is developed using Adobe Dreamweaver and bootstrap, HTML and JavaScript are used to enhance the user interfaces of the web based system. Mobile application is implemented using Android 6.0 with the aid of Android studio tool. XML, JAVA and other android related languages and equipment are used to implement the mobile application.

**IV. RESEARCH FINDINGS AND EVIDENCE**

Frequent itemsets are generated from the Apriori algorithm for support = 30% and the association rules generated for various confidence values are illustrated in table 1. Fig. 3 shows the graph of Apriori result analysis for various confidence values.

<table>
<thead>
<tr>
<th>Confidence (%)</th>
<th>Total Number of Association Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>161</td>
</tr>
<tr>
<td>30</td>
<td>128</td>
</tr>
<tr>
<td>40</td>
<td>109</td>
</tr>
<tr>
<td>60</td>
<td>53</td>
</tr>
<tr>
<td>80</td>
<td>31</td>
</tr>
</tbody>
</table>
The implemented system shows the Association rules that were obtained by the Apriori algorithm in the web dashboard and the Android algorithm in a table format in order for the manager to get a clear idea about the products that are sold along with another product. This will help them in the process of product placement.

![Association Rules Table](image1)

*Figure 3: Association Rules Table*

Products that has only a month left before the expiration is sorted out and stored in the Profit Optimization Table. This table shows the least price a product can be sold and still gain a profit, Profit that can be obtained and how many units the user has to sell in order to gain the profit. These results were taken using the Linear Regression Algorithm.

![Profit Optimization Table](image2)

*Figure 4: Profit Optimization Table*

Maximum and minimum sold product in a week is sorted out and shown in a graphical bar chart manner for the manager to easily understand and take decisions accordingly.

![Weekly Max and Min Product Analysis](image3)

*Figure 5: Weekly Max and Min Product Analysis*

Products that are in the Profit Optimization Table is added to the Discount Percentage Calculation section. User is able click on each product and see the details of the product and also observe the profit a single product can obtain when given a discount.

![Discount Percentage Calculator Product List](image4)

*Figure 6: Discount Percentage Calculator Product List*

![Discount Percentage Calculator](image5)

*Figure 7: Discount Percentage Calculator*
The date to host the next promotion and the product to be promoted and the End Date of the promotion is shown in the website as Notifications. The promotion dates are sorted out using past year performances.

V. CONCLUSION AND FUTURE WORK

It is proved that the implemented E-Mart system is an efficient and an affordable method for predicting detailed information regarding product promotion, pricing and placement. It is found to be an effective method for real time problem solving. It is evident that the sales promotion effectiveness can be enhanced by using open source tools and technologies in the supermarket context. A limitation of this study is that the implemented system being an online application, requires a stable internet connection. Another limitation in the mobile application is needing a device with Android version 6.0 or above for the application to work. Both mobile and desktop versions must have a proper internet connection for the system to work in its best condition. The client desktop must contain R environment in order for the scripts to run in that particular computer.

The implemented system can be improved by adding features such as business performance measurement and adding Time series analysis to predict the number of stocks that will be required in the future. Furthermore the system can be extended to use in different industries such as clothing and other business related fields rather than using only for the supermarkets.

ACKNOWLEDGMENT

The authors would like to express their deepest gratitude to the Sri Lanka Institute of Information Technology for allowing to conduct this study as part of the undergraduate degree program.

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Effect of Swine Manure with *Terminalia catappa* leaves Compost and NPK Fertilizer on Growth and Yield of Pepper (*Capsicum chinense* Jacq.) in Ibadan, Nigeria

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Abstract: In order to study the effects of swine manure with *Terminalia catappa* leaves compost and NPK 15-15-15 fertilizer on growth and yield of pepper, an experiment was conducted in the Screenhouse of the Department of Agronomy, University of Ibadan in 2010. Five treatments: control (without fertilizer), 13.0, 16.3, 19.6 t/ha swine manure + almond leaves (SA) compost and 0.3 t/ha NPK 15-15-15 fertilizer were each mixed with 5 kg soil in experimental pots. The treatments were arranged in a completely randomized design with four replications. Data were taken on fruit yield (FY), number of fruits (NF), plant height (PH), stem girth (SG), number of branches (NB) and number of leaves (NL) of pepper. Shoot dry matter (SDM) and nutrient uptake (NU) of pepper were determined at 18 weeks after transplanting (WAT). Data were analyzed using descriptive statistics and ANOVA at $\alpha_{0.05}$. The SA compost had 11.4% C, 0.5% N, 0.2% P, 0.3% K, 0.6% Ca and 0.3% Mg. Irrespective of the application rates, the NPK fertilizer and SA compost recorded significantly ($p<0.05$) higher PH, NL, SG and NB higher than the control. The NPK recorded the highest PH (34.0±0.8 cm) and NB (7.0±1.2 cm), while the highest NL (43.3±1.1 cm) of pepper was recorded by 13.0 t/ha SA. Significant ($p<0.05$) differences were also observed among the treatments for N, P and K uptake by pepper, where the highest P (2.8±0.1 mg/pot) and K (12.3±0.5 mg/pot) uptake of pepper were recorded under 13 t/ha SA compost. Relative to the control; 13.0, 16.3, 19.6 t/ha SA and 0.3 t/ha NPK significantly ($p<0.05$) increased the SDM of pepper by 133.0, 117.0, 125.0 and 117.0% respectively, while the NF of pepper was also increased by 61.5, 55.8, 56.7 and 49.0% respectively. However, pepper FY significantly ($p<0.05$) increased in the following order: control (44.5±1.0 g/pot) < 19.6 t/ha SA (54.5±1.5 g/pot) < 0.3 t/ha NPK (55.1±0.8 g/pot) < 16.3 t/ha SA (55.3±0.6 g/pot) < 13.0 t/ha SA (56.2±0.9 g/pot), with 13.0 t/ha SA compost recording 2.0% higher FY than that obtained from NPK.

Swine manure composted with almond leaves enhanced the nutritive components and yield of pepper. Thus, SA could be an effective source of organic nutrition for pepper production in Ibadan, especially at 13.0 t/ha.

Keywords: Swine manure, *Terminalia catappa* leaves, Compost, Pepper

1.0 INTRODUCTION

The vegetable (pepper) growers in Nigeria are beginning to show tremendous interest in the use of organic fertilizers to increase vegetable production. This is due to the fact that the use of chemical fertilizer to cultivate food crops can be detrimental to the soil, food and human health (Thomas, 2009). Thomas (2009) further explained that such foods cultivated with chemical fertilizers contain very low amount of Omega-3 oils and its deficiency in the human body could result to heart disease, cancers and mental disorder. Also, regular use of NPK for vegetable production cannot supply trace mineral elements such as Fe, Cu and Zn (Lawrence, 2004), which become gradually depleted over the years by continuous cropping of the same land. This depletion is
responsible for a marked decline of up to 75% in the quantities of these minerals present in fruit and vegetables (Lawrence, 2004). Hence, consuming such vegetables could lead to serious deficiency of these minerals in the human body and thus, alter its physiological processes.

Organic fertilizers have the potential to supply both the soil macro and trace nutrient elements required for pepper growth and yield (Alabi, 2006; Awodun et al., 2007). In realization of this, most consumers prefer buying organically grown vegetables to chemically grown vegetables in the market. This encourages farmers to use organic fertilizer such as goat, poultry, cattle and swine manure to grow their vegetables in Nigeria. However, swine manure is not widely adopted by farmers when compared to the use of poultry and cattle manure for improving soil fertility for pepper production in Nigeria. This could be due to the fact that swine manure has higher concentration of heavy metals compared to poultry and cattle manure. Accumulation of such heavy metals in the soil over time will lead to soil pollution (Wel and Chen, 2001). However, Zhang et al. (2012) established that typical swine manure contained 642.1, 8.6 and 15.1 mg/kg dry matter of Cu, As and Cd respectively. Generally, vegetable (pepper) cultivated with raw organic manure have higher risks of being contaminated with heavy metals and *Escherichia coli* bacteria. Eating foods containing *E. coli* bacteria would result to food poisoning (Ann and Steven, 2015). The best approach in solving the problem is the use of compost. Research efforts have shown the ability of compost to kill pathogens and break down phytotoxic compound contained in such organic materials (Rynk et al., 1992; Pace et al., 1995). Aiyelari et al. (2011) reported that the application of 5 and 10 t/ha poultry manure with almond leaves composts recorded significantly greater okra fresh pod yield than 250 kg/ha NPK fertilizer by 12.6% and 27.5% respectively. Therefore, it is also possible to obtain good quality compost from swine litter and almond leaves to support plants development in a very similar way to those of poultry litter with almond leaves compost. However, information are limited in the use of swine manure with almond leaves compost for the production of *Capsicum chinense*. Hence, the effects of swine manure with almond leaves compost and NPK 15-15-15 fertilizer on nutrient uptake and yield of pepper in the Screenhouse were evaluated in Ibadan.

### 2.0 MATERIALS AND METHODS

#### The study area

The experiment was carried out in Ibadan, Southwest Nigeria in 2010. It lies between latitudes 7° 25′ and 7° 31′ N and longitudes 3° 51′ and 3° 56′ E in the Rainforest Zone. The annual rainfall, daily air temperature and relative humidity recorded in Ibadan in 2010 was 1625.5 mm, 27.7°C, and 79.9%, respectively. The soil of the area is Alfisol according to the USDA classification. It is formed from Basement Complex rocks. It is classified locally as Iwo series (Smyth and Montgomery, 1962).

#### 2.1 Compost preparation

A 1:1 w/w Swine manure + Almond leaves compost (SA) was composted in 2009, under a shed located behind the Department of Agronomy, University of Ibadan using a static pile method (Yuh-MingHuang, 2005). The mixtures (Swine manure + Almond leaves) were turned and watered fortnightly. Temperature readings were taken at 50 cm depth from five spots in the compost pile at 10.00 am daily, using a glass bulb thermometer. The daily temperature was compared with the ambient temperature. The stability of the SA compost was taken as when the compost temperature was at equilibrium with the ambient temperature. The SA compost stabilized in 84 days at 55.3°C. Plates 2.1 and 2.2 shows the SA compost at the initial stage of preparation and after 84 days of composting, respectively.
2.2 Screenhouse Experiment

The experiment was conducted in the Screenhouse of the Department of Agronomy, University of Ibadan, between March and July, 2010. Effects of five fertilizer treatments: control (without fertilizer), 13.0, 16.3, 19.6 t/ha SA compost and 0.3 t/ha NPK 15-15-15 on the growth and yield of *Capsicum chinense* were investigated. Each treatment was mixed with 5 kg soil in pots and the experiment was arranged in a completely randomised design with four replications. The soil used for the experiment was collected from the experimental site at the Teaching and Research Farm, University of Ibadan. There were two pots per treatment and 10 pots per replicate. One seedling of *Capsicum chinense* was transplanted into each pot at 4 WAS in the nursery, a week after treatments application, to enhance mineralization. Watering was carried out weekly and weeding was done fortnightly during the experimental period.

2.3 Plant analysis

The initial materials (almond leaves and swine manure) were analysed for C, N, P, K, Ca and Mg. At maturity, the compost was air-dried and five samples were taken from the compost pile. The samples were milled and sieved with 0.5 mm wire mesh before being subjected to chemical analysis. Carbon was determined by ash method using furnace. Nitrogen was determined using Micro-Kjeldahl procedure (IITA, 1975). The mixture of concentrated nitric, perchloric and sulphuric acid in a ratio of 25:4:2 respectively, was used to digest 0.5 g of each sample. Phosphorus was determined using vanadomolybdate yellow colorimetry method (Jackson, 1962). Potassium was determined by flame photometry. Calcium and magnesium was measured with Atomic Absorption Spectrophotometer (Okalebo *et al.*, 1993).

2.4 Dry matter determination

Pepper shoots were harvested from the ground level with the root cut off at 18 WAT in the Screenhouse and
oven-dried at 70°C to a constant weight and mean weights were recorded as shoot dry matter yield. The dried plant samples were milled and sieved with 0.5 mm wire mesh. Nitrogen, phosphorus and potassium contents were determined using the same procedure described in 2.3. Nutrient uptake (mg/pot) was determined by multiplying nutrient content (%) with total dry matter yield (g).

2.5 Soil analysis

The topsoil samples (0-15 cm) used for the Screenhouse experiment, were randomly collected from the Teaching and Research Farm, University of Ibadan with the aid of a soil auger. The soil samples were air-dried, crushed and passed through 2 mm wire mesh for the determination of pH, P, K, Ca, Mg and Na. The soil pH was determined with a pH meter in 1:1 (soil/water) mixture. Available phosphorus was determined by Bray P1 method, in which colour was developed in soil extracts using the ascorbic and acid blue method (Murphy and Riley, 1962). Exchangeable K, Ca, Mg and Na were determined by neutral ammonium acetate extraction method. Potassium and Na concentration in the extract were determined using the flame photometer; while Ca and Mg were determined by atomic absorption spectrophotometer (Okalebo et al., 1993). Organic carbon and total N was determined from the soil sieved with 0.5 mm wire mesh. Soil organic carbon was determined using the Walkley-Black oxidation method (Nelson and Sommers, 1982). Total N was also determined using the Macro-kjeldahl procedure (Bremner and Mulvaney, 1982). Particle size analysis was determined using Bouyoucos hydrometer method (Bouyoucous, 1962).

2.6 Data collection

Data were collected on plant height, stem girth, number of leaves and number of branches of pepper at 12 weeks after transplanting (WAT). Plant height was taken from the ground level to the tip of the plant using a measuring tape, while stem girth was measured at 5cm above the ground level with the aid of a rope. Average fruits weights were determined with the aid of a weighing balance after harvesting.

2.7 Statistical analysis

The data collected were subjected to analysis of variance and the significant difference among the treatment means were separated using Duncan Multiple Range Test (DMRT) at 0.05 level of probability.

3.0 RESULTS

Table 3.1 shows the physico-chemical properties of the soil before cropping. The results of the analysis revealed that the soil was sandy loam with a pH of 6.1; SOC, 7.3g/kg; Total N, 0.9 g/kg; Available P, 8 mg/kg. The exchangeable cation was in the following order K (0.1 cmol/kg) < Na (0.4 cmol/kg) < Mg (1.5 cmol/kg) < Ca (1.8 cmol/kg). The CEC of the soil had 4.3 cmol/kg. Table 3.2 shows the chemical composition of the raw organic material before composting. The Almond leaves (A) had 39.7% C, 0.4% N, 0.1% P, 0.8% K, 3.6% Ca, 0.2% Mg and 99.0 C/N; while the Swine manure (S) had 11.2% C, 1.1% N, 0.1% P, 1.4% K, 3.9% Ca, 1.7% Mg and 10.7 C/N (Table 3.2). Swine manure with almond leaves compost (SA) had 11.4%, C, 0.5% N, 0.2% P, 0.3% K, 0.6% Ca, 0.3% Mg and 22.0 C/N (Table 3.3). The initial carbon content of the Almond leaves (A) was reduced by 71.1% after composting, while the initial N, P and Mg content of the leaves were increased by 23.1, 60.9 and 42.3% after composting, respectively. The initial K and Ca content of the leaves were decreased by 67.9 and 83.4% after composting respectively (Tables 3.2 and 3.3). Figure 3.1 shows the daily temperature of swine manure with almond leaves compost. The SA compost peaked at 55.3°C and stabilized in 84 days at 30°C. The N uptake of pepper under SA and NPK treatments were significantly (p<0.05) higher than the control, while the P uptake of pepper significantly (p<0.05) increased in the following order: control (0.5 mg/pot) < 19.6 t/ha SA (1.9 mg/pot) < 16.3 t/ha SA (2.1 mg/pot) < 13.0 t/ha SA (2.8 mg/pot). The K uptake of
pepper significantly (p<0.05) increased in the following order: control (1.4 mg/pot) < 16.3 t/ha SA (8.1 mg/pot) < 19.6 t/ha SA (10.0 mg/pot) < 0.3 t/ha NPK (12.2 mg/pot) < 13.0 t/ha SA (12.3 mg/pot). The highest P (2.8 mg/pot) and K (12.3 mg/pot) uptake of pepper were both recorded from the soil amended with 13.0 t/ha SA compost (Table 3.4). The plant height, stem girth, number of leaves and branches of pepper under SA and NPK treatments were significantly (p<0.05) higher than the control. The highest plant height (34.0 cm) and number of branches (7.0) recorded under NPK were not significantly (p<0.05) different from other treatments. However, the SA applied to pepper at 16.3 and 13.0 t/ha recorded the highest values for stem girth (2.0 cm) and number of leaves (43.3), respectively (Table 3.5).

Table 3.1. Physico-chemical properties of the soil of the experimental site

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH 1:1</td>
<td>6.1</td>
</tr>
<tr>
<td>Organic carbon (g/kg)</td>
<td>7.3</td>
</tr>
<tr>
<td>Total N (g/kg)</td>
<td>0.9</td>
</tr>
<tr>
<td>Available P (mg/kg)</td>
<td>8</td>
</tr>
<tr>
<td>Exchangeable cation (cmol/kg)</td>
<td></td>
</tr>
<tr>
<td>Ca</td>
<td>1.8</td>
</tr>
<tr>
<td>Mg</td>
<td>1.5</td>
</tr>
<tr>
<td>K</td>
<td>0.1</td>
</tr>
<tr>
<td>Na</td>
<td>0.4</td>
</tr>
<tr>
<td>Effective CEC (cmol/kg)</td>
<td>4.3</td>
</tr>
<tr>
<td>Particle size distribution (g/kg)</td>
<td></td>
</tr>
<tr>
<td>Sand</td>
<td>712</td>
</tr>
<tr>
<td>Silt</td>
<td>180</td>
</tr>
<tr>
<td>Clay</td>
<td>108</td>
</tr>
<tr>
<td>Textural class</td>
<td>Sandy loam</td>
</tr>
</tbody>
</table>

Table 3.2. Chemical properties of raw organic materials used for composting

<table>
<thead>
<tr>
<th>Organic material</th>
<th>C (%)</th>
<th>N (%)</th>
<th>C:N</th>
<th>P (%)</th>
<th>K (%)</th>
<th>Ca (%)</th>
<th>Mg (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond leaf</td>
<td>39.7</td>
<td>0.4</td>
<td>99.0</td>
<td>0.1</td>
<td>0.8</td>
<td>3.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Swine manure</td>
<td>11.2</td>
<td>1.1</td>
<td>11.0</td>
<td>0.1</td>
<td>1.4</td>
<td>3.9</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Table 3.3. Chemical properties of raw organic materials used for composting

<table>
<thead>
<tr>
<th>Organic material</th>
<th>C (%)</th>
<th>N (%)</th>
<th>C:N</th>
<th>P (%)</th>
<th>K (%)</th>
<th>Ca (%)</th>
<th>Mg (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SA = Swine manure + Almond leaves

### Table 3.4. Effects of swine manure with almond leaves compost on nutrient uptake of pepper

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate t/ha</th>
<th>N mg/pot</th>
<th>P mg/pot</th>
<th>K mg/pot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>0.6c</td>
<td>0.5c</td>
<td>1.4c</td>
</tr>
<tr>
<td>SA</td>
<td>13.0</td>
<td>4.2ab</td>
<td>2.8a</td>
<td>12.3ab</td>
</tr>
<tr>
<td></td>
<td>16.3</td>
<td>3.9ab</td>
<td>2.1ab</td>
<td>8.1b</td>
</tr>
<tr>
<td></td>
<td>19.6</td>
<td>4.9a</td>
<td>1.9ab</td>
<td>10.0ab</td>
</tr>
<tr>
<td>NPK</td>
<td>0.3</td>
<td>4.9a</td>
<td>2.1ab</td>
<td>12.2ab</td>
</tr>
<tr>
<td>S.E.±</td>
<td></td>
<td>0.9</td>
<td>0.4</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Means with the same letter(s) in a column are not significantly (p=0.05) different according to Duncan Multiple Range Test. SA = Swine manure + Almond leaves Compost, S.E.± = Standard error of the differences of means.

### Table 3.5. Effects of swine manure with almond leaves compost on morphological traits of pepper at 12 WAT

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate</th>
<th>Plant</th>
<th>Stem</th>
<th>Number of</th>
<th>Number of</th>
</tr>
</thead>
</table>

Days during composting

Fig. 3.1. Mean daily temperatures of almond leaves and swine manure combination during composting
Means with the same letter(s) in a column are not significantly (p=0.05) different according to Duncan Multiple Range Test. SA = Swine manure + Almond leaves Compost, S.E.± = Standard error of the differences of means

Table 3.6 shows the effect of swine manure with almond leaves compost on shoot dry matter yield of pepper at 18 WAT in the Screenhouse. The shoot dry matter yield recorded under the SA and NPK were significantly (p<0.05) higher than the control. Relative to the control, 13.0, 16.3, 19.6 t/ha AS and 0.3 t/ha NPK significantly (p<0.05) increased the shoot dry matter yield of pepper by 133.0, 117.0, 125.0 and 117.0% respectively (Table 3.6). The fertilizer treatments significantly (p<0.05) increased the number and fruit yield of pepper. Relative to the control; 13.0, 16.3, 19.6 t/ha SA and 0.3 t/ha NPK significantly (p<0.05) increased the number of fruit of pepper by 61.5, 55.8, 56.7 and 49.0% respectively. Similarly, fruit yield was significantly increased by the same treatments by 26.3, 24.3, 22.5 and 23.8% respectively. The highest fruit yield of pepper (56.2 g/pot) under 13.0 t/ha SA was higher than the control and 0.3 t/ha NPK by 26.3 and 2.0% respectively (Table 3.7).

Table 3.6. Effects of swine manure with almond leaves compost on shoot dry matter yield of pepper at 18 WAT

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (t/ha)</th>
<th>Shoot dry matter yield (g/pot)</th>
<th>Increase in shoot dry matter yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>1.2b</td>
<td>0</td>
</tr>
<tr>
<td>SA</td>
<td>13.0</td>
<td>2.8a</td>
<td>133.0</td>
</tr>
<tr>
<td></td>
<td>16.3</td>
<td>2.6a</td>
<td>117.0</td>
</tr>
<tr>
<td></td>
<td>19.6</td>
<td>2.7a</td>
<td>125.0</td>
</tr>
<tr>
<td>NPK</td>
<td>0.3</td>
<td>2.6a</td>
<td>117.0</td>
</tr>
<tr>
<td>S.E.±</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Means with the same letter(s) in a column are not significantly (p=0.05) different according to Duncan Multiple Range Test. SA = Swine manure + Almond leaves Compost, S.E.± = Standard error of the differences of means

Table 3.7. Effects of swine manure with almond leaves compost on fruit yield of pepper

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (t/ha)</th>
<th>Number of fruits/pot</th>
<th>% increase in number of fruits</th>
<th>Fresh fruit yield (g/pot)</th>
<th>% increase in fruit yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>10.4b</td>
<td>0</td>
<td>44.5b</td>
<td>0</td>
</tr>
</tbody>
</table>
4.0 DISCUSSION

The results of the soil analysis showed that the soil N (0.9 g/kg), P (8 mg/kg) and K (0.1 cmol/kg) were below the critical limit of 1.5 g/kg N, 10 mg/kg P and 0.16-0.20 cmol/kg K set for crop production in southwest Nigeria (Akinrinde and Obigbesan, 2000). The SOC (7.3 g/kg) was also lower than the critical value of 8.7 g/kg established for soils in southwest Nigeria (Sobulo and Adepetu, 1987). The soil pH (6.1) was moderately acidic and adequate for pepper production, when compared with the critical range of 5.5 to 6.5 reported for pepper (Whittle et al., 1959). The soil fertility was low in major plant nutrients and hence it was expected to benefit from swine manure with almond leaves compost which is an organic source of nutrition. The raw Almond leaves (A) had 39.7% C, 0.4% N, 0.10% P, 0.8% K, 3.6% Ca and 0.20% Mg. These values were in contrast to 2.0% N, 0.14% P, 1.0 % K, 1.9 % Ca and 0.25% Mg recorded for almond leaves by David et al. (2011). The Swine manure (S) had 11.2% C, 1.1% N, 0.1% P, 1.4% K, 3.9% Ca and 1.7% Mg. The values for C, P, Ca and Mg did not fall within the range of 20.0- 22.0% C, 0.6- 0.9% P, 0.4-0.9% K, 0.4-0.6% Mg and 1.0-1.5% Ca respectively, reported for swine manure by Tennakoon and Hemamala (2003). However, N (1.1%) was within range of 1.0-2.0% (Tennakoon and Hemamala, 2003). The swine manure with almond leaves compost (SA) had 5.2 g/kg ( 0.52%) N, 2.3 g/kg ( 0.23%) P and 2.6 g/kg (0.73%) K and these were contrast to the values of 5.1 g/kg (0.51%) N, 0.9 g/kg (0.09%) P and 7.3 g/kg (0.73%) K recorded from almond leaves with poultry manure compost established by Aiyelari et al. (2011).

The decrease in the temperature of the compost pile to ambient temperature is an indicator of the stability of the compost. The compost temperature of 55.3°C recorded in this study was high enough to kill pathogens, weed seeds and break down phytotoxic compounds in the compost (Rynk et al., 1992). This ensured that the compost was safe for application into the soil for pepper use. The addition of SA compost increased soil nutrients which also led to higher uptake of N, P and K by pepper plants. This could be the reason why there was significant increase in plant height, stem girth, number of leaves and branches of pepper in this study. In another Screenhouse study on the effects of sawmill wastes, animal manure, and NPK fertilizer on the performance of okra, Aduloju et al. (2011) discovered that plant height of okra was significantly (p<0.05) affected by the fertilizer treatments irrespective of the levels of application. They also noted that number of leaves of okra under the fertilizer treatments was not significantly (p<0.05) affected.

The SA compost applied to pepper at 13 t/ha produced the highest fruit yield of pepper than other treatments. For instance, its fruit yield was higher than that of NPK by 2%. In terms of nutrient compositions, 19.6 t/ha SA compost had higher nutrient values than the rest, recording 101.9 kg N/ha, 45 kg P/ha and 51 kg K/ha; while 16.3 t/ha SA had 84.8 kg N/ha, 37.5 kg P/ha and 42.4 kg K/ha and 13 t/ha SA had 67.6 kg N/ha, 30 kg P/ha and 33.8 kg K/ha. This result revealed that more of the nutrient was supplied by 19.6 t/ha AS compost and the least by 13.0 t/ha SA compost. Thus, it could be inferred that the quantity of nutrient supplied to the soil by a specific organic fertilizer may not determine the overall yield of crops.

5.0 CONCLUSIONS
It can be concluded from this study that addition of swine manure to *Terminalia catappa* leaves enhanced the rate of decomposition, thus resulting to increased mineralization and release of nutrients for pepper growth and yield. Also, application of swine manure with *Terminalia catappa* leaves compost at 13 t/ha produced the highest fruit yield of pepper, hence it is recommended for optimizing pepper production.

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COMPLEX FORMATION EQUILIBRIA OF COPPER(II), METFORMIN AND D-(+)MANNOSE OR D-(+)GLUCOSE IN METHANOL

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Abstract- Diabetes Mellitus is a metabolic disorder affecting carbohydrate metabolism, metformin is a drug widely used in the treatment of this disease. However, its mechanism of action has not been known yet, although several theories have been proposed to explain its hypoglycemic activity. A recent theory suggests a relationship between metformin and mitochondrial copper. On the other hand, glucose is the most abundant carbohydrate working as energy source; this carbohydrate has an important role in Diabetes Mellitus. In the present research work is reported a UV-VIS study with the purpose of analyzing the in vitro interaction between the ionic copper, metformin and glucose or mannose. The formation constant of ternary complexes of copper with metformin and glucose or mannose and its calculated electronic spectrum of each species in methanol solution, are reported. Hopefully, this information can be used in order to predict some of the possible interactions in vivo.

Index Terms- Diabetes mellitus; D-(+)-mannose; D-(+)-glucose; metformin

I. INTRODUCTION

Diabetes mellitus II is the fifth leading cause of death globally [1-3]. This disease interferes with the carbohydrate metabolism with which generate a chronic hyperglycemia [4-6]. The main effect in diabetes consists of excessive hepatic glucose production, peripheral insulin resistance and a defective secretion of insulin in beta-cells [7]. Type 2 diabetes mellitus is a treatable but not curable [8], currently the most commonly used medications for treatment of Type 2 diabetes are the metformin and sulfonylureas [9]. Metformin or dimethylbiguanide is the first-line drug [10-13], which lowers the blood glucose level by possibly suppressing hepatic glucose output and enhancing peripheral glucose uptake [8, 14]. The mechanism of action has not been defined [11, 15, 16], yet several theories have been elaborated to explain metformin action, its activity is probably related to AMPK (AMP-activated protein kinase) which promotes the use of blood glucose in the muscle[17, 18]. On the opposite, other studies propose the possibility that metformin might interact with mitochondrial copper and the therapeutic effect by metformin is linked to the properties of a copper-metformin species and its possible interaction with glucose [19, 20]. Glucose is an insulin dependant carbohydrate [21, 22], mannose, in contrast to glucose, fails to stimulate a measurable pancreatic release of insulin[23-25]. In this work, with the purpose to analyze an in-vitro direct interaction between the copper-metformin complex and the sugars: D-glucose, D-mannose and also chlorides, a spectrophotometric study was carried out. The calculated electronic spectrum and the formation constants of the complex copper (II)-metformin with each sugar and chlorides in methanol, is reported. Hopefully this information allows theorizing an in vivo interaction between metformin and these sugars.

II. MATERIALS AND METHODS

Cu(NO₃)₂·2.5H₂O (Fermont, Mexico), D-(+)-mannose and D-(+)-glucose (Sigma Aldrich) were of analytical grade and used without further purification. Metformin was obtained from Ficonax tablets (PiSA, Mexico). Methanol HPLC grade (Fermont, Mexico) was used as the solvent for the extraction of metformin from tablets and the determination of the formation constant for the complexes.

A. Physical measurements

The spectral measurements were performed using a Shimadzu 1800 UV-Vis Spectroscopy system at 298 K (RT), using quartz cuvettes with 1 cm path length and 3mL of volume. The spectral observed region observed was from 210 to 350 nm and was used for all experiments. The formation constants were determined by the spectrophotometric data refinement using the HypSpec software[26] and the distribution diagrams of species were calculated using software Hyperquad simulation and speciation (HySS) [26]. The use of this spectrophotometric method has been reported before [15, 27].

B. Extraction and purification of metformin

For the extraction and purification of metformin, tablets were pulverized and homogenized with methanol HPLC. The solution was filtered under vacuum and stored at 277 K until the formation of crystals of metformin; later were separated by vacuum filtration.

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C. Equilibrium studies

Experiments were performed using two different stock solutions of D- (+)-mannose (man) and D- (+)-glucose (glc) (355.20 µM and 488.40 µM), metformin (met) (372.00 µM and 496.00 µM), chloride (Cl) (342.20 µM and 478.80 µM) and Cu(NO₃)₂.2.5H₂O was used to prepare stock solutions of ionic copper (344.00 µM and 481.60 µM). In each experiment the concentration of copper and metformin were varied, metformin from 3.72µM to 74.40 µM and 4.96 µM to 99.20 µM and Cu(NO₃)₂.2.5H₂O from 3.44 µM to 68.80 µM and 4.82 µM to 96.32 µM, respectively. In each experiment, the final mannose or glucose concentration was set constant at 35.52 µM and 48.84 µM, respectively. For the systems with chloride, the chloride concentration was varied from 3.42 µM to 68.44 µM and 4.79 to 95.76 µM. A total of 40 spectra were using for the refining process in each system.

III. RESULTS

In this study, in all the equilibrium determinations, it is required to avoid the use of ionic strength; if the ionic strength is increased a precipitation of the copper complexes occurs. Instead of water, methanol was used as the solvent. Considering that water with a donor number of 18 and methanol of 19, methanol is slightly nucleophilic than water and increase stability the complex[28-30]. Using water as solvent at physiological pH ranges is very important. Nevertheless, using water might generate hydroxylated or protonated species. The generation of several species at the same time might interfere with the formation constant determination. In this first study, water was avoided as a solvent in order to generate a starting point to find an accurate value of a formation constant so that in later studies water can be used as a solvent.

A. Formation constants of the copper (II)-metformin with D- (+)-mannose and D- (+)-glucose

The formation of the complexes of copper (II) and metformin with glucose or mannose has not been reported before. Nevertheless we use as a starting point the previously reported values of the formation constants for the species copper(II)-metformin with chloride and bromide[15]. The electronic spectra of the solutions for the systems of copper(II)-metformin-D- (+)-mannose and copper(II)-metformin-D- (+)-glucose are presented in Fig. 1 and 2, respectively. For both systems when the concentration of copper and metformin are increased, a hyperchromic effect at 235 nm is observed, in both systems.

![Figure 1](image-url)

Figure 1. Absorption spectra of copper (II)-metformin with D- (+)-mannose system in methanol solution, (a) For spectra 1-20: [man] = 35.52 µM, [Cu(II)] = 3.474µM to 68.80 µM and [Met]= 3.72 µM to 74.40 µM. (b) For spectra 21-40: [man] = 48.84 µM, [Cu(II)] = 4.82µM to 96.32 µM and [Met]= 4.96 µM to 99.20 µM

The determination of the formation constants represents the equilibrium between Cu²⁺, metformin, and mannose or glucose, in each system respectively. This process consisting of the simultaneous analysis of the spectra of the experiments at two different concentrations of the stock solutions of copper and metformin and the use of different concentration range of mannose or glucose. This method is based on the correlation between the spectrum obtained, the concentration of the used metal and ligands and a proposal of possible colored species. Absorbance values were obtained at several wavelengths, considering a single colored species was found plus Cu²⁺ and [Cu(met)]²⁺, the determination of the formation constants was achieved using the next model:

\[
\text{Cu}^{2+} + \text{Met} + \text{man} \rightleftharpoons [\text{Cu(met)(man)}]^{2+} \quad \log \beta_{110} \quad (1)
\]

\[
\text{Cu}^{2+} + \text{Met} + \text{glc} \rightleftharpoons [\text{Cu(met)(glc)}]^{2+} \quad \log \beta_{110} \quad (2)
\]
Figure 2. Absorption spectra of copper (II)-metformin with D-(+)-glucose system in methanol solution, (a) For spectra 1-20: [glc] = 35.52 µM, [Cu(II)] = 3.474µM to 68.80 µM and [Met]= 3.72 µM to 74.40 µM. (b) For spectra 21-40, [glc] = 48.84 µM, [Cu(II)] = 4.82µM to 96.32 µM and [Met]= 4.96 µM to 99.20 µM.

The logarithmic value of the formation constants obtained in this study and the summary of the experimental parameters are reported in Table 1. The results obtained show the unique formation of a mono-species for the system with mannose or glucose, with a formation constant of log $\beta_{110} = 10.52 \pm 0.02$ and log $\beta_{110} = 10.61 \pm 0.01$, respectively. The calculated electronic spectrum of the species $[\text{Cu(met)(man)}]^{2+}$ and $[\text{Cu(met)(glc)}]^{2+}$ are shown in Fig. 3a), both species show a maximum at 235 nm and $\varepsilon = 15880$ L mol$^{-1}$cm$^{-1}$ and $\varepsilon = 13806$ L mol$^{-1}$cm$^{-1}$, respectively.

Figure 3. a) Calculated electronic spectra of the copper (II)-metformin with D-(+)-mannose and D-(+)-glucose complexes in methanol. (1) Cu$^{2+}$; (2) $[\text{Cu(met)(glc)}]^{2+}$; (3) $[\text{Cu(met)(man)}]^{2+}$; (4) $[\text{Cu(met)}]^{2+}$. b) Calculated electronic spectra of the copper (II)-metformin with D-(+)-mannose and D-(+)-glucose with chloride complexes in methanol. (1) Cu$^{2+}$; (5) $[[\text{Cu(met)(glc)}]\text{Cl}]^{1+}$; (6) $[[\text{Cu(met)(man)}]\text{Cl}]^{1+}$; (4) $[\text{Cu(met)}]^{2+}$.

In this work, the mono species of copper-metformin with mannose and glucose were found, but the bis-complex was not identified. This could be explained considering the nucleophilic character of methanol, which is higher than water [28, 30], also is possibly that the oxygen atoms of the sugar molecules increases the stability of the complexes and might generate a steric hindrance.

B. Formation constants of the copper (II)-metformin with D-(+)-mannose or D-(+)-glucose with chloride

The electronic spectra of the solutions for the systems of copper(II)-metformin-D-(+)-mannose and copper(II)-metformin-D-(+)-glucose both with chloride are presented in Fig. 4 and 5. For both systems when the concentration of the solution with copper, metformin and chloride is increased, a hyperchromic effect at 235 nm is observed, in both systems. The determination of the formation constants represents the equilibrium between Cu$^{2+}$ metformin, mannose or glucose and chloride. This process consist also in the simultaneous analysis of the spectra of the experiments at two different concentrations of the stock solutions of copper, metformin mannose or glucose and chloride, and the use of different concentration ranges of mannose or glucose in each experiment. This method is based on the correlation between the spectrum obtained, the metal and the ligands concentrations used, as well a suggestion of possible colored species.
Table 1: Summary of experimental parameters for the complex system of copper (II)-metformin-D-(+)-mannose or D-(+)-glucose and systems with halides in methanol

<table>
<thead>
<tr>
<th>Solution composition</th>
<th>Experimental method</th>
<th>Temperature</th>
<th>Total number of data points</th>
<th>Method of calculation</th>
<th>Species</th>
<th>Equilibrium</th>
<th>Log β</th>
<th>σ</th>
</tr>
</thead>
</table>
| [T₁L] range from 3.72 to 74.40 µMol L⁻¹ and 4.96 to 99.20 µMol L⁻¹  
[T₉X] range from 3.44 to 68.80 µMol L⁻¹ and 4.82 to 96.32 µMol L⁻¹  
[TX] constant at 35.52 and 48.84 µMol L⁻¹  
Ionic strength, electrolyte  
PHT range  
Not used | Spectrophotometric titration | 25°C | Cu complexation: 40 solution spectra | HypSpec | [Cu(met)(man)]²⁺  
[Cu(met)]²⁺ + man ⇄ [Cu (met)(man)]²⁺ | log β₁₁₀ = 10.52 ± 0.02 | 0.0147 |
| [T₁L] range from 3.72 to 68.44 µMol L⁻¹ and 4.79 to 95.76 µMol L⁻¹  
[T₉X] range from 3.72 to 74.40 µMol L⁻¹ and 4.96 to 99.20 µMol L⁻¹  
[TX] constant at 35.52 and 48.84 µMol L⁻¹  
Ionic strength, electrolyte  
PHT range  
Not used | Spectrophotometric titration | 25°C | Cu-ligand-chloride to mannose complexation: 40 solution spectra | HypSpec | [Cu(met)(man)Cl]⁺  
[Cu(met)Cl]⁺ + man ⇄ [Cu(met)(man)Cl]⁺ | log β₁₁₁ = 15.64 ± 0.01 | 0.0059 |
| [T₁L] range from 3.44 to 68.80 µMol L⁻¹ and 4.82 to 96.32 µMol L⁻¹  
[T₉X] constant at 35.52 and 48.84 µMol L⁻¹  
Ionic strength, electrolyte  
PHT range  
Not used | Spectrophotometric titration | 25°C | Cu complexation: 40 solution spectra | HypSpec | [Cu(met)(glc)]²⁺  
[Cu(met)]²⁺ + glc ⇄ [Cu (met) (glc)]²⁺ | log β₁₁₀ = 10.61 ± 0.01 | 0.0052 |
| [T₁CL] range from 3.72 to 68.44 µMol L⁻¹ and 4.79 to 95.76 µMol L⁻¹  
[T₉X] range from 3.72 to 74.40 µMol L⁻¹ and 4.96 to 99.20 µMol L⁻¹  
[TX] constant at 35.52 and 48.84 µMol L⁻¹  
Ionic strength, electrolyte  
PHT range  
Not used | Spectrophotometric titration | 25°C | Cu-ligand-chloride to glucose complexation: 40 solution spectra | HypSpec | [Cu(met)(glc)Cl]⁺  
[Cu(met)Cl]⁺ + glc ⇄ [Cu(met)(glc)Cl]⁺ | log β₁₁₁ = 16.18 ± 0.01 | 0.0066 |
Absorbance values were obtained at several wavelengths, considering a single colored species were found plus Cu\(^{2+}\), [Cu(met)]\(^{2+}\) and [Cu(met)(man)]\(^{2+}\) or [Cu(met)(glc)]\(^{2+}\), the determination of the formation constants was achieved using the next model:

\[
\begin{align*}
\text{Cu}^{2+} + \text{Met} + \text{man} + \text{Cl}^- & \rightleftharpoons [\text{Cu(met)(man)(Cl)}]^+ \quad \log \beta_{111} \\
\text{Cu}^{2+} + \text{Met} + \text{glc} + \text{Cl}^- & \rightleftharpoons [\text{Cu(met)(glc)(Cl)}]^+ \quad \log \beta_{111}
\end{align*}
\]  

(3)  
(4)

Figure 4. Absorption spectra of copper (II)-metformin-D-(+)-mannose with chloride system in methanol solution: (a) For spectra 1-20, [man] = 35.52 µM, [Cu(II)] = 3.474 µM to 68.80 µM, [Met] = 3.72 µM to 74.40 µM and [Cl] = 3.42 µM to 68.44 µM. (b) For spectra 21-40, [man] = 48.84 µM, [Cu(II)] = 4.82 µM to 96.32 µM, [Met] = 4.96 µM to 99.20 µM and [Cl] = 4.79 µM to 95.76 µM.

Figure 5. Absorption spectra of copper (II)-metformin-D-(+)-glucose with chloride system in methanol solution: (a) For spectra 1-20, [glc] = 35.52 µM, [Cu(II)] = 3.474 µM to 68.80 µM, [Met] = 3.72 µM to 74.40 µM and [Cl] = 3.42 µM to 68.44 µM. (b) For spectra 21-40, [glc] = 48.84 µM, [Cu(II)] = 4.82 µM to 96.32 µM, [Met] = 4.96 µM to 99.20 µM and [Cl] = 4.79 µM to 95.76 µM.

The logarithmic value of the formation constants obtained in this study and the summary of the experimental parameters are reported in Table 1. The results obtained shows the unique formation of a mono-species for the system with mannose or glucose and chloride, with a formation constant of log \( \beta_{111} = 15.64 \pm 0.01 \) and log \( \beta_{111} = 16.21 \pm 0.01 \), respectively. The calculated electronic spectrum of the species [Cu(met)(man)(Cl)]\(^{1+}\) and [Cu(met)(glc)(Cl)]\(^{1+}\) are shown in Fig. 3b, this spectrum have a maximum at 235 nm and ε = 15183 L mol\(^{-1}\) cm\(^{-1}\) and ε = 14293 L mol\(^{-1}\) cm\(^{-1}\), respectively.

C. Distribution curves of the systems of copper(II)-metformin-D-(+)-mannose and copper(II)-metformin-D-(+)-mannose-chloride

The Fig. 6a and b shows the distribution diagrams of the system copper(II)-metformin-D-(+)-mannose and copper(II)-metformin-D-(+)-mannose-chloride. A solution with an equimolar concentration of copper (II), metformin and mannose has a formation of 94.6% for [Cu(met)(man)]\(^{2+}\) and about of 5.40% of ionic copper. For the chloride experiments, a solution with an equimolar concentration of copper(II), metformin, mannose and chloride, yields approximately 98.65% of [[Cu(met)(man)]Cl]\(^{1+}\) and 1.35% of ionic copper.
D. Distribution curves of the systems of copper(II)-metformin-D-(+)-glucose and copper(II)-metformin-D-(+)-glucose-chloride

The Fig. 7a and b shows the distribution diagrams of the system copper(II)-metformin-D-(+)-glucose and copper(II)-metformin-D-(+)-glucose-chloride. A solution with an equimolar concentration of copper (II), metformin and glucose has a formation of 95.41% for $[\text{Cu(met)(glc)}]^2+$ and less of 4.59% of ionic copper. For the chloride experiments, a solution with an equimolar concentration of copper(II), metformin, glucose and chloride, yields approximately 99.73% of $[\text{Cu(met)(glc)Cl}]^+$ and 0.27% of ionic copper.

Figure 7. Formation curves of the copper (II)-metformin-D-(+)-glucose complexes in methanol a) $[\text{glc}]= 35.52 \, \mu\text{M}$ and copper (II) range from 3.474µM to 68.80 µM. b) For system with chloride $[\text{glc}]= 35.52 \, \mu\text{M}$ and copper (II) range from 3.474µM to 68.80 µM.

IV. CONCLUSION

The study of the stability of metal complexes is a great research area to theorize possible interactions in biological systems. According to the results obtained in this study, the complex copper-metformin-glucose have a slightly higher formation constant compared with the other system with mannose, nevertheless the glucose and mannose systems have a similar stability. On the other hand, the use of chloride increases the affinity for interacting with the sugar molecule. Also the formation constants of the systems with chloride are quite similar. Nevertheless, considering that the formation constants values of the copper-metformin species with each sugar molecule are non-statistically distinguished. If this interaction occurs in vivo systems, the copper-metformin complex is not capable to distinguish the interacting sugar and possibly an additionally mechanism should be present.

ACKNOWLEDGMENTS

The authors wish to thank the Secretaría de Educación Pública (SEP) through PRODEP program also to the Secretaría de Innovación, Ciencia y Educación Superior (SICES) for its economic support through their program “Convocatoria de Investigadores Jóvenes 2016”, are gratefully acknowledged.

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Biochemical Methane Potential (BMP) of Miscanthus Fuscus for Anaerobic Digestion

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Abstract- There is an increasing global demand for energy crops and animal manures for an eco-friendly and renewable energy to supplement fossil fuel, aid in heat and electricity production. In order to meet this demand, this study aimed at optimizing the anaerobic digestion of Miscanthus Fuscus for biogas production at mesophilic temperatures in a biochemical methane potential (BMP) test. Methane production was measured for 20 days in a 500mL schott bottles in a batch mode and controlled at 37 ± 1°C. Miscanthus Fuscus was characterized in the batch reactor to enable the inoculum activity and the biogas volume reported during the 20 days. The cumulative volume of biogas (L/day) for the five biodigesters labelled as sample IDs 1-5 is reported as 0.67, 1.16, 1.01, 0.57, and 1.17 L/day respectively. Highest methane yield was reported on the 16th day of the BMP test at 27% v/v of biogas produced.

Index Terms- Anaerobic digestion, Biogas, Biochemical methane potential, Miscanthus Fuscus.

I. INTRODUCTION

With the ever-increasing energy consumption and the depletion of fossil resources, the footing for a shift towards sustainable production of biofuels and bioproducts such as biogas from renewable sources still remain a key demand22. Several studies have been carried out to find renewable energy sources that possess the potential of replacing fossil fuel1. Also, urbanization has led to an increase in landfills and it is estimated that by 2025, two-thirds of people will be living in the cities globally23. For decades, the synthesis of a renewable energy source as an alternative to non-renewable energy source has been evaluated, with energy being produced from biogas through anaerobic digestion process4. Biogas is a renewable fuel that consists of 60-70% methane, 20-30% carbon dioxide and other trace gases such as hydrogen sulfide. The gas produced, can be used to generate electricity and also in the production of combined heat and power generation using appropriate technologies13. The anaerobic digestion process from which biogas is produced basically involves four main stages as a result of the biodegradation of organic matter by a cluster of microorganisms7. The first stage which is the hydrolysis is the rate-determining step, where carbohydrates, proteins, and fats present in the is biomass converted to glucose, amino acids, and fatty acids respectively. The next stage, which is acidogenesis, involves the conversion of these products to volatile fatty acids by acidoenic bacteria. The volatile acid products are then converted to carbon dioxide, hydrogen and acetates by acetogenic bacteria then finally the carbon dioxide produced can react with the hydrogen present to produce methane or the acetates are broken down to by methanogenic bacteria to form methane and carbon dioxide with other trace compounds21, 26.

The performance of a biogas plant can be evaluated by studying and monitoring the variation in parameters, which includes temperature, agitation, carbon-nitrogen ratio, organic loading rate, hydraulic retention time, etc. Meanwhile, sharp change in these parameters could adversely affect the biogas production process22. For higher efficiencies, these parameters should be varied within a desirable range to operate the biogas at optimum threshold. Anaerobic digestion under thermophilic temperature often yields higher biogas than mesophilic temperatures: higher temperatures favour higher methane production compared to lower temperatures16. Interestingly, anaerobes have been found to be most active at mesophilic than thermophilic temperatures as the latter tend to require higher heat input as investigated in this study15.

The pH of a digestion slurry affects the growth of microbes during anaerobic digestion and thus the digester should be maintained within a desired range of 6.8-7.2 by feeding it at an optimum loading rate to obtain higher yield25. The level is reported not to remain constant throughout the process because of the various anaerobic digestion processes especially at the acidogenesis stage as various acids are produced the pH of the digestion slurry tend to increase after the acidogenesis stage30. A pH of 8.0 has also been observed to produce higher yield of biogas from biomass which is in contrast with the optimum pH for higher yield of biogas as predicted by (Budiyono et al., 2013)5, 18. Furthermore, it has been established that biogas production is much dependent on substrate loading rate, as methane yield has been found to increase with considerable reduction in loading rate28. This conflicts with an analysis with which co-digestion was evaluated at different organic loading rates (OLR) under low mixing conditions and a stable performance being obtained when the system was overloaded6. Thus, illustrating how overloading can easily lead to system failure1.
Certain limitations such as process instability, process failure, poor methane yield, high hydraulic retention time of 30-50 days and reactor failures have limited the full exploitation of the anaerobic digestion process\(^\text{17}\). Although several efforts have been made in few decades, there still remain the need for researchers to seek for alternative processes to curb for these limitations to boost the efficacy of the biogas production. Processes such as co-digestion, low organic loading, pretreatment methods (for example, liquid hot water, acid hydrolysis, steam explosion, and alkaline hydrolysis), and the use of energy crops as feedstocks, have increased the efficacy of biogas production through anaerobic digestion\(^\text{2, 20}\). Recirculation of digested slurry (digestate which is enriched with microbes) back into the reactor and design modification of existing biogas plants are some of the ways to also improve the gas production in biogas plants\(^\text{25}\).

Miscanthus Fuscus, one of three species known as elephant grass, is a South Asian grass species first described by William Roxburgh. This bamboo-like plant grows rapidly up to 3 meters high, generating a high yield of biomass with low ash content, suitable for use in electricity generation\(^\text{29}\). It is, however, a promising non-food crop yielding a high-quality lignocellulosic material which can be used in a number of ways, including energy and fiber production, thatching, and industrial use as in the case of this study\(^\text{8}\). Miscanthus Fuscus has been found to be suitable for biogas production and has a higher methane yield potential per unit area\(^\text{14}\). Research have proven that, Miscanthus Fuscus harvested before winter increases the yield and digestibility for anaerobic digestion\(^\text{10}\).

This study seeks to focus on the production of biogas on Laboratory scale using the biochemical methane potential test with Miscanthus Fuscus, an energy crop under mesophilic anaerobic digestion.

### II. MATERIALS AND METHODS

The biochemical methane potential test was carried out to determine the potential of the Miscanthus Fuscus (Fig.1) with cow dung.

![Fig.1: Harvested Miscanthus Fuscus](image)

#### Material Sampling

Miscanthus Fuscus was harvested from a local farm land at Adako Jachie in the Ashanti region of Ghana, and was used as the main feedstock for the biogas production. The feedstock was washed and dried to remove the unwanted particles. Furthermore, it was shredded and milled with a hammer miller (Fritsch Pulverisette 558, Germany) to obtain particle size of 10 mm. This was done to increase the surface area for adsorption during the anaerobic digestion process. A fresh cow dung used as inoculum was obtained from the cattle farm of Kwame Nkrumah University of Science and Technology, Department of Animal Science. The inoculum was kept in a sealed schott bottles, stored at 4°C, left to stand for 3 days before carrying on with further analysis.

#### Characterization of feedstock and Inoculum

The raw feedstock was characterized and analyzed for total solids, moisture content, volatile solids, and ash contents in accordance with the standard methods\(^\text{23}\). All procedures were carried out in the Laboratory using a precision balance (Kern PCB 3500-2, United Kingdom) for weighing the masses, a convection oven (VWR DRY-line oven, Pennsylvania) for drying feedstock and inoculum and a muffle furnace (Nabertherm, Germany) for ashing. The pH was measured by a pH meter (Thermo Scientific Orion star A121, United States of America). The experimental design of the feedstock and inoculum for the feeding each of the biodigesters is depicted in Table 1. Also, the pH recorded in each of the biodigesters after the 20 days is reported in the same table. Volatile fatty acids production rate is much higher than the methane production rate resulting in pH levels below the optimum range and can inhibit methanogens. This is because of their high level of sensitivity to acidic conditions\(^\text{9}\). After feeding the biodigesters at an optimal loading rate, the pH in each biodigester in this study was kept within the desired range of 6.7-7.0 as shown in Table 1. This is almost the same for what was recorded by Maile et al. (2016b) where CaCO\(_3\) and NaOH was rather used to control the alkalinity during the anaerobic digestion\(^\text{12}\).
Experimental design for the feedstock and the inoculum

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Elephant grass (% RM)</th>
<th>Cow dung (% DM)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>0</td>
<td>6.78</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>100</td>
<td>7.05</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>50</td>
<td>7.08</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>75</td>
<td>7.01</td>
</tr>
<tr>
<td>5</td>
<td>75</td>
<td>25</td>
<td>6.89</td>
</tr>
</tbody>
</table>

Experimental setup and procedure

The total solids and volatile solids of the feedstocks and inoculum were pre-determined and used to prepare the digestion samples into the 500 mL schott bottles (with an effective 350mL volume). For each run, a headspace of 150 mL was left which was purged with nitrogen gas (N₂) to create the anaerobic environment within each of the biodigesters. The biodigesters were closed air-tight with rubber caps and incubated in a Laboratory incubator (Uniscope SM9052, United State of America) as shown in Fig. 2. Since it is a batch system, it was made to run until digestion is complete.

Nutrients, in the form of trace metals are added in biodigesters to improve the efficiency and stability during the anaerobic digestion process in mono-digestion. In this study, the trace metals, nitrogen, potassium, phosphorous, and iron were added to each biodigester to improve the efficiency and stability of the biodigester as employed in mono-digestion as depicted in Table 2. After stirring to ensure uniformity, the pH of each biodigester was measured and recorded within an optimum range of 6.7-7.1 as shown in Table 1. However, since the recorded pHs during the analysis were within the desired range as predicted by Sreekrishnan et al. (2004), no solvent was introduced in the biodigester for pH adjustment.

The composition of biogas was assessed by a batch biochemical potential (BMP) test at a mesophilic condition of 37±1°C for a retention time of 20 days for the overall analysis using a Biogas analyzer (Geotech Biogas 5000, United Kingdom). The anaerobic digestion system was designed to quantitatively determine the volume of biogas produced using a water displacement method and qualitatively for methane (CH₄), Carbon dioxide (CO₂) and trace amounts of hydrogen sulfide (H₂S).

Table 2: Composition of nutrient supplementation to each biodigester

<table>
<thead>
<tr>
<th>Name of compound</th>
<th>Elemental nutrient</th>
<th>Concentration (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium chloride</td>
<td>N</td>
<td>0.530</td>
</tr>
<tr>
<td>Potassium dihydrogen orthophosphate</td>
<td>K</td>
<td>0.270</td>
</tr>
<tr>
<td>Disodium hydrogen phosphate dihydrate</td>
<td>P</td>
<td>0.560</td>
</tr>
</tbody>
</table>

III. RESULTS AND DISCUSSION

Composition of Miscanthus Fuscus and Cow dung

The inoculum (cow dung reported as raw material) and the feedstock (Miscanthus Fuscus reported as dry matter) is characterised for the total solids, volatile solids, and ash composition is shown in Table 3 below. The results showed a great methane potential as a significant biodegradable fraction that do exist in the feedstock.

Table 3: Reported values for the characterization of the feedstock and inoculum

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Total solids (% RM)</th>
<th>Total solids (% DM)</th>
<th>Volatile solids (% RM)</th>
<th>Ash content (% DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.945</td>
<td>91.055</td>
<td>88.945</td>
<td>11.055</td>
</tr>
<tr>
<td>2</td>
<td>10.215</td>
<td>89.785</td>
<td>10.215</td>
<td>89.785</td>
</tr>
<tr>
<td>3</td>
<td>8.135</td>
<td>91.865</td>
<td>8.135</td>
<td>91.865</td>
</tr>
<tr>
<td>4</td>
<td>8.615</td>
<td>91.385</td>
<td>89.9</td>
<td>10.1</td>
</tr>
<tr>
<td>5</td>
<td>9.84</td>
<td>90.16</td>
<td>84.56</td>
<td>15.44</td>
</tr>
</tbody>
</table>

*DM: dry matter; *RM: raw material

Effect of Biochemical Methane Production on the Biogas Production

Methane Production

The rate of methane production can be affected by factors such as the surface area or microorganisms to substrate ratio,
microbial activity inside the biodigester, pH in the biodigester at any given time, and the solid retention time. As shown in Fig. 3, the actual production of methane was observed after day 2. This could be due to the fact that the microorganisms needed to acclimatize to the set conditions such as temperature within the biodigesters. The sample ID 2 was also observed to yield the highest amount of methane after a sharp rise from day 4 to day 11 (12% v/v biogas) which may be due to maximal hydrolytic activity of the ferment. However, in all the five biodigesters, sample ID 5 yielded the highest methane production on day 16 (27% v/v biogas) as the methane production started on day 4 followed by sample ID 2. The yield of methane in the rest of the biodigesters was not appreciable throughout the anaerobic digestion process. This could be attributed to unfavourable anaerobic digestion conditions within the biodigesters which yielded low methane.

CO₂ Production

Biogas, a renewable fuel consists of 60-70% methane, 20-30% carbon dioxide and other trace gases such as hydrogen sulfide. However, Carbon dioxide remain the second abundant gas after methane in biogas and thus a reduction of methane was observed to cause a rise in the yield of carbon dioxide as shown in Fig. 3 and 4 comparatively. It was observed in this study that the amount of carbon dioxide produced was higher as compared to that of the methane in all the biodigesters. However, lower yield of methane has been attributed to higher carbon dioxide in biogas from previous studies. Nonetheless, recent studies have warranted the use of concentrated alkaline compounds such as NaOH for the CO₂ dissolution. The highest carbon dioxide yield was reported on day 3 by sample ID 1 as depicted in Fig.4.

H₂S Production

H₂S was however observed to be predominant in the biogas produced and a likelihood to contribute to the lower yield in the methane production with sample ID 1 recording the highest on day 2 (90% v/v biogas). H₂S in sample ID 4 was observed to be higher in both day 3 (60% v/v biogas) and day 16 (60% v/v biogas) which could be attributed to a favourable sulphur producing conditions by the microorganisms during this stage of the anaerobic digestion process as shown in Fig. 5 below.

The Water Displacement Method for Biogas Production

This method has been developed to measure the volume of biogas produced and widely utilized to determine biogas yield in anaerobic digestion process. This method has for the past decade been used for the measurement of the volume of biogas produced from reactors especially at Laboratory scale. Since biogas has a lower density than water and insoluble in water, the downward displacement was adopted as the evolved gas was observed to be displaced at the topmost portion of the inverted glass tube, hence its volume measurement. However, the amount of water displaced is thus found to be equal to the biogas generated. In this study however, the cumulative volume of biogas for the five biodigesters labelled as sample IDs 1-5 was reported as 0.67, 1.16, 1.01, 0.57, and 1.17 L/day respectively as in Fig.6 below.
In addition, the highest volume of biogas produced was recorded by sample ID 5. This gives an indication that the volume of biogas produced is directly proportional to the methane produced.

Fig. 7. Overall biogas production from the water displacement method

IV. CONCLUSION

The biochemical methane potential (BMP) test of Miscanthus Fuscus with cow dung was investigated as little is known in literature about the production of this feedstock at Laboratory scale to produce biogas. The volume of the BMP test was determined for the five biodigesters at an average of 0.916 L/day of biogas production. The pH was also observed within the optimum range of 6.7–7.1 and thus no need for pH adjustment. Also, anaerobic digestion in this study at mesophilic temperatures was found to be a viable process for biogas production and thus warranted by all researchers both for its production at larger scale and also a look at the activity of inhibitors. The highest methane content was found to be 27% v/v of biogas yield and was observed to be lower as compared to the carbon dioxide yield. Thus, a pretreatment technique and carbon dioxide purification method is warranted to all researchers.

Moreover, Miscanthus Fuscus has the potential to produce biomethane, which can be used to ease the dependency on fossil fuel derived energy and as an alternative energy source for combined heat and energy, which is eco-friendly.

ACKNOWLEDGMENT

The authors are thankful to the Kwame Nkrumah University of Science and Technology, Department of Chemical Engineering for their support and using their Biotechnology Laboratory for the experimental runs.

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Determinants of sustainability of exclosure establishment and management practices in Tigray Region, Ethiopia.

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Abstract - Converting degraded free grazing lands into exclosures is one option to promote natural regeneration of plants and to restore degraded ecosystems in Ethiopia. The present study was initiated with the objective of assessing the determinants that affect the sustainability of exclosure establishment and management practices at the household level. A total of 180 households were systematically selected and a structured questionnaire was provided to these households to collect their perception. Ten in-depth interviews with key informants 9 FGDs were also carried out. Determinants of farmers’ sustainability of exclosure establishment and management practices were assessed. The empirical results from binary logistic regression model showed age, tenure, and off-farm activity were positive and significant predictors of sustainability of exclosure establishment and management practices while household size, farm size, distance and number of livestock have a negative effect on exclosure establishment and management practices in the study area and they were not significant except livestock number. These findings strengthen the fact that in order to achieve sustainable exclosure establishment and management practices, institutional and economic factors should be given special attention. In conclusion, there is a need for sensitization of farmers to form groups to benefit formal training of all community in the exclosures and soil and water conservation technologies and capacity building of farmers in other livelihoods areas to reduce the burden on natural resources.

Index Terms - Exclosure, Management, Sustainability, Tigray (Ethiopia)

I. INTRODUCTION

For exclosures to continue playing their environmental conservation role, socio-economic needs of local people are very important. A sustainable and socially fair harvesting system of the wood resources or a rotational grazing system initiates local people to have a positive attitude towards exclosure (Descheemaeker et al., 2006). The vegetation in the exclosures most useful to the communities are mainly the herbaceous and woody plants, specifically grass, tree and shrub species (Betru et al., 2005).

Natural resources, such as forests are among the primary sources of livelihoods of poor people by providing food, fodder, and fuelwood. In the northern highlands of Ethiopia, forest resources are major sources of livelihoods and comprise 27 % of the total household income (Bedru et al., 2009). Similarly, 34 % of the household per capita income in Bale mountains, southern Ethiopia (Yemiru et al., 2011) and 39 % of the average household income in Dendi district, Ethiopia (Mamo et al., 2007) is generated from forest resources. However, the forest resources in Ethiopia and many developing countries have been deteriorating over time (Sunderlin et al., 2005; Bedru et al., 2009). Deforestation and overexploitation of forests in Ethiopia resulted in reductions in forest and food products and aggravated poverty and malnutrition (Mulugeta et al., 2005). For example, Reusing (1998) estimated the rate of deforestation of 163, 600 ha yr⁻¹ in the highlands of Ethiopia. Moreover, owing to overgrazing, the natural vegetation in the northern highlands of Ethiopia has virtually disappeared; leaving degraded free grazing lands devoid of vegetation (Betru et al., 2005). For that reason, efforts to rehabilitate degraded natural resources could become a potential strategy for livelihood improvement (Taddese, 2001; Kebrom, 2001; Shylendra, 2002).

In response to the degradation of land resources, “Baito” (a system of political leadership and administration at the “Tabia” or Wereda level and development agents of the Bureau of Agriculture and Rural Development (BoARD) in collaboration with the communities in Tigray, Northern Ethiopia, established exclosures on degraded free grazing lands to combat forest degradation (Wolde et al., 2010).

More than 80, 000 ha of hillsides were closed to foster regeneration of indigenous tree species during 1985 to 1990. However, most of the exclosures were harvested or destroyed by 1995 and the experience with exclosures in Ethiopia was disappointing (Hoben, 1995). Most importantly, inadequate scientific and technical knowledge, the use of a standardized approach without regard to local agro-ecological conditions, and top-down authoritarian and politicized approaches followed in the implementation of establishing exclosures, disregard of the views and interests of the local communities whom the program was intended to serve contributed to the poor performance of exclosures in the “Derg” regime (Berhanu et al., 2003). The experience with exclosures in Tigray was limited in the “Derg” regime but increased since 1991. The area covered by exclosures in Tigray increased from 143,000 ha in 1996 to 262,000 ha in 2005 (TFAP, 1996; RLUPD, 2000; Betru et al., 2005), and has further increased 575, 217 in 2010 and to 875, 230 ha in 2014 (Personal communication with the expert of implementation of natural resources management in Tigray, 10th May, 2015). The size of an exclosure ranges from as small as 1 ha to 700 ha.

In Tigray, the priority areas for establishing exclosures are normally identified as a joint initiative of local communities, Governmental and Non-Governmental Organisations.

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implemented as part of this large-scale land rehabilitation works and afforestation and terracing activities. Exclosures were also since then as an outcome of the large-scale implementation of very degraded in 1868, but has shown a remarkable improvement (2009) found that the natural resources in northern Ethiopia was on degraded free grazing lands. In particular, Nyssen socio-economic outcomes from the establishment of exclosures Most of these studies documented positive environmental and government interventions (Yohannes and Waters-Bayer, 2007). Tigray owing to a long history of war, political uncertainty, and critical, because of the built-up weakness of village rules in (Chisholm, 1998; Betru et al., 2003). The negative experiences in managing exclosures using top-down approaches in the “Derg” regime and the encouragement of TPLF towards empowering local governance contributed to the more participatory approaches in managing exclosures with locally devised rules. However, Segers et al., (2008) pointed out that the mobilization of farmers in central Tigray tends towards convincing farmers to implement the development programs of the government in central Tigray and was not participatory.

There is an ongoing debate in the literature of communal resources management regarding the more relevant institutional arrangements for improving rural livelihoods using the available communal resources (Ostrom, 1990). The debate encompasses views that romanticise the effectiveness of village rules and considering village rules as solutions to most problems in managing communal resources at low transaction costs. On the contrary, there are views that undermine the effectiveness of village rules in facilitating users to have common goals towards managing communal resources in a sustainable manner (Campbell et al., 2001; Makepe, 2006). Neither of these extreme views could contribute to solving the challenges in the management of exclosures on its own under the rural context of Tigray, Ethiopia. There is a general consensus among researchers on the need of effective village rules such as taboos to manage forest resources and to enhance socio-ecological benefits (Chisholm, 1998; Betru et al., 2005). This need becomes so critical, because of the built-up weakness of village rules in Tigray owing to a long history of war, political uncertainty, and government interventions (Yohannes and Waters-Bayer, 2007). Most of these studies documented positive environmental and socio-economic outcomes from the establishment of exclosures on degraded free grazing lands. In particular, Nyssen et al., (2009) found that the natural resources in northern Ethiopia was very degraded in 1868, but has shown a remarkable improvement since then as an outcome of the large-scale implementation of afforestation and terracing activities. Exclosures were also implemented as part of this large-scale land rehabilitation works and contribute to the improved forest resources. We suppose that such positive outcomes could result from the village rules that are used in managing the exclosures. However, studies are lacking on the relevant institutional arrangements that ensure the sustainable management of exclosures. This lack of evidence exists despite the fact that more than three decades have passed since the establishment of most of the exclosures in Tigray. Particularly, the effectiveness of village rules with the goal of promoting sustainable management of exclosures was ignored and not explored well because most of the researchers were emphasizing on the biophysical impacts of exclosures. This information is, however, critical for managing exclosures in Tigray in a sustainable manner.

Consequently, in-depth analysis of the effectiveness of village rules in managing exclosures becomes crucial for reinforcing sustainability outcomes such as preventing forest degradation and achieving equal benefit sharing among users. We considered forest degradation, conflicts among users over natural resource use, and meeting high expectations of users to realize economic benefits from exclosures as important challenges in the management of exclosures and evaluated the effectiveness of village rules by examining their roles in addressing those challenges. Therefore the following project was initiated with the objective of assessing the determinants that affect the sustainability of exclosure establishment and management practices at the household level.

II. MATERIAL AND METHODS

2.1. Study area

Tigray Region has five administrative zones, which are further sub-divided into 35 Woredas (districts). The study was conducted in three Woredas/districts of Tigray (12° - 15° N latitude and 36° 30' - 40° 30' E longitude), the northernmost region of Ethiopia (Figure 1). The specific study area was selected based on criteria’s from the list of districts of the region that have had greater than twenty-five years age area exclosures with different management and utilization system. The wide variety of altitude (range between 1400 and 2900), the age of exclosures (vary between 1 and 25 years), size of exclosures (differ from 8 to 125 hectares), proportion of exclosure, and distance from residence (vary in the range 0.5 to 9 kilometers). Fair accessibility is also under consideration.
2.2. Topography
The topography of the areas comprises several forms from high slope to flat, ragged and deep gorges and gullies. Most of the areas were characterized by cleared forest and considered as the most degraded and eroded area in the previous time. The topography of Tigray contains the three main traditional divisions of arable Ethiopia: the Kolla – lowlands (c1400-1800 meters above sea level) with relatively low rainfall and high temperatures; the Woina dega – middle highlands (c1800-2400 m.a.s.l.) with medium rainfall and medium temperatures; Dega – highlands (c2400-3400 m.a.s.l.) with somewhat higher rainfall and cooler temperatures.

2.3. Climate
Analysis of the meteorological data showed that the mean annual temperature for Raya Azebo was 20.8 °C and the mean minimum and maximum were 11.8 and 33.5°C respectively. The hottest months are April and June, while coldness is from September to December. The mean annual rainfall is 604 mm, which varied greatly from year to year. Generally, the study area has bimodal rainfall pattern, with low rainfall from February to May and the main rainy season (June – September). Kilite Awulaelo Woreda average daily air temperature of the area ranges between 8°C and 30.1°C with a mean of 19.7°C. The mean annual rainfall of the area is about 610 mm. Kilite Awulaelo Woreda has unimodal rainfall pattern.

2.4. Site Selection
The study was conducted in Raya Azebo Woreda (Genete, Havelti, Mehoni Kebeles), Atsbi Womberta Woreda-(Hadinet, Kelesha Emene, Haikmeshal Kebeles), and Kilite Awelaelo Woreda-Kihen, Negash, Abreha We Atsbeha Kebeles) located in Southern and Eastern parts of Tigray region (Figure 1). The Kebeles demonstrate degraded vegetation and soils and differ in elevation, rainfall, agro-ecology, access to the main road, distance to regional capital, population distribution and density and lithology.

2.5. Population and economic activities
Mixed crop-livestock farming is the dominant farming system of the Woredas. The main livestock in Raya Azebo are cattle, sheep, goats, and camel. Livestock provides draught power, transport, food, and income. Pasture is available in free grazing lands. Crop residue (mainly the stalk of maize and sorghum and straw from teff and barley) and chopped cactus are used to feed cattle whenever there is a severe shortage of feed during the dry season. The total population of the Raya Azebo Woreda was 161,394 of which 80,193 (49.7%) were males and 81,201 (50.3%) were females. With regard to farm households, the number of male-headed households (MHHs) and female-headed households (FHHs) were 18,201 and 18,334, respectively and a total of 36,541 (WoFED report, 2016).

Distribution of land was done based on the fertility status of the soil (fertile, less fertile, moderately fertile), and the functional category of the plot (field plot and backyard plot). Concerning the landholding size in the area, it is estimated that a household
has 0.84 ha on average. Crops are produced in rain-fed agriculture mainly for subsistence purpose.

Even in some areas the prevalence of a bimodal rainfall pattern is common, the system of double cropping (production of two crops on the same plots of land in a year) is not practiced both on the highlands and lowlands except in irrigated land. Manuring and crop rotation are practiced very rarely. Diversion of floods and water harvesting mechanisms are also practiced, especially in the lowlands where rainfall is relatively scarce.

Livestock husbandry is an integral part of the mixed farming system in the study area. Among the various livestock reared, cattle constitute the highest proportion (61.5%) (Zenebe et al., 1998). Other important domestic animals next to cattle in the order of quantity and importance are sheep (20.3%) and goats (10.5%). Donkeys, horse, mules, and camels are the most important means of transport for the rural households. In general, the livelihood of the livestock family depends on natural vegetation and crop residues. The use of tree parts as fodder is very limited in the study area. “Hizaeti” and “Mewayara” or “Mewcha” are the two most practiced traditional systems of grazing in the area. These are common pool natural resources management systems or a common grazing place designated particularly for oxen and cattle other than oxen respectively.

The total population of the Kilte Awelaelo Woreda is estimated at 164,743 of these 80,943 (49.1%) are male and 83,800 (50.9%) are female in the year 2015 (WoFED report, 2016). Out of the total population, about 90.46% of the population is living in rural areas and 9.54% is living in urban areas. Average family size is five and population density of the district is 87.4 people per square kilometer. Like in the other drought-prone areas of the region, agriculture in Kilte Awelaelo is only subsistence, which is unable to secure adequate food supply, and cash for the farm households’ yearly expenditures. Farmers grow different food crops and cash crops and in the area, including beekeeping and poultry. The dominant crops grown in the area include *Triticum aestivum* (wheat), *Hordeum vulgare* (barley), *Vicia faba* (faba bean), *Sorghum bicolor* (Sorghum) and *Eragrostis teff* (teff). The villages are characterized by low and erratic rainfall, drought, and land degradation, as are most other parts of Tigray. Like more than 85% of the Ethiopian population, the residents of the study area live in rural areas and depend on land resources including forests and grazing lands for their livelihoods (CSA, 2008).

### 2.6. Sampling of respondents for the socio-economic study and considerations in group discussions.

Reconnaissance field survey was made to obtain an overview of the study sites, followed by a detailed preliminary survey. The data for the study was collected from primary sources. The main source of primary data was a household survey that was conducted from May 2016 to July 2016 using a structured survey questionnaire. The respondents for individual interviews were chosen by using purposive sampling technique, as suggested by Patton (2002), in order to select specific elements of a population that are believed to represent the range of variation expected in a population. Purposive sampling technique methods were used to select both study sites and households. Observation and structured questionnaire were employed to collect information related to households’ perception of the role of enclosures.

The criteria we used for selecting the respondents were: villagers who were involved in the decision-making process for instance in demarcating the area to establish enclosures, who have first-hand information about the establishment of rules and enforcing rules in managing enclosures. Moreover, we included villagers that live near and far from the enclosures, and also farmers in the neighboring villages. For the purpose of this study, the heads of the selected households (usually the household head is implicitly assumed to be the decision maker in sustainability studies) were interviewed using a structured questionnaire which covers a broad range of personal, social, economical, institutional, and plot level issues relevant to the process of sustainability enclosure establishment and management practices or the instruments including questions related to the background information of the households such as socio-economic variables to determine the key predictors that differentiate household’s strategy choice and choice of natural resource management and conservation.

Two initial meetings, 10 in-depth interviews with key informants including village administrators and guards of enclosures were conducted. In addition, 9 focus group discussions with men and women subgroups, ranging in size from five to seven participants, were carried out. Besides, the performances of area enclosures on biophysical qualities of the areas were noticed and recorded by observation. Furthermore, for
focus group discussion, we used a random sampling technique to select men and women participants from a list of dwellers in the villages. Separate men and women subgroups were organized so that both women’s and men’s perceptions are equally represented and members in the subgroups could feel comfortable discussing the issues. The discussions focused on the management of exclosures and how the village rules addressed the challenges in the management of exclosures. We encouraged all participants to speak and we gave participants equal chances to contribute to the discussion in the facilitation to reduce the dominance of conversation by few members of the focus groups. Interviews were conducted by the first author with the help of a translator whose first language is Tigrigna, the local language spoken in the study areas. We used participatory appraisal tools in the group discussions, for instance, we used scoring exercises to compare the importance of different communal resources to the livelihoods of villagers.

In addition, transect walks following the altitudinal gradients of the sites were used to get an impression of the conditions of the exclosures. Observations and informal discussions with villagers were used to get information on how villagers refer to community rules and challenges, and how villagers manage the exclosures. Moreover, secondary data on socio-economic settings were collected from literature and local organizations including BoANRD.

2.6. Data Analysis

A total of 180 households were systematically selected from the list of local community members received from the Village administration. A structured questionnaire was provided to these households to collect their perception of area exclosure and benefits gained from it. Respondents were included using a statistical formula as follows:

\[ n = \frac{z^2\cdot p\cdot q\cdot N}{n^2 + z^2\cdot p\cdot q} \]

Where, 
\( n \) = sample size
\( N \) = total population of households in all sites
\( Z^2 \) = confidence interval (1.96, constant)
\( d^2 \) = margin of error
\( p \) = proportion of population (0.5, constant)
\( q \) = 1- \( p \)

Assumption: let \( d \)= 0.05 and \( q \)= 0.5

\[ n = \frac{(339)(0.05)^2 + (1.96)^2(0.5)(0.5)}{180} \]

\[ n = \frac{n \cdot N1}{N} \]

Where \( n \) = sample size on the first site
\( N \) = total number of households included in the study
\( N1 \) = total number of households in all sites
\( N \) = total number of households in all sites

\[ n1 = \frac{113 \cdot 180}{339} \]

\[ n1 = 60 \]

Similarly,

\[ n2 = \frac{n \cdot N1}{N} \]

Where \( n2 \) = sample size on the second site
\( n \) = number of households in the second site
\( N1 \) = total number of households included in the study
\( N \) = total number of households in all sites

\[ n2 = \frac{109 \cdot 180}{339} \]

and

\[ n3 = \frac{n \cdot N1}{N} \]

Where \( n3 \) = sample size on the third site
\( n \) = number of households in the third site
\( N1 \) = total number of households included in the study
\( N \) = total number of households in all sites (Daniel, 1995)

\[ n3 = \frac{117 \cdot 180}{339} \]

The complexity of the interdependence among different factors made it difficult to take a separate examination of each factor under consideration. However, generally, the hypothesis is that if individual households can earn significant contribution from the outcome of exclosure establishment (on livestock production and productivity, apiculture, vegetable production and better ecosystem and climate); these households manage sustainably to perpetuate these benefits; otherwise the reverse is true other things remained constant. Hence, as hypothesized in various studies this study test the following major factors (table 1).

Household Livelihood Strategy (Sources of Income)

- The impact of those households with off-farm livelihood strategies those are completely independent of exclosure like trade cannot be determined *apriori*.

Household Human Capital:

- Farmers who are older experienced more exclosures than younger; thus, age is expected to have a positive relationship with exclosure establishment.
- Higher levels of literacy, training and secured land tenure are hypothesized to have a positive association with exclosure establishment.
- Two opposing relationships are expected between exclosure establishment and household size. On the one hand, the larger the size of the household, the higher the subsistence consumption needs, and given a fixed benefits, the lower the willing of the farmer to participate in the management of exclosure. On the other hand, larger household size is the source of labor which is an important input to participate in the exclosure soil and water conservation practices, because it requires more labor. Hence cannot be determined *apriori*.
- Regarding sex of household head, female-headed households are expected to be less likely to participate in the management of exclosure, maybe because of their...
less exposure to the external environment and new technology.

Household Physical Capital:
- Household physical capital endowment – land and oxen – is expected to have a positive or negative relationship with its investment decision on exclosure establishment. So, cannot be determined apriori.

Household Financial Capital:
- Household’s endowment of financial capital (e.g. household saving and access to credit service), is obviously expected to have a positive relationship with a farm household’s investment decision and exclosure establishment.

Farmland factors:
With respect to the influence of the characteristics of exclosure on the households, exclosure distance near to their home, lower catchment flat slope farm plots, and infertile plots are expected to increase management and establishment of exclosures.

Table 1. Definitions of Variables Used in the Regression Analyses

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE(+), (-)</td>
<td>Age of the household head in years</td>
</tr>
<tr>
<td>SEXDMY(+), (-)</td>
<td>Sex of respondent; male= 1, Else=0</td>
</tr>
<tr>
<td>HHSIZE(+/-)</td>
<td>Total number of household size</td>
</tr>
<tr>
<td>HHLIT(+)</td>
<td>Literacy status of household head 1=literate, 0= otherwise</td>
</tr>
<tr>
<td>TENURE(+)</td>
<td>Whether a farmer perceives a risk of loss of land in the future; 1 if he/she perceives 0 otherwise</td>
</tr>
<tr>
<td>FMSIZE (+/-)</td>
<td>The size of the farm, in hectares</td>
</tr>
<tr>
<td>DISTANCE (+)</td>
<td>Distance of nearest exclosure from homestead, in km</td>
</tr>
<tr>
<td>SLOPE_CAT(+)</td>
<td>Slope category of majority of household head land; flat and mid slope=1, Else=0</td>
</tr>
<tr>
<td>TRAINING(+)</td>
<td>Whether training about soil conservation received by the farmer; 1 if a farmer got training and 0 otherwise</td>
</tr>
<tr>
<td>CREDIT(+)</td>
<td>Credit access of household head; Yes=1, Else=0</td>
</tr>
<tr>
<td>OFF_FARM(+/-)</td>
<td>Whether a farmer engaged in off-farm employment; 1 if a farmer has off-farm employment and 0 otherwise</td>
</tr>
<tr>
<td>PERCEIVE(+)</td>
<td>Whether a farmer perceives land degradation as a problem; 1 if farmer had perceived erosion as a problem and 0 otherwise</td>
</tr>
<tr>
<td>LIVESTOCK(+/-)</td>
<td>Livestock holding (in TLU)</td>
</tr>
<tr>
<td>SOIL_FERTI(+)</td>
<td>Soil fertility category of majority of household head land; infertile=1, Else=0</td>
</tr>
</tbody>
</table>

Note:
Dependent variable- decision to exclosure establishment
signs (+/-), in braces, indicate the expected sign of coefficients of the specified variable to exclosure establishment

The study heavily depends on the quantitative method of data analysis. The study used descriptive statistics (averages, cross-tabulation, and percentages) as well as econometric models (Binary Logistic Regression). Frequency tables were generated for general information, t-tests were applied to compare the mean differences, chi-square tests were applied to analyze categorical data, and binary logistic regression was applied to find out the degree of relationship between independent and dependent variables influencing the sustainability of exclosure establishment and management practices. All other socio-economic and questionnaire survey data were analyzed and interpreted with appropriate statistical tools using SPSS software V.20. Finally, the data analyzed and interpretations were conducted by including data from observations that were recorded in the field.

III. RESULTS

3.1. Socio-Economic Characteristics of Farmers used for logistic regression.

In this section, the general household characteristics are presented and selected variables were used for logistic regression analysis in section 3.2. In addition to the tabular presentation and description of variables, all variables under consideration were tested to see their statistical significance.

Mean age of respondents were 38.4 years. Statistically significant differences (P= 0.001) were found in age. This means age may be important in influencing exclosure establishment and management. Sex is not significant and may not be important in exclosure establishment and management.
Household size is significant only at 10% therefore it may not be major determinant in exclosure establishment but when we see with respect to poor resource farmers who depend solely on family labour to maintain their farms it may have an influence but it has also implication on resource share from the exclosure and public works on the area. As shown in table 2 the average household size is also more or less 6 persons rounding to the nearest whole number.

More literate farmers are assumed to increase the ability to obtain process and use of information relevant to the use of new adoption technology. In addition, high rate of literacy increases the capacity and ability to obtain and apply relevant information concerning the use of exclosures. The survey result shows variation statistically significant at less than 5 percent level. Thus, literacy could have a contribution in exclosure establishment and management in the area.

### Table 2. Description and summary statistics (mean and percentage) of the variables used in the binary logistic model (n = 180).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent/ Constant</td>
<td>decision to exclosure establishment</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Mean Age of the household head in years 38.41</td>
<td>0.0001***</td>
</tr>
<tr>
<td>Sex</td>
<td>Sex of respondent 84.4</td>
<td>0.108</td>
</tr>
<tr>
<td>Household size</td>
<td>Total number of household members 6.3</td>
<td>0.072*</td>
</tr>
<tr>
<td>Literacy</td>
<td>Literacy status of household head (%) 40.56</td>
<td>0.04**</td>
</tr>
<tr>
<td>Tenure</td>
<td>Farmer’s perception towards tenure (%) 94.4</td>
<td>0.0001***</td>
</tr>
<tr>
<td>Farm size</td>
<td>The size of the farm, in hectares 0.84</td>
<td>0.02**</td>
</tr>
<tr>
<td>Distance</td>
<td>Average distance of nearest exc. from homestead, in km 3.04</td>
<td>0.001***</td>
</tr>
<tr>
<td>Slope</td>
<td>slope category of the majority of household land 57</td>
<td>0.77</td>
</tr>
<tr>
<td>Training</td>
<td>Training about SWC received by the farmer 97.8</td>
<td>0.0001***</td>
</tr>
<tr>
<td>Credit</td>
<td>Credit access household (%) 60</td>
<td>0.01**</td>
</tr>
<tr>
<td>Off-farm</td>
<td>A farmer engaged in off-farm employment (%) 85</td>
<td>0.001***</td>
</tr>
<tr>
<td>Perceive</td>
<td>A farmer perceives land degradation as a problem (%) 99.4</td>
<td>0.02**</td>
</tr>
<tr>
<td>Livestock</td>
<td>Livestock holding (in TLU) 3.11</td>
<td>0.003***</td>
</tr>
<tr>
<td>Soil fertility</td>
<td>Soil fertility category of majority of household land (%) 60</td>
<td>0.01**</td>
</tr>
<tr>
<td>Infertile</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Fertile</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>
Farmers’ perception of land degradation and recognizing it as a problem is an important factor that influences the exclosure establishment and management practices. Table 2 showed significant differences were observed on the level of perception regarding the causes of land degradation. Similarly, chi-square tests showed that the use of credit, training about SWC techniques, a farmer engaged in off-farm employment and soil fertility categories of the majority of households land were statistically significant differences and could have contribution and influence in exclosure establishment and management in the area.

3.2. Results of Logistic Regression Model

This section of the study is devoted to testing the relative effect of the variables under consideration towards exclosure establishment and management in the study area. Table 3 presents the logit estimates of the determinants of the likelihood of exclosure establishment and management practices sustainability. A chi-square test which measures the goodness of fit of the model is found to be significant at 1 percent level; signifying a good fit i.e., the model is adequate.

The logistic regression model result shows that, though not significant, sex and educational status of the household heads has a positive coefficient which implies that male headed and literate households have a higher probability of acceptance of exclosure establishment and management than female-headed and illiterate households. In the same manner, training, the perception of land degradation, and slope of farmland are not significant in the model result but their positive coefficient indicates their positive contribution to acceptance of exclosure establishment and management in the area.

Table 3. Factors that affect the sustainability of exclosure establishment and management (logit model).

<table>
<thead>
<tr>
<th>Variable in the Equation</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>.095</td>
<td>.046</td>
<td>4.267</td>
<td>1</td>
<td>.039</td>
<td>1.100</td>
</tr>
<tr>
<td>SEX</td>
<td>1.576</td>
<td>.928</td>
<td>2.883</td>
<td>1</td>
<td>.090</td>
<td>4.838</td>
</tr>
<tr>
<td>HHSIZE</td>
<td>-.146</td>
<td>.142</td>
<td>1.064</td>
<td>1</td>
<td>.302</td>
<td>.864</td>
</tr>
<tr>
<td>HHLIT</td>
<td>.447</td>
<td>.768</td>
<td>.339</td>
<td>1</td>
<td>.560</td>
<td>1.564</td>
</tr>
<tr>
<td>TENURE</td>
<td>2.867</td>
<td>1.059</td>
<td>7.333</td>
<td>1</td>
<td>.007</td>
<td>17.592</td>
</tr>
<tr>
<td>FMSIZE</td>
<td>-.949</td>
<td>.535</td>
<td>3.148</td>
<td>1</td>
<td>.076</td>
<td>.387</td>
</tr>
<tr>
<td>DISTANCE</td>
<td>-.299</td>
<td>.246</td>
<td>1.467</td>
<td>1</td>
<td>.226</td>
<td>.742</td>
</tr>
<tr>
<td>SLOPE_CAT</td>
<td>.109</td>
<td>.733</td>
<td>.022</td>
<td>1</td>
<td>.882</td>
<td>1.115</td>
</tr>
<tr>
<td>TRAINNING</td>
<td>24.044</td>
<td>15094.772</td>
<td>.000</td>
<td>1</td>
<td>.999</td>
<td>27677757192.712</td>
</tr>
<tr>
<td>CREDIT</td>
<td>1.342</td>
<td>.734</td>
<td>3.345</td>
<td>1</td>
<td>.067</td>
<td>3.828</td>
</tr>
<tr>
<td>OFF_FARM</td>
<td>2.861</td>
<td>.832</td>
<td>11.824</td>
<td>1</td>
<td>.001</td>
<td>17.478</td>
</tr>
<tr>
<td>PERCEIVE</td>
<td>20.141</td>
<td>40192.963</td>
<td>.000</td>
<td>1</td>
<td>1.000</td>
<td>558369624.960</td>
</tr>
<tr>
<td>LIVESTOCK</td>
<td>-.323</td>
<td>.154</td>
<td>4.412</td>
<td>1</td>
<td>.036</td>
<td>.724</td>
</tr>
<tr>
<td>SOIL_FERTI</td>
<td>.676</td>
<td>.740</td>
<td>.835</td>
<td>1</td>
<td>.361</td>
<td>1.966</td>
</tr>
<tr>
<td>Constant</td>
<td>-48.695</td>
<td>42933.975</td>
<td>.000</td>
<td>1</td>
<td>.999</td>
<td>.000</td>
</tr>
</tbody>
</table>

-2Log likelihood  63.886
Model chi-square  88.29
Correctly predicted Positive attitude %  96.7
Correctly predicted other attitude %  70.4
Overall cases correctly predicted%  92.8

Source: Model output

IV. DISCUSSION

4.1. Determinants of sustainability of exclosure establishment and influencing factors for its management practices

Empirical studies have considered a broad range of factors such as credit constraint, limited access to information, farm size, socioeconomic and institutional factors to assess exclosure establishment and management practices by farmers. Yet, not all factors are equally important in different areas and for farmers with different socio-economic situations. This means the decision to accept or not a particular measure exclosure establishment and management practices varies depending on the age of farmer, educational level of household size, landholding size, livestock ownership and other factors that indicate also the wealth status of farmers.

With regard to the age of the household head, previous researchers reveal that the direction of the influence of this variable is either way. Farmer’s age is negatively related to the
adoption of soil and water conservation practices (Bekele and Holden, 1998) and Paulos et al., (2004) for Ethiopia, and Krishna et al., (2008) for Nepal). On the other hand, Aklilu (2006) for Ethiopia reported that farmer’s age is positively related to the adoption of soil and water conservation practices. As table 2 shows, the average age of household heads was high, this was about 38.4 years. In this study, age variable has a positive coefficient and significant at 0.01 levels, signifying a strong impact on the decision to exclosure establishment and management practices. This can be explained by the fact that older farmers have longer farming experience and relate to the use of exclosure establishment and management practices as compared to the younger counterparts. The result shows that keeping other variables in the model constant, as the age of the household heads increases by one unit sustainability or acceptance of exclosure establishment and management increase by a factor of 1.1. This implies older farmers accept more exclosure establishment and management than the younger counterparts do.

As observed by Bekele and Holden (1998), the effect of household size on the adoption of soil and water conservation practices may be either positive or negative. Larger households are able to provide the labor that is required for establishing and maintaining selected conservation structures and smaller ones may face labor problems which may hinder adoption and sustained use of certain practices. However, Abera (2003) found out that if a family is larger, there will be more demand for land to meet subsistence needs. Hence, members may not adopt soil and water conservation practices. The result from the logistic regression shows that household size and acceptance of exclosure establishment and management has a negative association, but not significant at 10 percent level. It signifies that household size was not an important factor to influence the acceptance of exclosure establishment and management in the area.

To test this hypothesis a literacy status dummy was included in the logit model. The variables literacy status of household head was positively related to acceptance of exclosure establishment and management, but the result was not strong enough to support the idea since it is not significant.

The relationships between farm size, soil and water conservation practices differ from place to place. Farm size is found to have mixed effects on the sustainability of soil and water conservation practices. While various studies (Wagayehu and Lars, 2003; Ersado et al., 2004; Aklilu, 2006) indicated positive relation between adoption of soil and water conservation practices and farm size, Pender and Kerr (1998) find differential effects of farm size on soil and water conservation practices across the three villages they studied in India. However, in this study, farm size was found to influence acceptance of exclosure establishment and management negatively and significant at 10 percent level. The result implies all other variables remaining constant, increase in a unit of cultivated farm size would result in a decrease in the acceptance of exclosure establishment and management by the factor of 0.387. The negative influence might be explained that a large proportion of farmers with larger farm sizes tend to use soil and water conservation practices on any of their plots than the exclosure.

Land tenure as an important predictor was also assessed and the result shows, as expected, a positive and significant relationship at 1 percent level, signifying a strong impact on the decision to acceptance of exclosure establishment and management practices. Thus, farmers that have access to land secured they cultivate through inherited or obtained from the Tabias administration are more likely to accept exclosure establishment and management practices than their counterparts that are living with renting or sharecropping.

The value that inherited land acceptance of exclosure establishment and management practices is 17.59 times that are accessed for renting, sharecropping or others. This can be explained by the fact that farmers cultivating their own lands are more secured compared to those rented. The possible explanation is that land ownership has some influence on acceptance of exclosure establishment and management practices. Most farmers feel secure under the current land tenure system, and tenure is not a constraint in most cases. However, a few farm groups who rent land mainly young people and new landless regard insecure tenure as a constraint in the acceptance of exclosure establishment and management practices.

As expected of this study, the coefficient of the distance of an exclosure from homestead was found to be negative but not significant. This should have given them the opportunity to pay more attention to nearby exclosures with less care to distant ones. This can be attributed to the fact that farmers give more attention to nearby exclosures and the care given to distant areas is low. Therefore, the greater distance of an exclosure from homestead (As distance increases), and the long-term and immediate benefits of the exclosures may have discouraged farmers from giving the emphasis and management of exclosures. This finding is not in agreement with (Wagayehu and Lars, 2003) who found significant but similarity with negative correlation between no conservation decision and distance of a parcel from the residence but positive correlation between distance of the plot and adopting conservation decision in Ethiopia (Kessler, 2006) also found out that farmers invest more in soil and water conservation in fields situated near to residences.

The slope of a plot was included as an explanatory variable. Considering the assumption of the higher the slope category of a land, the greater will be the severity of soil erosion. This means that on sloping lands the impact of soil erosion would be more visible to the farmers and force them to take remedial actions. This is because the slope is an indicator of soil and water loss from the farmland or other lands. Thus, farmers cultivating sloping fields perceive the threat of soil loss better than farmers who cultivate gentle or level sloping fields. This is also true on exclosures and free grazing lands. This implies that farmers cultivating vulnerable fields are more likely to adopt soil and water conservation practices on their farms than those cultivating less vulnerable lands. It implies slope of plots is positively related to the sustainability of soil and water conservation holding other factors constant. The finding supports to that of (Bekele and Holden, 1998; Wagayehu and Lars, 2003; Berhanu and Swinton, 2003; Aklilu, 2006). As per the same authors, the conclusion was that a positive and not significant effect of the slope of a plot on the decision to adopt soil and water conservation practices.

Another important factor analyzed in the model is the level of off-farm income. Off-farm employment does not necessarily lead to more sustainable land use. Rather, better access to off-
farm activities especially in the exclosure community works will increase income and farmers’ incentives to invest in soil and water conservation practices. It has a positive sign and highly significant. The association is strong since exclosures are managed by FFW and PSNP programs too but unrelated findings also reported by (Pender and Kerr, 1998; Berhanu and Swinton, 2003; Tenge et al., 2004; Akilul, 2006). They reported off-farm income on farmers’ had a negative association with the sustainability of soil and water conservation practices. However, it was hypothesized that the more the farmer earns off-farm income the less liquidity problem he/she faces so that he/she is more likely to accept exclosure establishment and management practices even in the absence of credit access. It has a positive sign but significant at 10 percent level.

The positive influence might be explained that farm income is low and the farmers cannot rely on agriculture. The low annual farm income has probably forced some of the sample households to engage in off-farm activities. Household’s survival depends on the ability to generate off-farm income so as to smooth their consumption as means of risk management. A major reason could be that majority of the households rely on non-farm activities as they have very small and fragmented farm size. The implication is that farmers are discouraged to rely on farming, which in turn, may result in farmer’s to under-invest on their farmlands.

A substantial number of households in the Tigray region participates in food-for-work (FFW) activities which involve labour contribution to public works such as road construction or maintenance, soil and water conservation activities, and forest rehabilitation and receiving food in return for their labour services and this results supports a trend reported by other authors who found, that (Berhanu and Swinton, 2003; Fitsum et al., 1999).

The effect of soil fertility on acceptance of exclosure establishment and management was found to have a positive association, but not significant at 10 percent level. Plots with both fertile and infertile soils positively influenced farmers’ acceptance of exclosure establishment and management but the difference is insignificant possibly the majority of the farmers assume their farmland is different from the exclosure and the farmland fertility is not associated with the exclosure management and them did look only short-term economic benefits of their farmland or they did not see the negative effects of erosion on their plots in the long term.

Access to credit and acceptance of exclosure establishment and management practices is given much emphasis in many empirical studies. In the same way in this study, the effects of credit were assessed. The result showed, as expected, a positive and significant at 10 percent level, signifying an impact on the decision to acceptance of exclosure establishment and management. This implies that households with better access to credit are more likely to have a higher probability of acceptance of exclosure establishment and management than those without access.

Regarding the credit access, the stipulation of interpreting this result is that farmers who did not take credit may not necessarily mean they had no access to it. This means that use of credit may not clearly distinguish between farmers who chose not to use available credit and farmers who did not have access to credit. For instance, farmers may not take credit if it is not affordable, or if they perceived it is associated with some risks, though there is access (availability).

This means rationale farmers will use credit if it is profitable. Profitability, in turn, depends on the cost of credit and the potential returns on investment. Moreover, from the FGD respondents replied the main microfinance institute in the study areas is Dedebit Credit and Saving Institution (DECSI). DECSI was established in response to the work done by REST in providing credit services to the poor, and since it was officially registered in 1997, much of DECSI’s work has continued to focus on the provision of credit services for the poor in the rural areas of Tigray.

The multipurpose cooperative operating in the areas is another major source of credit. The cooperative provides credit in kind (main inputs such as improved seed, chemical fertilizer, etc) interest-free. Informal credit sources such as friends, relatives, and neighbors also play an important role in providing cash credit when individuals are in urgent need of money.

These Cooperatives or Credit and saving associations (CSA) groups can borrow during a given loan disbursement cycle. In order to borrow, a member will present a proposal to the group, outlining what they intend to use the loan for, and how they will be able to repay it. For example, members might use the loan for agricultural production (Fertilizer or Improved seed purchase), to invest in petty trading or other income-generating activities. In principle, members will select the person with the most convincing proposal. However, it is also not uncommon for loans to be given to the person who appears to need it most, for example, to cover medical expenses, as long as the members are confident that the person can repay the loan. Penalties are imposed on members who fail to repay their loans within the specified time period, which is usually between 1-3 months typically meet twice a month, and each member will contribute a specified amount of money to a savings pool, and a smaller amount to a social fund. After a certain amount of capital has accumulated in the savings fund, members can take out loans, which they are obliged to repay with interest within a certain time period. Group members will collectively agree upon the contribution amounts, interest rates and repayment periods. However, the approach is meant to be flexible and in principle, individuals can contribute whatever amount they can afford. In such cases, the amount they can borrow is proportional to their accumulated savings.

In some cases, a group may also decide not to disburse loans on an individual basis, but to collectively invest their savings in a group business venture and then share the profits. After a certain period, usually between 9-12 months, the group will share the savings and any interest accrued with all the members. As such Village Savings and Loan Associations (VSLA) members can earn dividends on their savings whether they borrow from their group fund or not.

The challenges involved in providing microfinance for the poor are related to low demand, particularly in areas where potential clients are unfamiliar and suspicious of the microfinance products being introduced. There are also challenges relating to the cost of providing financial services to the poor, given that transaction costs are high in comparison to the returns that can be expected from poor clients. Essentially
MFI’s have to be financially viable, and there is little incentive for them to invest in the poor and the Raya Azebo Woreda also 30% Muslim population and religiously use of this MFI is limited.

The logistic regression model result also shows that, though not significant, sex and educational status of the household heads has a positive coefficient which implies that male headed and literate households have a higher probability of acceptance of exclosure establishment and management than female-headed and illiterate households. In the same manner, training, the perception of land degradation, and slope of farmland are not significant in the model result but their positive coefficient indicates their positive contribution to acceptance of exclosure establishment and management in the area.

The number of livestock on acceptance of exclosure establishment and management was found to have a negative association, and significant at 0.05 level. The result implies all other variables remaining constant; increase in a unit of livestock would result in a decrease in the acceptance of exclosure establishment and management by the factor of 0.72. The negative influence might be explained that a large number of livestock needs a larger proportion of grazing lands than exclosures and farmers with a high number of livestock want to have a larger size of free grazing lands than that of exclosure. Land degradation is sometimes taken as synonymous with soil degradation. Soil degradation commonly manifests itself through soil erosion and soil fertility decline (Alemneh et al., 1997). In the strict sense of the word, however, land degradation is more than degradation of the soil (Woldeamlak, 2003). Likewise, farmers in the study perceive land degradation in its broader sense. These include soil erosion, soil fertility decline, and loss of vegetation cover and transformation of farmland to rocky bare land. Soil erosion causes a reduction in infiltration and water holding capacity of the soil as well as a loss of plant nutrients which ultimately results in low productivity (Carucci, 2003).

In fact, only a few farmers named a disadvantage of the soil and water conservation practices and exclosure establishment and the top cited reasons for negative impacts are the following. This was mainly due to the problem of time and labor for its maintenance. The regular maintenance of soil and water conservation is problematic; as they only have limited time and labor to do such work. Thus, they stopped applying soil and water conservation practices at some portions and only kept the area from any interference. Finally, few farmers had totally had a negative perception because the structures of soil and water conservation are a source of rodents for their farmland in the areas. Due to the very small number of answers, general statements cannot be made.

Due to exclosure establishment, the advantages most often mentioned are decreasing in soil erosion; increase crop production/yield and soil fertility; and no expansion of farmland towards conservation areas. The advantage, soil erosion decreasing was mentioned by farmers by almost 93%. Further, the soil fertility and the crop production/yield are connected directly; this can be stated that after making the soil more fertile, the harvest will increase. So may be in few years, even more farmers would say that the harvest increased through the restoration of degraded lands since its implementation. The soil erosion decrease advantage mentioned by them also help one can assume that the management practices and exclosure establishments in the watersheds were successful. Without increasing the grazing land size livestock production is going with fodder and grass supply products were also a sign of the success of the exclosure management.

The most frequently quoted reason of exclosure establishment is to reduce soil erosion. In fact, this is the most mentioned reason for sustainability of exclosure establishment and management practices at all levels. Some respondents have believed that exclosure in the watersheds will improve the soil moisture of their farm's plots in the leveled grounds of the lower catchments. Others were influenced by increased yield and soil fertility. The reasons behind the adoption of soil and water conservation measures were similar with the mentioned expectations of sustainability of exclosure establishment and management practices. Still, reduced soil erosion and improvement of soil fertility were the two major expectations in adopting of soil and water conservation and sustainability of exclosure establishment and management practices.

On the other hand, farmers expected that sustainability of exclosure establishment and management practices could help their farms to generate more variation or sources of livelihood. It was observed that most of the expectations mentioned can only be acquired within a long-term period of time such as prospects related to developing to bench terrace, soil fertility improvement, soil loss reduction and increase yield. Immediate benefits were not expected that much from the soil and water conservation practices and exclosure establishment. Farmers’ expectations of long-term benefits perhaps have motivated them to try and continuously adapt the soil and water conservation and exclosure establishments.

Majority of the respondents claims that exclosures have no damaging effect on their cultivated farms. Perhaps this served as one of their motivation to continuously adapt the soil and water conservation practice at high intensity. Only a few farmers mentioned some negative effects of exclosure establishment. Few reasons mentioned here are that’s of wildlife shed after the exclosures have damage on our livestock and farms, and limitation of the free grazing areas.

Nevertheless, despite the problems experienced by local farmers, most were encouraged by restoration of degraded lands by exclosure as well to apply soil and water conservation practices both on exclosures and their farms. Yet for them, the gains are far more worthy than the undesirable characteristics of the soil and water conservation.

Concerning the restoration of grazing lands and exclosure establishment, FGD members said that grazing has “decreasing” and in some areas “no change”. Still, there is a difference in the different Tabias. For example, in the Tabia of Hadinet in Atsbi Woreda and Hawelti of Raya Azebo Woreda responded that grazing lands are not improving; instead, it is getting lower from time to time. The focus group discussion participants from the Tabia of Genete and Kihen confirmed that even though grazing land is small, the area is protected from animal and human intervention and that the people also participated massively in public soil and water conservation. However, the limited sizes of free grazing lands were open usually.

The amount and duration of yearly rainfall was an important factor that determined the duration of opening and closing
periods of the free grazing lands, in Kilte Awelaelo and Atsbi Woreda the opening and closing periods of the free grazing lands are during the month of Meskerem (September), while in Raya Azebo Woreda, especially the Mehoni Tabia where the grass production was the highest and the topography is plain, so it has five to six opening and six to seven closing months.

Fuelwood is one of the critical problems in all Tabias in the study area. People usually use animal dung and few eucalyptus trees grown on their private plots of land. The reason why wood production has decreased, while the number of trees has increased, is that wood distribution from exclosures is yet not allowed and a limited usage is allowed. After soil and water conservation was introduced, at least, the degradation and depletion of the natural resource bases are minimized. All respondents agree that, had it not been for soil and water conservation, conditions would have worsened and hence people and animals would not have survived. The survey results indicated that soil erosion and flooding have decreased.

From the analysis, it was possible to understand that in all Tabias communities have a similar perception about the benefits of exclosure establishment and activities on the soil and water conservation. There is a common consensus about the positive benefits of exclosure establishment. For example, one of the study sites named Haikmehal is found in a lower slope and is surrounded by chains of mountains; it is exposed to flooding but now, thanks to a massive soil and water conservation practices, the area is fully protected from flooding.

Moreover, as participants confirmed, new springs have emerged and a discharge from the existing ones improved, new irrigation schemes have been started to be developed with the availability of water, biodiversity is regenerating and wild animals are emerging, and local-climate around the treated watersheds is improving. This result is supported and has been noted in terms of soil conservation, water infiltration, crop yield, biomass production, groundwater recharge, and flood hazard prevention (Berhau et al., 2003; Belete, 2003).

This observation is further substantiated by field investigation in Tigray: a photographic record over 30 years, which show the status of natural resources since 1975. The study demonstrates that in Tigray, sheet and rill erosion rates have decreased, infiltration and spring discharge are enhanced, and vegetation cover and crop production have improved. The rehabilitation was due to both the improved vegetation cover and to the implementation of physical conservation structures. Similarly, overall land management has improved in 85% of the analyzed landscapes (Nyssen et al., 2007). However, maintaining and enhancing farmers’ participation is obviously a continuous challenge. Thus, it implies that sustained motivation will determine the success or the failure of any future restoration program in Tigray (Nyssen et al., 2009; Reubens et al., 2011). For this reason, community mobilization for collective action was considered an important intervention aimed at restoring the productive capacity of the land as water was conserved and soil loss was kept minimal.

V. CONCLUSION AND IMPLICATIONS
The purpose of this study was to investigate the factors that influence the sustainability of exclosure establishment and management practices in the highlands of Tigray. The land users’ understanding and perception of exclosure establishment and management practices are important when sustainable natural resources management options are considered. A large-scale mass mobilization undertaken for more than three decades in soil and water conservation practices has minimized flooding and thus soil erosion or degradation both in the farmlands and in exclosures, although it was less practiced in on-farm conservation compared to the exclosures.

Results of the study also indicated that perception of farmers towards benefits of conservation attempts in changing and hence important contribution towards livelihoods has been recorded. However, the benefits are not yet adequate. Therefore, if the people of the study areas are to continue with the community-based soil and water conservation practices, they have to realize tangible net benefits in terms of production and income as well as environmental improvements. The study revealed that the landless people have tackled not only land degradation by applying various hillside conservation methods such as soil/stone bunds, trenches, and tree plantation but also, creating alternative income through different activities such as the sales of honey production and growing vegetables.

Determinants of farmers’ sustainability of exclosure establishment and management practices were assessed. Any further improved conservation technology initiative should aim at enabling local farmers to exclosure establishment and management practices conducive to increasing income as well as to enhancing soil conservation. The empirical results from binary logistic regression model showed age, tenure, and off-farm activity were positive and significant predictors of sustainability of exclosure establishment and management practices while household size, farm size, distance and number of livestock have a negative effect on exclosure establishment and management practices in the study area and they were not significant except livestock number. These findings strengthen the fact that in order to achieve sustainable exclosure establishment and management practices, institutional and economic factors should be given special attention.

Thus, in order to achieve sustainable exclosure establishment and management practices, institutional and economic factors should be given special attention. Extension workers or development agents are urgently needed to give education for farmers to maximize public awareness for the effective and sustainable use of soil and water conservation practices, and the availability of credit is not a solution by itself unless it is accompanied by better rearrangement on repayments. Farmers should be given repayment grace period in times of complete crop failure. There is a need for sensitization of farmers to benefit formal training of all community in exclosure establishment and soil and water conservation technologies and capacity building of farmers in other livelihood areas to reduce the burden on natural resources.

It is frequently argued that various personal, economic, socio-institutional and biophysical attributes have influential roles in farmers’ decisions about the sustainability of exclosure establishment and management practices in different areas of Ethiopia. From this analysis, the variables age, household size, and literacy status of the household head have variations. Tenure security and credit access were also found to be important as an
explanation for the positive answer shown by most of the farmers.

Exclosure establishment and management are perceived and valued as positive by all farmers. The farmers point out a lot more advantages than disadvantages of exclosure establishment. However, they also expressed concerns about the negative impacts of exclosures such as reduction of fuelwood and shortage of grazing areas for their livestock. These concerns should be addressed because the farming system in the study area is labor intensive and involves the use of livestock traction power, livestock production is an important source of income and wealth, and the local communities use fuelwood to meet their household energy demands. Thus further expansion of exclosures in the near future could face resistance from local communities in case the direct and indirect benefits of exclosures to the local communities will not be transferred into payments for the respective ecosystem services.

The most important advantages of exclosure establishment were soil fertility increase; increase crop production/yield; erosion decrease; increase fodder and grass supply, and decrease flooding. According to the farmers, the most limiting factor in terms of exclosure establishment and management practices are time and labor intensive.

Off-farm income is low (most of them engage as daily labourers and in safety net program) and the farmers dominantly rely on agriculture as means of their livelihood. However, the low annual farm income has forced some of the households to engage in off-farm activities is due to small land size and fragmented plots of land. The implication is that farmers are discouraged to rely on farming, which in turn may result in farmers to under-invest in soil and water conservation practices on their farmlands.

As land degradation is severe in the highlands of Ethiopia, applications of soil and water conservation practices are a must. As a result, there are many efforts made by the government for rehabilitation of natural resources in particular of soil and water conservation practices, such as experience sharing of farmer’s field-based, giving of workshops for farmers, and agricultural days. Therefore, to promote conservation efforts, policies should identify social and economic factors with respect to soil and water conservation and integrate them into the plans, according to the results of the analyses the most important are resources availability and household characteristics. Moreover, conservation should, therefore, be linked to subsidies if possible and credit facilities for those poor farm groups for a long duration. Any effort to achieve sustainable exclosure establishment and management practice should enhance both farm and off-farm income in a way that reinforces each other. Moreover, exclosure establishment and management practices should not only be aimed at minimizing soil erosion but should also cover other household objectives, such as the improvement of soil fertility, yield increase and fodder for animals.

Exclosure establishments and SWC practices in Tigray result in multifunctionality of the land and the livelihood of the community, although inadequate compared to the level of the degradation and depletion of natural resources and the low level of the livelihood of the community. There are certain major observable improvements after the implementation of integrated watershed management such as reduced soil erosion and increased soil moisture availability which could be explained by the increase in crop production; increased groundwater recharge; reduced sedimentation and run-off problems in the lower parts of the watershed; stabilized gullies and river banks; rehabilitation of degraded lands and improved ecological balance; and introduction of modern beehives and increase in honey production. However, the benefits are not yet adequate.

Communities of the study areas are facing difficulty with health hazards associated with community work because of the mountainous and hilly nature of topography in Tigray. This is worrying and can affect the contribution of labor to community work. Free grazing is also another major factor causing the destruction of the physical and biological conservation (both stone and soil bunds) works and the conflicts over free grazing lands. Thus, restricted grazing and resolving the conflicts over free grazing lands was critical for the sustainable management of free grazing lands. Thus, the local leaders should provide logistics associated with health care when an accident occurs, give accreditation to informal institutions, in order to empower the local community and minimize the conflicts among the society in relation to free natural resource management. Last, from this study raise policy issues that awareness creation among respective stakeholders would be important in the attempt to implement soil and water conservation practices and community natural resources management in sustainable ways.

Thus, in order to make the existing community natural resources management efficient and self-sustaining, it requires intervention by local administrator in the study areas, such as training by extension workers are right away required to change the perception of farmers about the benefits of conservation and give information the present successful existing of exclosures via sitting best models in the study areas as well as in the region, so this can probably be used to obtain support for the local population. The local administrator should also provide some logistics associated with health care when accident occurs mainly in a large-scale mass mobilization of soil and water conservation practices, and the local leaders should give accreditation to informal institutions, in order to empower the local community and minimize the conflicts among the society in relation to free natural resources management. Based on the study findings, the following recommendations were drawn.

Focusing on environmentally friend activities - since all economic activities could not affect the natural regeneration, those activities should be carefully studied and encouraged. The activities like beekeeping should be given attention and conditions should be facilitated in order to maximize the economic return. To fulfill this, the traditional way of beekeeping should be replaced by modern honey production. It is by assuming that, if the modern honey production is going to reduce the economic pressure on the population, the degree of impact on the natural forest will be reduced. Therefore, focusing on and encouraging such economic activities which are environmentally benign is very important.

Resource managers, the scientific community, NGO’s and local communities need to come together for participatory research and action-oriented management interventions. Also, they need to adopt a paradigm shift in the view of practicing an adaptive as well as a landscape management approach to conservation.
Before expanding the area covered by exclosures, it is crucial to consider forest management options such as enrichment plantation of indigenous woody species that can grow fast in exclosures to address the shortage of fuelwood and improve future ecological and economical benefits of the exclosures. As fuelwood shortages are one of the concerns for the negative impacts of exclosures raised by the local communities, enhancing fuelwood supply from exclosures could reduce resistance from the local communities while planning to expand the area covered by exclosures. Moreover, transferring the direct and indirect benefits of exclosures into payments for the respective ecosystem services could increase the interest of the local communities on exclosures.

Special attention should be given to solve the shortage of grazing land due to enclosure so as to encourage community’s interest in expanding and managing enclosure practices in their locality. In the area due to small farm size and fragmented plots of land households are characterized by food insecurity. Any effort to achieve food security should enhance both farm and off-farm income in a way that reinforces each other, extension workers or development agents are urgently needed to give educate the farmers to maximize public awareness for the effective and sustainable use of exclosures and management practices, and the availability of credit is not a solution by itself unless it is accompanied by better rearrangement on repayments. Farmers should be given repayment grace period in times of complete crop failure. Credit access should not also associate with the wealth status of farmers such as oxen and landholdings to address the poor to participate in the application of modern technologies.

Finally, there is a need for sensitization of farmers to form groups to benefit formal training of all community in the exclosures and soil and water conservation technologies and capacity building of farmers in other livelihoods areas to reduce the burden on natural resources.

ACKNOWLEDGEMENTS

The corresponding author acknowledges International Foundation for Sciences (IFS) of Sweden, Addis Ababa University Department of Plant Biology and Biodiversity Management, and Mekelle University for financial and logistical support.

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Secure Data Collaboration Services with Outsourced Revocation in Cloud Computing

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Abstract- Cloud computing is an emerging and promising technique for allowing users to handle and access data from remote locations. However, with the technology getting matured, the users’ privacy and the security of user’s statistical information is progressively challenged. The traditional centralized access control scheme uses a symmetric key approach and does not support validation. We aim to illustrate the vital issues of identity revocation in this paper. Here we introduce the concept of an instance of outsourcing computation into Identity-Based Encryption (IBE) which trails to a revocable IBE scheme in the server-aided0 setting. Most of the key generation related operations during key-update and key-issuing processes are removed with this scheme, leaving only an invariant number of elementary operations for Public Key Generation (PKG). To achieve this goal, we employ a technique that allows the use of an under crossed private key for each user, in which an AND gate is involved to fasten together and restrict the identity component and the time component. For this purpose, we give the encryptor full control over the access rights, providing viable key management even in the case of multiple freelance authorities, and enabling feasible user revocation, which is requisite in practice. Furthermore, we propose another construction which can be demonstrated under the recently formalized Refereed Delegation of Computation model (RDoC). Finally, we present a view of experimental results to establish the productivity of our model.

Keywords— Cloud Computing; Identity-based encryption; Data Security; Outsourced Data; Access-control; Refereed Delegation of Computation model; Revocation.

I. INTRODUCTION

Cloud computing technology has become the promising and prominent technology of the time. The companies are opting for the services of cloud service providers (CSPs) in place of maintaining their own data centers due to flexibility and cost savings in outsourcing their computing jobs to the experts. This allows them to concentrate on their own field of expertise of business. However, the recent trends of outsourcing data storage to CSPs raise the issue of security, which leads us to the necessity of encryption. Traditional crypto systems confidentially encoded data for a target recipient (e.g. from Davidson to Harley) which restricted the range of prospects and extensibility presented by the cloud environment. In a scenario in which companies are conjoining on a cryptography project and employees are working together on some tasks, suppose Davidson wants to share some data of a sub task with those who are working on it, and with the managers of the project from the different companies. With the traditional encryption approach, recipients must be determined in advance so that they are having their keys. Furthermore, either they have to share the same private key or numerous encrypted versions (with different keys) must be stored. These compromises the security, efficacy and the flexibility expected in a robust cloud environment.

Identity-Based Encryption (IBE) is an amazing substitute for public key encryption. It makes simpler key managing in a certificate-based Public Key Infrastructure (PKI). IBE uses a type of public-key encryption in which the public key of a user is some unique information about the identity of the user (e.g., IP address, unique name, email address, etc). This means that a sender can encrypt a message using the text-value of the receiver's specific identity as a key, who has access to the public parameters of the system. The receiver acquires its decryption key from a central authority, which is required to be trusted as it creates secret keys for every user [1]. Consequently, the receiver is able to decrypt this text by obtaining the private key connected with the resultant identity from Private Key Generator (PKG). IBE demands an efficient revocation mechanism as it allows an arbitrary string as the public key which is considered as an appealing advantage over PKI. Specifically, if the private keys of some users get compromised, there should exist a methodology to revoke such users from the system. In PKI setting, revocation mechanism is recognized by affixing legitimacy periods to certificates or using intricate combinations of procedures [2], [3], [4]. This is the primary drawback of the traditional PKI system.

In view of that, key-update efficiency at PKG can be substantially reduced from linear to the height of such binary tree. Though the binary tree introduction is competent to accomplish a relatively high performance, it will result in other problems as noted below:

1. For each and every node on the path i.e. from the identity leaf node to the root node, PKG has to generate a key pair which results in a logarithmic complexity that depends upon the number of users in the system for issuing a single private key.

2. The cultivating size of the private key which is logarithmic in the number of users in the system makes it problematic for the storage of user’s private keys.

3. With increasing number of users in the system, PKG has to maintain a binary tree with a surplus number of nodes. This brings together one more tailback for the global system. If the revocation is analytically calculated in PKI, scarce revocation mechanisms are registered in IBE. The skill of cloud computing users for on-demand computing related to cloud-based services such as Amazon’s EC2 and Microsoft’s
Windows Azure or Brightcove video cloud has shown that they are not competent in using complex systems. The persons using the cloud services expect that IBE revocation to repair any disputes of productivity and storage overhead pronounced above should be simple. Simply transferring the PKG’s master key to the Cloud Service Providers (CSPs) could be a more sophisticated approach. The CSPs then simply update all the private keys and transmit the private keys back to unrevoked users by using the traditional key update technique. However, this approach is less trustworthy as in this system the security depends upon the CSPs who are permitted to access the master key for IBE system.

4. The public clouds are exterior to the trusted sphere of users and are not devoted to users’ distinct privacy. For this reason, it is not desirable to entrust a secure volatile IBE scheme to CSPs to reduce the overhead computation.

In this paper, we will examine the outsourcing reckoning into IBE revocation, and deliberate on the security description of outsourced revocable IBE. We propose a scheme to divest all the key generation connected maneuvers during key-issuing and key-update, leaving a constant number of simple maneuvers for PKG and qualified users to accomplish locally. In this scheme, as with the recommendation in [3], we realize revocation through updating the private keys of the unrevoked users. But unlike that work [3] which irrelevantly concatenates time period with identity for key generation/update and necessitates to re-issue the unabridged private key for unrevoked users, we suggest a unique collusion resistant key issuing process. For this, we shall employ a hybrid private key for each user, in which an AND gate is involved to fasten together and restrict two sub-components, namely the time component and the identity component. Initially, the user is able to achieve a default time component (i.e., for the current time period) and the identity component from PKG as his/her private key. Unrevoked users’ need to request on the key-update component to a recently introduced entity named Key Update Cloud Service Provider (KU-CSP), in order to hold the ability to decrypt.

In contrast to the suggestion of the authors, D. Boneh and M. Franklin [3], in the arrangement we suggest here, KU-CSP just needs to update a frothy component of the key instead of the need to re-issue the complete private keys. We further come up with:

- The establishment of KU-CSP, the user needs no communication with PKG in key update.
- No secure passage or user authentication is vital during key-update between user and KU-CSP.
- A security enhanced edifice under the lately formalized Refereed Delegation of Computation (RDoC) model [9].
- Lastly, we provide extensive investigational results to determine the adeptness of our proposed model.

Let us deliberate on Identity-based Encryption (IBE) scheme which characteristically involves two entities, PKG, and users (both sender and receiver).

This consists of the succeeding four algorithms:

A. Setup(λ): In this algorithm, a security parameter λ is taken as input and gives the public key PK and the master key MK. (master key is not revealed at PKG.)

B. Keygen (ID, MK): PKG runs the private key generation algorithm, which takes the user’s identity and master key MK as input and outputs a private key SKID.

C. Encrypt (M, ID): Sender runs the encryption algorithm, which takes the receiver’s identity ID_ and a message M to be encrypted as input and outputs the cipher text CT.

D. Decrypt (CT, SKID): Receiver runs the decryption algorithm, which takes the cipher text CT and his/her private key SKID_ as input and outputs a message M or an error.

II. RELATED WORKS

Shamir et al in 1984[1] talked in the paper about a type of cryptographic scheme, which allows users to communicate in a secure manner and also helps in verifying signatures without the use of any type of keys or third party involvement. Aiello in 1998[2] talk about the user to provide communication in a secure environment. It emphasizes on digital identification. Boneh in 2001[3] proposed a brand new scheme for identification which was called IBE. It follows the ciphertext security model and gives many applications for the given systems. Elwailly in 2004[4] provides two schemes for implementation, one being a tree system and another being an improvement in the certificate revocation process. It helps in the time and other complexities that exist in the model. Sahai in 2005[5] provided an IBE scheme that was called Fuzzy Identity-Based Encryption. It was based on descriptive models. It uses private key and ciphertext for attribute-based encryption. It deals with attacks from collusions and random errors. Goyal in 2007[6] presented an all new certificate revocation system and it made use of the hash chaining system. This scheme considerably helped in reducing costs in various areas. Huang in 2008[7] gave an attribute-based scheme in which each user is provided with a specific set of attributes. It basically works on encryption and decryption of ciphertext in the system. It is the first scheme to not take into account a central authority. Boldyreva in 2008[3] took forward the concept of IBE that is identity-based encryption.

The scheme suggested helps more users access this system by improving the efficiency from linear to logarithmic to secure it further. Hanaoka in 2010[9] proposed an efficient model for encryption that worked on parallel keys. It gave schemes which provide cheaper costs for computation. Canetti in 2011[10] looked into various protocols that work by a computational process to work on the verifiability and identification of system and its security.

Identity-Based Encryption (IBE) is a tool used to streamline the public key and certificate regulation at Public Key Infrastructure (PKI). It is an important alternative to public key encryption. However, one of the main disadvantage of IBE
During revocation. Efficient revocation has been well studied in conventional PKI setting, but the difficult management of certificates is eliminated in IBE.

- **Revocable IBE:** Introduced by and firstly implemented by Boneh and Franklin [3], IBE has been researched intensively in the cryptographic community in respect of construction and first schemes were validated secure in random oracle model. Subsequent systems were established securely in standard model under selective-ID Security or adaptive-ID security. In recent times, there have been multiple lattice-based constructions for IBE Systems. However, there is scope for ample work on revocable IBE. Hanaoka et al. proposed a way for users to periodically renew their private keys without communicating with PKG [10]. However, the authors propose a tamperresistant hardware device and mediator-aided revocation. If an identity is revoked then the mediator is asked to stop helping the user. Apparently, it is non-practical since all users are unable to decrypt on their own and they need to convey with mediator for each and every decryption. Lately, Lin et al. proposed space effective revocable IBE mechanism from nonmonotonic Attribute-Based Encryption (ABE), but their structure requires O(r) time’s bilinear pairing operations for a single decryption where r is the number of revoked users.

- **Other Revocation Technique:** The authors examined proxy re-encryption to pose a revocable ABE scheme. In this scheme, confident authority only requires updating master key according to attribute revocation status in each time period and affect proxy re-encryption key to proxy servers. The proxy servers will then re-encrypt cipher text using the re-encryption key to make sure all the unrevoked users can perform successful decryption. A third-party service provider is presented in both Yu et al. and this work. Accordingly, Yu et al. utilized the third party (work as a proxy) to ascertain revocation through encrypting cipher text which only conforms to the special application that the cipher text is stored at the third party. However, in our formulation, the revocation is realized according to updating private keys for unrevoked users at cloud service provider which has no binding on the location of cipher text.

- **Outsourcing Computation:** The difficulty about how to securely outsource dissimilar variants of affluent computations has drawn attention from computer science community for a long time. Attallah et al. offered a framework for secure outsourcing of scientific computations for instance matrix multiplication and quadrature. The solution utilized the masking technique and thus led to escape of private information. Chaum and Pedersen initially posed the concept of wallets with observers, a piece of secure hardware mounted on the client’s computer to accomplish some expensive computations. Rosenberger and Lysianskaya offered the first outsourcing-secure algorithm for modular exponentiations based on pre-computation and server aided computation. Atallah and Li researched the problematic computing domain regarding the edit distance amidst two sequences and presented a competent protocol to securely outsource sequence comparison with two servers. Furthermore, Benjamin and Atallah spoke about the problem of secure outsourcing for broadly pertinent linear algebraic computations. Even so, the offered protocol necessitates the expensive operations of homomorphism encryption. Attalla and Frikken further considered this problem and gave enhanced protocols based on the frail secret hiding postulation. Chen et al. Made an efficiency enhancement on the work and anticipated a new scheme for outsourcing single/simultaneous modular exponentiations.

- **Cryptographic Background**

  a. **Definition 1. (Bilinear map)**
  
  Let G, GT be cyclic groups of prime order q, writing the group action multiplicatively. \( g \) is a generator of \( G \). Let \( e: G \times G \rightarrow GT \) be a map with the following properties:
  - **Bilinearity:** \( e(g_{1}a, g_{2}b) = e(g_{1}, g_{2})ab \) for all \( g_{1}, g_{2} \in G \), and \( a, b \in \mathbb{Z}_q \);
  - **Non-degeneracy:** There exists \( g_{1}, g_{2} \in G \) with \( e(g_{1}, g_{2}) \neq 1 \), in other words, the map does not send all pairs in \( G \times G \) to the identity in \( GT \);
  - **Computability:** There exists an algorithm to compute \( e(g_{1}, g_{2}) \) for all \( g_{1}, g_{2} \in G \).

  b. **Definition 2. (DBDH problem)**
  
  The decision Bilinear Diffie-Hellman (DBDH) problem is that, given \( g, g_{x}, g_{y}, g_{z} \in G \) for unknown random value \( x, y, z, \epsilon \in \mathbb{Z}_q \), and \( T \in \mathbb{Z}_q \), to decide if \( T = e(g_{x}, g_{y}, g_{z}) \). We say that the \((t,\epsilon)-DBDH\) assumption holds in \( G \) if no \( t \)-time algorithm has probability at least \( 1 + \epsilon \) in solving the DBDH problem for non-negligible \( \epsilon \).

III. RESEARCH ELABORATIONS

We propose a system model for outsourced revocable IBE in Figure 1. In comparison with typical IBE scheme, a KU-CSP is convoluted to comprehend revocation for negotiated users. Basically, the KU-CSP can be anticipated as a public cloud run by a third party to supply basic computing capabilities to PKG as homogenous services over the network. Normally, the KU-CSP is hosted away from users and the PKG. Also, we have provided a technique to cut down on the storage cost and computation of PKG by proposing a flexible and provisional leeway to the infrastructure.

When revocation is provoked, instead of requesting private keys from PKG again in [3], unrevoked users have to ask the KU-CSP for updating a trivial component of their private keys. Though many credentials are involved in KU-CSP’s deployment, in this paper we just logically envisage it as a computing service provider. We are concerned about how to design secure scheme with an untrusted KU-CSP. Based on the system model proposed, we are capable of...
defining the outsourced revocable IBE scheme. Equated with the customary IBE definition, the KeyGen Encrypt and KeyGen Decrypt algorithms are redefined to assimilate the time component (This could be the system time). Note that two lists RL and TL, are used in our definition, where RL captures the identities of revoked users and TL is a linked list for the past and current time period.

A. **KeyGen**(MK,ID,RL,TL):
   The key generation algorithm route by PKG takes as input—a master key MK, an identity ID, a revocation list RL and a time list TL. If ID ∈ RL, the algorithm is abandoned, otherwise, it sends the private key SKID = (IK[ID], TK[ID][Ti]), to user where IK[ID] is the identity factor for private key SKm and TK[ID][Ti] is its time factor for current time period Ti. Additionally, the algorithm leads an outsourcing key OKID to KU-CSP.

B. **Encrypt**(M, ID,Ti,PK):
   The encryption algorithm routed by sender takes as input-message M, an identity ID and a time period Ti. It outputs CT which is the ciphertext.

C. **Decrypt**(CT,SKID ):
   The decryption algorithm routed by receiver takes as input-a ciphertext CT encrypted under identity ID and time period Ti and a private key SKID = (IK[ID'], TK[ID'][Ti' ]). It outputs the original message M if ID = ID' and Ti = Ti', otherwise outputs 1. Moreover, two algorithms are defined too to apprehend revocation at KU-CSP through updating the private keys of unrevoked users.

D. **Revoke**(RL, TL, {ID1... IDi}):
   The revocation algorithm routed by PKG takes as input—a revocation list RL, a time list TL and the set of identities to be revoked is given by {ID1... IDi}. It results in an updated time period Ti+1 along with the updated revocation list RL' and time list TL'.

E. **KeyUpdate**(RL,ID,Ti+,OKid):
   The key update algorithm whose route is defined by KUCSP uses a revocation list RL, an identity ID, a time period Ti+1 and the outsourcing key OKID for identity ID as the inputs. It gives the user and his updated time component in private key TK[ID][Ti+1] as output if his identity ID is not held in RL, otherwise, outputs ⊥.

In this paper, we deliberate user revocation likewise is the procedure, to deprive users of decryptability even if they have been issued their private keys. To this end, we implant a time period into private key for revocation.

For example, ‘Harley’ in our setting not only encrypts the message with Davidson’s email address “davidson@company.com” but also with the current time period (e.g., “Oct 08, 2017”). When Harley receives the encrypted email, he then obtains his private key comprising of an identity factor and a time period factor from PKG. With the both appropriate factors, the email can be read.

Suppose Harley had approached KU-CSP. Then, the time factors of all the other users are updated by KU-CSP with a fresh time period (say, “Oct 19, 2017”). After that, the message sent to Harley should be encrypted with Harley’s email address and the updated time period. Since Harley does not have the time factor equivalent to the updated time period, the succeeding encrypted messages cannot be decrypted by Harley even if they are envisioned for him.

The challenge in scheming the outsourced revocable IBE scheme is how to avert a collusion between Harley and other unrevoked fraudulent users. Specifically, a fraudulent user (named Mark) can share his updated time factor (that is, Oct 19 2017) with Harley, and assist Harley to decrypt ciphertext even if Harley just has the previous one (i.e., “Oct 18, 2017”). We will show how to dodge such a collusion later.

IV. SECURITY DEFINITION

We presume that KU-CSP in the illustrated system model is semi-trusted. Specifically, it will trail our protocol but will attempt to search out as much secret information as possible based on its ownership. Hence, two types of adversaries are to be examined as follows.

1. **Type-I adversary:**
   It is defined as a curious user with identity ID but revoked before time period Ti. Such adversary attempts to acquire beneficial information from ciphertext text intended for him at or after Ti (e.g. time period Ti , Ti+1, .......) through conniving with other users even if they are unrevoked. Therefore, it is permitted to enquire for private key including identity component and updated time component for complacent users. We postulate that under the assumption of KU-CSP semi-trust worthiness, type-I adversary cannot get outsourcing key for any users.

2. **Type-II adversary:**
   It is defined as a curious KU-CSP which intends to acquire valuable information from cipher text intended for some goal identity at time period Ti. Such adversary not only retains outsourcing keys for all users in the system, but also is capable of getting user’s private key through colluding with any other user with identity ID’. It is noted that to make such attack realistic, we must restrict ID’ ≠ ID.

Under this scenario, we are able to define CCA security game for type-I and type-II adversary correspondingly to our setting in Fig. 1. Assume Ai is the type-i adversary where i = I, II. Then, its benefit in attacking the IBE with outsourced revocation scheme $\varepsilon$ is defined as

$$\text{Adv}_\varepsilon, A_i (\lambda) = |\text{pr}[b_i = b_i^*]-0.5| \quad \ldots (1)$$

c. **Definition 3:**
   An identity-based encryption is reliable against ciphertext attack (IND-IDCCA) with outsourced revocation scheme, if no polynomially bounded adversary has a nonnegligible benefit against challenger in security game for both type-I and type-II adversary.
Lastly, away from the CCA security, we also postulate the following:

1) An IBE with outsourced revocation structure is IND-IDCPA secure (or semantically secure alongside chosen-plaintext attack) if no polynomial time adversary has nonnegligible benefit in modified games for both type-I and type-II adversary, in which the decryption oracle in both phase 1 and phase 2 is uninvolved;

2) An IBE is secure in selective model in which the test identity and time period is succumbed before setup if no polynomial time adversary has non-negligible improvement in modified games for both type-I and type-II adversary.

V. PROPOSED APPROACH

The application’s success intended at tackling the significant matter of identity revocation, we initiate outsourcing subtraction into IBE for the first time and put forward a revocable IBE format in the server aided scenery. Our system off-loads all of the key making related operations throughout key-issuing and key-update processes to a Key Update Cloud Service Provider (KU-CSP), and takes only the invariable amount of simple functions for PKG and users to make locally. This goal is attained by operating a novel collusion-resistant technique. We hold a hybrid private key for each user, in which an AND gate is implicated to connect and vault the identity constituent and the time constituent.

Furthermore, we recommend another assembly which is verifiable protected under a formalized Refereed Delegation of Computation model. Finally, we present general investigational consequences to make obvious the effectiveness of our proposed edifice.

ADVANTAGES:

It achieves competence for both the private key size at the user and calculation at PKG. User does not need the PKG throughout key-update, in additional, PKG is permitted to be offline after conveying the revocation list to KUCSP, No protected canal or user confirmation is required during key-update among user and KU-CSP. The proposed approach is shown in Figure 1.

1) Input Design:
The input design is an association between the information system and the user. It includes the functions of developing specifications and procedures for data preparation and those steps that are necessary to put transaction data into a usable form so that processing can be achieved by inspecting the computer to fetch data from a written or printed document or it can occur by keying the data directly into the system. The design of input concentrates on controlling the amount of input required, monitoring and controlling the errors, avoiding delay and extra steps and keeping the process simple.

2) Objectives:
Input Design is the process of converting a user oriented variety of the inputs into a computer-based system. This design is important to avoid bugs in the data input process and show the correct direction to the management. It will help for getting correct information from the computerized system. It is achieved by creating user-friendly interfaces for the data entry to handle large volume of data and their access. The purpose of designing input is to make data entry easier and to be free from bugs. The data entry screen is designed in such a way that all the data manipulations can be performed easily. It also provides log or record viewing facilities and check for its validity. The necessary coding is inbuilt for data validity. Data can be entered with the help of screens or user-interfaces. Suitable messages are provided as and when needed. The principle objective of input design is to create an input layout that is scalable and easy to follow.

3) Output Design:
A quality output design describes that the quality output is one, which meets the requirements of the end user and presents the information correctly and consistently. In any system results of processing are transmitted to the users and to other system managers through outputs. Output design determines how the information is to be displaced for instant need and also the hard copy output. It is the most significant and direct source of information to the user. Effective and intelligent output design improves the system’s relationship to assist user decision-making. Designing computer outcome should go in a well-organized, well thought out manner; the correct output must be developed while ensuring that each output element is designed so that user will find the desired output easily and effectively. When analyzing design computer output, the programmer should figure out the specific

Fig.1. The Proposed approach for outsourcing subtraction into IBE.
output that is needed to meet the user’s requirements. It is essential to select ways for presenting user’s information in the way management requires. The output form for an information system should fulfill one or more of the objectives namely, information about past activities, logs, current status or projections of the future, important events, problems, or warnings, triggers to an action etc.

VI. CONCLUSION

This paper emphasizes the basic issue of character repudiation, outsourcing calculation inculcated into IBE and a revocable plan in which the repudiation operations are assigned to CSP. With the aid of KU-CSP, the proposed scheme:

1) Realizes constant competence for both calculations at PKG and private key size at consumer.

2) Removes the requirement of user to contact the PKG after every key update, that is, PKG is permitted to be offline after sending the revocation list to KU-CSP.

3) Eliminates the need for protected channel or user verification in key-update between user and KUCSP.

In addition, the paper apprehends revocable IBE a strong contender of the encryption model of the future. The advanced construction presented in the paper shows that it is secure under RDoC model, in which not less than one of the KU-CSPs is assumed, to be honest. Therefore, if a revoked user and either of the KU-CSPs collide, it is unable to help such user re-obtain his/her decrypt ability. Finally, we offer general tentative results to present the competence of our anticipated construction.

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Debtors Management and Financial Performance of Selected Microfinance Institutions at Nairobi City County In Kenya

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Abstract: The purpose of this study was to assess the effect of debtors management on the financial performance of selected microfinance institutions (MFIs) at Nairobi County in Kenya. The independent variables for debtors management were: debt collection policy, internal control systems, client appraisal and legal framework. On the other hand, the dependent variable was financial performance of selected MFIs at Nairobi County in Kenya. Primary data was collected by the aid of self administered questionnaires and analyzed using multiple regression analysis. Both descriptive statistics and inferential statistics were determined. The nine licensed MFIs in Nairobi City, Kenya by the CBK as at 31st December 2014 were the target population of the Study. In each of the 9 MFIs, four individuals were purposively selected to participate in the study as respondents; these were the Branch Manager, Credit Officer, Debt Recovery Officer, and Finance Officer and hence the sample size was 36 Officers in the 9 MFIs. With the aid of SPSS version 21.0 and Excel software, quantitative results were tabulated and presented in the form of charts, bar graphs, and narratives. The study found out that debt collection policy, legal framework and internal control systems are statistically significant in influencing financial performance of selected MFIs at Nairobi City in Kenya. The study further established client appraisal had no statistically significant effect on financial performance of MFIs at Nairobi city in Kenya. The study found out that internal control systems had a significant effect on financial performance of MFIs in Nairobi city Kenya. The research recommends that all MFIs should have established debt collection Policy, adopt internal control system, closely monitor implementation of internal control systems and that the MFI Managers and the regulators should put more emphasis on compliance procedures.

Key Words: debt collection policy, internal control systems, client appraisal, legal framework, financial performance

1. Introduction
In East Africa, provision of Microfinance Institutions (MFIs) services is a function of Savings and Credit and Credit Cooperative Organizations (SACCOs). Kiiru (2007) indicates that getting access to microfinance loans and other services are limited in Kenya and other East African nations due to lack of collateral and the high-interest rates. The primary investment activity of microfinance institutions is extending these credits. For these financial services, poor people are willing to pay because of the added advantage they receive for not collateralizing anything (Gaurav, 2011). The management of debtors encompass the management of collection policy, internal control systems, client appraisal and legal framework systems.

Charitou, Elfani and Lois (2010) define debtors’ management as a strategy that entails the process of designing a policy that governs how a company extends credit to its customer base and monitoring those systems. According to Pandey (2004), the term debt management refers to ensuring that the collection of book debts is done. Ijams (2005) indicates that the aim of this process is to minimize as much as possible the amount of bad debts that the company will incur as a result of customers failing to repay the total loan acquired.

If the company invest in excessive inventory and receivables it will reduce the profit, whereas there is a risk of not being able to meet commitments due to little investment to meet the risk of not being able to lend (Harris, 2005). Pandey (2004) concurs with the statement that debtors constitute a substantial portion of current assets of several businesses. For example, after inventories in the balance sheet, trade debtors are the major components of the current assets. The primary source of income of all businesses is the sale of goods and services. Without a credit facility, the sales of a company may not increase beyond a particular limit and these low sales have an impact on the profits and the liquidity of the firm. In the other hand if trade debts are not recovered in time they result in losses to the organization (Saleemi, 2003).
Stoner (2003) defines financial performance as the ability to survive, grow, operate efficiently, profitably, survive, and react to the threats of the environment and opportunities. Return on sales, return on assets, return on investment, return on equity, sales growth and return on capital employed forms part of financial measures of a firm’s performance. Brennan and Soloman (2008) argue that the objective performance measures include indicators such as revenue growth, return on capital employed and profit growth. Many firms' weak performances are as a result of poorly performing assets. These findings are reflected in the company's return on investment, return on assets, on performing loans and value added. Today, microfinance institutions are seeking financial sustainability.

Recently, performance measurement in MFIs has undergone tremendous changes from both external and internal point of views. These factors include: business environment, changes in technology, the involvement of commercial banks in MFIs and increased competition resulted in a shift in performance measurement trend MFIs with most of the stakeholder requiring improvement in financial performance measures and also a balance between financial and non-financial measures (Hermes et al., 2011). Zeller & Meyer, (2002) states that MFIs performance can be viewed as a triangle comprising outreach to the poor, poverty impact and financial sustainability. MFIs financial performance measurements involve four core areas, outreach to poor, sustainability, repayment rates and efficiency (Rosenberg, 2002). Empirical evidence on the performance of microfinance institutions has reported different results across different MFIs.

Dinos et al. (2010) indicate that the microfinance institutions are popular among millions of Kenyans who rely on basic needs such as clothing, shelter, food, medical expenses and school fees. They exist as viable and credible alternatives to formal banking institutions that to a large extent are beyond the reach of ordinary Kenyans. The MFIs provide the financial support based on their stable structure. The MFIs are one of the major contributors to the national economy since they have mobilized funds over kshs.150 billion. The Micro-Finance Act 2008 requires that loans policy and procedures manual specify the criteria and procedures applicable to the evaluation, processing, approval process, documentation and release of credit facilities in writing by every individual licensed MFIs. Schreiner (2003) posits that disbursement of loans must be according to the established credit policy and procedures. Hence, despite the significance of MFIs to the Kenyan economy and importance of sound debtors management, it remains unclear as to whether MFI debtors management practices significantly affect financial performance of the institutions.

It is risky for microfinance to lend money without having an efficient debtor recovery systems. Most micro-lending is unsecured hence making credit risk a primary concern for MFIs. The MFIs mainly focus on individuals who due to lack of the ability to provide security or guarantee against the money borrowed cannot secure credit from banks. Most of the banks do not extend credit to these kinds of people due to high-risk of defaulting to repay of interest and in some cases the principal amount itself. Therefore, MFIs are required to craft sound credit management that comprises of identification of existing and potential risks inherent in lending activities (CGAP, 1999).

Sound debtors management is paramount for financial institution’s continuous growth of profit while deteriorating credit quality is the primary cause of poor financial performance and condition. When credit standards have relaxed the probability of bad debts increases (Gitman, 1997). Organizations must, therefore, ensure that the Management of accounts receivables is efficient and effective. Delaying collecting cash from debtors has severe financial implications in the form of affecting customer relations and increased bad debts. Profitability is reduced if payment is made late, and failure to pay, then a total loss is incurred. Bearing this in mind, it is simply good business to put debt management at the front end by managing it strategically.

There is empirical evidence that links debtors management to firm performance. Gatuhu (2013) studied the effects of credit management on the financial performance of MFIs in Kenya and found the need to enhance client appraisal, credit risk control, and collection policy. Orua (2009) studied the relationship between capital structure and financial performance of MFIs in Kenya. Njeri (2010) studied the effects of liquidity on the financial performance of deposit taking MFIs in Kenya and found that the performance of MFIs in Kenya highly depends on the level of institutions liquidity. Much of the Empirical evidence has attempted to study Microlending and Micro financing with a primary focus on MFIs regarding poverty alleviation, particularly in Kenya, but still MFIs in Kenya experience high levels of non-Performing loans. If this trend continues viability and sustainability of MFIs will be threatened and their goals will not be achieved. Hence, it is by these gaps that the current study was anchored upon.

The study sought to investigate the effect of debtors’ management and financial performance of selected Microfinance Institutions at Nairobi County in Kenya. The specific objectives of this study were: to establish the effect of debt collection policy on financial performance of selected MFIs at Nairobi County in Kenya, to determine the effect of the internal control system on financial performance of selected MFIs at Nairobi County in Kenya, to establish the effect of Client Appraisal on financial performance of selected MFIs at Nairobi County in Kenya and to determine the effect of legal framework on financial performance of Selected MFIs at Nairobi County in Kenya.
2. Literature Review

2.1. Theoretical Review
This is the theoretical anchorage of the study. The section captures relevant theories and models that inform the study. This section will highlight the following theories and models; the Grameen Solidarity group theory, Loanable funds theory and the 5 C’s Credit Rating Model.

2.1.1. The Grameen Solidarity Group Theory
The Grameen model was invented in 1976 by Professor Muhammad Yunus, the founder and managing director of Grameen Bank. Since the model proved to be successful today, it’s practiced in more than 250 outlets of Grameen Bank in more than 100 countries (Yunus, 1999). This model is based on peer group pressure whereby loans are made to individuals in groups of four to seven. For group members to access subsequent loans is dependent on successful repayment by all team members. It’s evident from organizations such as Grameen Bank who use this type of microfinance model that these groups has proved effective in deterring defaults (Armendariz & Morduch, 2005).

A new branch of the MFI is set up in a village with a field officer and some qualified workers, who have already done research on the population there in advance and made their choice according to its potential demand and its need for financial support. These employees of the MFI support then up to 15 to 20 villages in the surrounding and strive to make the local, poor people aware of the microfinance possibilities through word of mouth and personal advisory. The lending process is similar to the solidarity group approach. Groups of five are created. However, in the beginning, only two members of the group receive a loan and are monitored for one month. The credibility of the group will then be based on the repayment performance of the first two individuals (Hazeltine & Bull, 2003).

If they are reliable and could pay back their loan, the remaining members qualify for a loan as well, since the group is jointly and severally liable for the single members. Loans go first to two members of the group, then to another two, and then to the fifth group member. Given that loans are being correctly and timely repaid, the cycle of lending continues (Armendariz & Morduch, 2005). This theory puts more emphasis on the group members monitoring one another more efficiently than the lender hence the risk for such borrowers is thus shifted from the MFI to the borrowers themselves. In theory, this sounds prudent, in practice borrowers may not be able to evaluate the riskiness of each others’ projects and the inherent riskiness of their partners effectively. Most MFIs have adopted the Grameen approach. They use the concept of Joint liability to reduce the risk as members have knowledge of the individual character and can screen potential borrowers.

2.1.2. The Loanable Funds Theory
The Loanable Funds theory was formulated in 1934 by British economist Robertson. The theory assumes that interest rates are determined by the supply of Loanable funds and demand for credit. This theory intends to improve upon the classical theory of interest. It recognizes the fact that money can play a fundamental role in the investment and saving processes and thus causes variations in income level. It is a monetary approach to the theory of interest, as distinguished from the theory of classical economists. According to Wensheng (2002), the loanable funds theory synthesizes both the monetary and non-monetary aspects of the problem.

According to this theory, the rate of interest is the price that equates the demand for and supply of loanable funds. At the equilibrium level where demand-supply of Loanable funds, savers and investors are the happiest possible. Ngugi (2001) argued that interest equates the demand for loanable funds with the supply of loanable funds as the price. This theory has implication on Microfinance savers and borrowers according to this theory this two groups should be adequately compensated at equilibrium. One party should not feel exploited by Interest rate which is widely spread. The interest rate should be structured in a way every party feel comfortable (Emmanuelle, 2003). Therefore, this theory comes in handy to provide knowledge on the pricing of Loanable funds, by unearthing the determinants of pricing of Loanable funds which have a direct implication on debtors’ management.

2.1.3 The 5 C’s Model
Pandey (1993) recognizes the 5 Cs as measurement parameters in setting credit standards. The lenders use this model to determine the creditworthiness of potential debtors. The model is based on the information declared by the applicant to the bank. The 5 C’s model emphasizes on the capacity, character, collateral, capital, and conditions of the applicant who requires the financial assistance. 5 C’s is an approach for evaluation of creditworthiness using the 5C’s of credit summarized by Peavler (2013) as follows: capacity refers to borrower's ability to meet the loan payments of interest and principal.
According to Pandey (1995), the credit manager attempts to ascertain the applicant’s willingness to pay and settle his or her obligation. In making an analysis of the client’s character, the company should consider some of the aspects of the clients. These aspects include bank references, marital status, attachment to government agencies, the level of education contact Operation stability and historical background. Collateral is referred to as a form of security for the lender. Majorly banks usually require collateral as a type of insurance in case the borrower cannot repay the loan. They refer to items like land, houses, commercial and residential estates or any other property of value offered as the security of the value of the loan extended to the borrower (Kakuru, 2001). The collateral should be safe, easily marketed and that its value should be able to cover up the debt when sold in case the borrower defaults to pay (Van Horne, 1995).

Capital is the money invested in the business and is an indicator of how much is at risk should the company fail. It is ascertained by the analysis of the financial statements with particular emphasis on the risks and the debt-equity ratios and also evaluating the customer firm working capital positions (Floucks, 2001). The financial manager can also assess the statement of financial position to ascertain how much the owner has invested in the business as his personal stake. Conditions refer to the economic and political situation in the country. According to Kakuru (2001), this includes the assessment of prevailing economic and other factors like social-political which may affect the customer’s ability to pay. Due to the high cost which reduces their profits that may affect their payments (Pandy, 2001).

According to Pandey (1995), one should evaluate the customer’s financial position by analyzing ratios and trends in cash and working capital positions. The attributes to consider are how much the owner of the business has put in the business as this determines the stake of the person in the business. Pandey (2008) contends that, in some situations, the applicant may be required to offer securities before credit is advanced. The character refers to the obligation that a borrower feels to repay the loan. The concept seeks to evaluate the key criteria of repayment ability, by analyzing the financial health of the borrower, the stream of cash flows and other qualitative factors and the character of financial discipline (Pride et al., 2008). The 5 C’s model is relevant in this study as MFIs use this model to determine the creditworthiness of potential debtors.

The theory informs the study in that the CBK regulated Microfinance institutions will consider the cash flow from the business, the repayment timings, and the successful repayment of the loan. The success of MFIs mostly depends on the effectiveness of their debtor's management systems since they generate most of their income from savings, interest earned and on loans extended to members. The MFIs will use the 5Cs model of credit to evaluate a customer as a potential borrower. The 5Cs will help the MFIs to increase loan performance, as they get to know their customers better.

### 2.2 Empirical Review

The section reviews several studies on the study variables with an objective of documenting research gaps. These include local and foreign studies.

#### 2.2.1 Debit Collection Policy

Kariuki (2010) found that for an organization to ensure that credit management is done various policies should be put in place, one of these policies is a collection policy that is needed since all customers do not pay the firms bills in time. Some clients take long to make payments while some do not pay at all. The aim of collection effort should be to accelerate collections from slow payers and reducing bad debt losses.

Ayodele, Thomas, Raphael and Ajayi (2014) carried out a study on the impact of credit policy on the performance of Nigerian Commercial Banks using Zenith Bank as a case study. Primary data was collected through questionnaires served on sixty (60) respondents of the bank. The findings from the study showed that the incidence of bad debts would be minimized if a sound credit policy is put in place.

Byusa and Nkusi (2012) studied effects of credit policy on bank performance in selected Rwandan Commercial banks. The study sought to determine the effects of credit policy on bank performance using data on selected Commercial Banks. The results obtained indicated that the Rwanda’s commercial banks increased their accounts, increased customer base, and improved their financial indices, thereby maximizing their profits. Usually, banks have unusually high and increasing average interest rate spreads and interest rate margins showing both highly poor competition and inefficiency.

#### 2.2.2 Internal control system and Financial Performance

Wainaina (2011) examined the internal control function. He established that, other than the prevention and detection of fraud; internal controls should portray the overall strength of the accounting environment in an organization as well as the accuracy of its financial and operational records. There is also need to decide the form of contract with your customer. Thirdly to assess each client’s creditworthiness this depends on your personal experience and available source of information for its customers. Fourthly
establish practical credit terms after determining your customer standing credit. Finally, you must collect; this requires tactic and judgment.

Ali (2013) studied the relationship between internal control and organizational financial performance of people’s bank Zanzibar Ltd. The objectives of this study entail; to establish the effectiveness of internal controls used in PBZ, to examine the level of performance in PBZ and to set up a relationship between internal control and financial performance in PBZ. The study found that the internal controls used in PBZ were efficient and satisfactory; the organizational level of performance was considered to be adequate, and there was a significant positive relationship existing between the internal control systems and organizational financial performance to some extent. The study recommended that; PBZ management should design more efficient internal control systems in all aspects.

2.2.3 Client Appraisal and Financial performance MFIs
Kiplimo and Kalio (2014) Study had sought to find out the Influence of Credit Risk Management Practices on Loan Performance of Microfinance Institutions in Baringo County. The objective of the study was to determine the client appraisal on loan performance of microfinance institutions in Baringo County. The descriptive research design methodology was employed based on a survey of Microfinance institutions in Baringo County. Since all branch managers and credit officers, were directly targeted in the study Census sampling technique was appropriate. Inferential and descriptive statistics was used in data analysis. The study findings indicated that there was a strong relationship between client appraisals and loan performance in Microfinance institutions. The study showed that an increase in client appraisal led to a rise in the performance of loans in MFIs in Baringo County.

The researchers used only one objective to conclude that credit risk management practices significantly influence loan performance of MFIs in Baringo County ignoring other factors that are likely to have influence on loan performance of MFIs in Baringo county. However, this study will help the research to determine the significance of client appraisal on financial performance of MFIs in Nairobi County.

2.2.4 Legal Framework and Financial performance
Latifee (2006) indicated that while collection procedures may vary from one company to another, they should all be compliant with existing laws. The set Acts must also be adhered to by third party collection agencies, not only in details of collection procedure but also the manner in which the selection takes place. A collection procedure is defined as a comprehensive statement of steps to be taken regarding when and how the past-due amounts of debt are to be collected. Each company has its collection procedure, with information such as grace periods, due dates, date of repossession, penalties, date of turnover of delinquent account to a collection agency. For any loan arrangement, the collection procedure should be clearly spelled out as part of the loan terms. It's essential for borrowers to be aware of the details of the collection process to avoid penalties, and in the case of secured loans or collateral, repossession of the collateral.

Robin and Mitten (2000) studied the legal frameworks and performance standards for Microfinance. This study was commissioned jointly by PRET/DAI and the KNFP to compare how various countries are approaching issues about the legal-regulatory framework for microfinance. The study found out that it is also critical to recognize the differences between financial regulation and financial supervision considering legal-regulatory framework reforms. Financial regulation is defined as the body of rules, laws, and compliance procedures that determine the entry, operations, and exit of various actors within the financial system.

2.3 Summary of Literature Review and Research Gap
From the review of Literature, debtors management plays a critical role in improving financial performance in commercial banking institutions. Most studies have been inclining to focus on determining the effects of credit management on financial performance of MFIs, rather than the provision of good debtors management framework.

Review of local studies had focussed on determining the effect of credit management on the financial performance of MFIs in Kenya and the relationship between capital structure, and financial performance of MFIs in Kenya. It's, therefore, evident that the studies assessing the effects of debtors management on financial performance of licensed MFIs in Nairobi, Kenya remain elusive. There is, therefore, a gap in the empirical evidence available. The purpose of this study seeks to bridge the gap.

3. Research Methodology
The research design is defined as a conceptual structure within which to conduct research (Kothari, 2004). It contains the outline for data collection, measurement and analysis the research design focuses on turning research objectives and questions into a research project and considers research choices, strategies and time horizons (Saunders, Lewis & Adrian, 2009). The study adopted a descriptive design. The study used descriptive research design to obtain information concerning the current status of the phenomena to
describe “what exists” on variables in a situation. This descriptive design was appropriate because it enabled the study to do a
descriptive analysis of the relationship between debtors management and its effect on financial performance of deposit taking MFIs
licensed by Central Bank of Kenya as at 31st December 2014 as per CBK website.

Mugenda and Mugenda (2003) defined population as an entire group of people, events or things of interest that the researcher wishes
to investigate. The target population is the number of elements that a study is interested in building statistical inferences (Mugenda &
Mugenda, 2003). Hence, the target population of the study consisted of 36 respondents from selected 9 MFIs in Nairobi City, Kenya
that was licensed by CBK as at 31st December 2014. The Branch Managers and Credit Officers, Debt recovery officer and Finance
officer in MFIs in Nairobi City were targeted for the study.

The sample size describes the list of all population units from which the sample will be selected (Cooper & Schindler, 2003). The
study focussed on all the nine licensed MFIs in Nairobi city center by CBK as at 31st December 2014. In each MFI, four individuals
were purposely selected to participate in the study as respondents, that included the Branch Manager, Credit Officer, Debt Recovery
officer and finance officer. This yielded a sample size of 36 respondents as shown in Table 3.1 below. Purposive sampling was used
to select respondents. Bernard (2002) defines purposive sampling technique as the deliberate choice of an informant due to the
qualities the informant possesses. Non-probability sampling focuses on sampling techniques where the units that are investigated are
based on the judgment of the researcher. What needs to be known is determined by the researcher. They also sought to find people
who can and are willing to provide the information by knowledge or experience.

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of respondents per MFI</th>
<th>No. of MFIs</th>
<th>Sample size(Respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch managers</td>
<td>1</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Credit officers</td>
<td>1</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Debt Recovery Officers</td>
<td>1</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Finance Officer</td>
<td>1</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4</strong></td>
<td><strong>9</strong></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

The study used questionnaires and secondary data collection sheet to collect data. Primary data was collected using questionnaires.
Mellenbergh (2008) defined a questionnaire as a research instrument consisting of a series of questions and other prompts for the
purpose of gathering information from respondents. Annual reports and financial statements of the respective MFIs for the period 1st
January 2010- 31st December 2014 were used as the source for secondary data. The secondary data (from the financial statements)
was collected using secondary data collection sheet. The data included the total assets, after-tax profit, written off debt and value of
loans outstanding. The researcher administered the questionnaire to each respondent in the study. The questionnaire had Likert-type
closed and open ended questions. The closed-ended questions were used to test the rating of various attributes. Hence, helping in
reducing the number of related responses to obtain more varied responses. The essence of open-ended questions is to provide
additional information that will not have been captured in the close-ended questions.

Mugenda and Mugenda (2003) indicate that data validity is the degree to which the results obtained from analysis of data represents
phenomenon under study. The questionnaire was pre-tested among five respondents within the study area who were excluded from
the actual study for the purpose of reducing potential biases. To achieve content validity the researcher sought assistance from
experts; supervisor was sought in the development of the questionnaire to ensure it collected relevant data to answer the research
questions.

Reliability is the degree of consistency and precision in which the measuring of the instrument demonstrates under same
circumstances (Mugenda & Mugenda, 2003). Same research respondents using the same instrument should generate the same results
under identical conditions (Amin, 2005). Cronbach’s alpha coefficient was used to test for reliability of the instrument. Cronbach’s
alpha establishes the internal consistency or average correlation of items in a survey instrument to gauge its reliability (Dawson,
2009). Nunnly (1978) proposes 0.7 to be an acceptable reliability coefficient.
On getting approval to conduct the study, the researcher contacted the participants to inform them of the impending study. This was achieved by visiting the premises. The purpose of this was to inform the respondents the purpose of the study and seek an appointment. On the material day, the research assistant was engaged for data collection purposes. The research assistants were trained on the purpose of the study and administration of the questionnaire. On filling the questionnaires, the ‘drop-and-pick-later’ technique was adopted. For the purpose of secondary data, the study obtained published financial statements from the MFIs under study. Secondary data collection sheet was be filled with the collected financial statements.

Data analysis refers to the process of ordering, structuring and giving meaning to collected data (Mugenda & Mugenda, 2010). Collected data was edited to ensure accuracy and completeness, and then items were coded and scored. Multiple Regression Analysis (Standard), Descriptive Statistics (means and standard deviations) and inferential statistics were used to analyze data. SPSS software (version 21.0) was adopted to assist in data analysis and presentation. The study used tables and charts to present the findings. The following regression model guided the study:

\[ Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \]

Whereby;

- \( Y_i \) = Financial Performance (Net income, Loan book, ROA, and NPL)
- \( X_1 \) = Debt collection policy
- \( X_2 \) = Internal control system
- \( X_3 \) = Client Appraisal
- \( X_4 \) = Legal framework
- \( \beta_0 \) = Intercept
- \( \beta_1 \) to \( \beta_4 \) = Coefficient
- \( \varepsilon \) = error term

Note- Financial performance was measured over a five year period. The average performance was then computed for each of the financial performance indicators considering that the independent variable is cross-sectional in nature.

The study performed several preliminary diagnostic tests in view of multiple regression analysis. This study used Shapiro-Wilk test and quantile-quantile plots (Q-Q plots) to test for normality owing to its usefulness in comparing two samples to see if they arise from the same distribution. In linear regression, this helped to ascertain the normality of the residuals. Homoscedasticity refers to the assumption that the dependent variable exhibits similar amounts of variance across the range of values for an independent variable. The statistical method for evaluating homoscedasticity is the Levene statistic that SPSS computer test for the homogeneity of variances (Hedayat, 2009). Levene’s test assesses the statistical assumption that variances of the population from which the different samples are drawn are equal. If the results show p-value the Levene's test is less than a significant level (0.05) the obtained differences in sample variances. If you reject a null hypothesis of equal variances, it is concluded that there is a distinction between the variance of the population (Gibbons, 2007). This study used Levene's test to test for homoskedasticity.

Multicollinearity is state of very high inter-correlations or inter-associations among the independent variables. It's, therefore, a type of disturbance in the data. Statistical inferences made about the data may not be reliable if present in the data (Brook, 2008). Two collinearity diagnostic factors can help identify multicollinearity namely variance inflation factor (VIF) and Tolerance (Gordon & Frye, 2002). Tolerance is defined as a measure of collinearity as reported by most statistical programs such as SPSS. The variable under consideration is termed to be almost a perfect linear combination of the independent variables already in the equation if the tolerance value is small and that it should not be added to the regression equation. The small tolerance value is required for all variables involved in a linear relationship. Hence, a small tolerance value less than 0.1 should be investigated further. If a small tolerance is accompanied by large standard errors and no significant Multicollinearity may be an issue (Neeleman, 2000). According to Gurajarati (2004) to remedy this problem the researcher has to drop one none of the variables that cause this so as to be able to generate significant coefficient or more data can be obtained on the variables so as to produce precise parameter estimates. The study used variance inflation factor (VIF) and Tolerance to test for Multicollinearity.
According to Mugenda and Mugenda (2003), ethical considerations are important for any research. Ethical issues taken into account included: the proper conduct of the researcher and confidentiality of the information obtained from the respondents. An introductory letter to meet the respondents was obtained from the University. Respondents were encouraged to participate voluntarily and before administering the questionnaire; the researcher sought informed consent from respondents. The researcher ensured anonymity and confidentiality of all the information collected. The researcher did not induce respondents to provide data. The respondents were given adequate time to fill the questionnaires. The study was factual in reporting the findings and gave credit to other literature cited.

4. Data Analysis, Presentation, and Interpretation

4.1 Response Rate
The study targeted a population size of 36 respondents from which 30 filled in and returned the questionnaires making a response rate of 83.3%. This response rate was satisfactory to make conclusions for the study. The total response rate was above the 51 percent response threshold for questionnaire surveys in social sciences (Pinsonneault & Kraemer, 1993) and thus the use of the collected data was considered reliable for this study.

4.2 Reliability Statistics
The study used Cronbach’s alpha coefficient to test for reliability of the instrument as indicated in the table below.

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>Cronbach's Alpha Based on Standardized Items</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>.948</td>
<td>.595</td>
<td>.531</td>
</tr>
</tbody>
</table>

The result shows an overall Cronbach’s Alpha value of 0.948. The research instrument was therefore considered as reliable since it surpassed the minimum threshold of 0.7.

4.3 Diagnostic Tests
4.3.1 Shapiro-Wilk Normality Test

Given multiple regression analysis, the study used Shapiro-Wilk to test for Normality of the residuals as shown in the table below.

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>.964</td>
<td>30</td>
<td>.390</td>
</tr>
</tbody>
</table>

The P-Value is greater than 0.05, so there is no evidence of significance deviation from normality of the residuals.

Using Q-Q plot on Figure 2.1 below the points fall along the straight 45-degree line, this indicates that the sample data quantiles follow the normal distribution quantiles. The study can therefore safely conclude that data used is normally distributed.
Figure 4.1: Normal Q-Q Plot

4.3.2 Tests of Multicollinearity

Kennedy (1992) recommends 10 as the maximum levels of VIF acceptable in measuring Multicollinearity. The table below provides the Output of Multicollinearity test using Tolerance and VIF.

Table 4.3: Tests of Multicollinearity

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
<td>VIF</td>
</tr>
<tr>
<td>(Constant)</td>
<td>.202</td>
<td>.092</td>
<td>1.112</td>
<td>.277</td>
<td></td>
</tr>
<tr>
<td>Debtors</td>
<td>.345</td>
<td>.077</td>
<td>1.057</td>
<td>4.448</td>
<td>3.490</td>
</tr>
<tr>
<td>Appraisals</td>
<td>.019</td>
<td>.046</td>
<td>.076</td>
<td>.417</td>
<td>.680</td>
</tr>
<tr>
<td>Framework</td>
<td>.277</td>
<td>.147</td>
<td>.026</td>
<td>1.026</td>
<td>2.044</td>
</tr>
<tr>
<td>Systems</td>
<td>.236</td>
<td>.162</td>
<td>.201</td>
<td>1.603</td>
<td>1.978</td>
</tr>
<tr>
<td>a. Dependent Variable: MFI Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the coefficients output multicollinearity statistics obtained VIF Values above, meaning that the VIF Value obtained is between 1 and 10, it can be concluded that there are no Multicollinearity symptoms.

4.4 General Information

4.4.1 Gender of Respondents

The respondents were asked to indicate their sex to make the study gender sensitive. Their response is indicated in the table below.

Table 4.4: Gender of Respondents
The research study sought to establish the respondent’s gender distribution. From the findings above, the females were slightly above at 53.3% while the males at 46.7%.

### 4.4.2 Age Bracket of Respondents

To assess the responsibility of the respondents, the respondents were requested to give their age, and the responses were as below.

<table>
<thead>
<tr>
<th>Age Bracket</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between 21-25 years</td>
<td>7</td>
<td>23.3</td>
<td>23.3</td>
<td>23.3</td>
</tr>
<tr>
<td>Between 26-30 years</td>
<td>15</td>
<td>50.0</td>
<td>50.0</td>
<td>73.3</td>
</tr>
<tr>
<td>Between 31-35 years</td>
<td>7</td>
<td>23.3</td>
<td>23.3</td>
<td>96.7</td>
</tr>
<tr>
<td>Between 36-40 years</td>
<td>1</td>
<td>3.3</td>
<td>3.3</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

Findings in the table above indicates that 23.3% of the respondents were between the age of 21-25 years, 50% were between 26-30 years, 7% were between 31-35 years, and 1% were above 36-40 years. This implies that most of the respondents were youths hence they can easily understand the debt management policies.

### 4.4.3 Education Information

To be sure of the quality of the information given, the respondents were requested to provide their level of education, and the response is portrayed below.

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma</td>
<td>3</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Degree</td>
<td>26</td>
<td>86.7</td>
<td>86.7</td>
<td>96.7</td>
</tr>
<tr>
<td>Masters</td>
<td>1</td>
<td>3.3</td>
<td>3.3</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>

Findings in Table 4.6 indicate that a small number of respondents were highly educated this is shown by the 3.3% of respondents who had masters degrees, 10% were Diploma holders while 86.7% of the respondents which is the majority were degree holders. By their education structures the researcher might assume that they know what the organization performance is and the hindrance to effective performance.

### 4.4.4 Duration in Employment

As a precondition to assess the reliability of the data collected, the respondents were requested to indicate the period they have worked with the organization. Their response was as given below.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>
From the analysis in the table above, 43.3% have served the organization for less than two years, 36.7% between 2-4 years, 16.7% between 5-6 years and 3.3% have served the organization for 7-8 years. Thus, this analysis indicates that probably they fail to embrace organizational policies as a result of low payments and lack of motivation since the majority of the respondents have only worked in the organization for less than two years.

4.4.5 Designation/Role in the Organization
The study also sought to find out the position of the respondents in the organization as indicated.

Table 4.8: Designation/Role in the Organization

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch Manager</td>
<td>3</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Credit Officer</td>
<td>11</td>
<td>36.7</td>
<td>36.7</td>
</tr>
<tr>
<td>Debtors rec officer</td>
<td>6</td>
<td>20.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Others(specify)</td>
<td>10</td>
<td>33.3</td>
<td>33.3</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The research study wanted to establish the current designation of the respondent in the organization. The findings as shown in Table 4.8 above indicate that 36.7% of the respondents were Credit officers, followed by others with 33.3%, while 20% were Debtors recovery officers and 10% of the respondents were Branch managers.

4.5 Descriptive Statistics
This section consists of descriptive findings on the dependent and independent variables as used in the study. Descriptive statistics enable the description of the distribution (mean) and variation (Standard deviation) of responses of the target population as well as allowing the researcher to determine average scores on the variables used in the study. The scores in the study used Likert-type scale where 1=strongly agree, 2=Agree, 3=Not sure, 4=Disagree and 5=strongly disagree.
4.5.1 Debt collection policy

From the findings, 70% of the respondents agree that Formulation and implementation of debt collection policy have been a challenge in debt management. 86.6% of the respondents agree that Collateral securities are required before the loan is granted, 86.7% agree that regular review has been done on debt collection policy to improve on debt management. 93.3% are in agreement that the available debt collection policy has assisted towards effective debt management. 83.3% are also in agreement that organization should ensure that there is harmonized debt collection policy. 93.4% agree that the debt collection policy should be set and adhered to.

Table 4.9: Statement in relation to Debt collection policy

<table>
<thead>
<tr>
<th>Statement</th>
<th>Count</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>In your opinion, the organization sets a strong elaborate debt to follow up procedures on the delayed payments</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.60</td>
<td>.855</td>
</tr>
<tr>
<td>The organization implements these terms and policies in case of failure to pay back the Loan.</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.60</td>
<td>1.037</td>
</tr>
<tr>
<td>The organization complies with laid down legal aspects when issuing a credit to customers.</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.57</td>
<td>.774</td>
</tr>
<tr>
<td>In your opinion, the organization sets and follows debt collection policy and terms.</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.43</td>
<td>.728</td>
</tr>
<tr>
<td>The organization ensures that there is harmonized debt collection policy.</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.67</td>
<td>.844</td>
</tr>
<tr>
<td>Available debt collection policy has assisted towards effective debt management.</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.57</td>
<td>.728</td>
</tr>
</tbody>
</table>
The regular review has been done on debt collection policy to improve on debt management.

<table>
<thead>
<tr>
<th>The regular review has been done on debt collection policy to improve on debt management.</th>
<th>30</th>
<th>1</th>
<th>4</th>
<th>1.83</th>
<th>.913</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collateral securities are required before the loan is granted</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.77</td>
<td>.858</td>
</tr>
</tbody>
</table>

The computed means for the statements range from 1.43 to 2.07 indicating a strong agreement with all the statements, with a standard deviation ranging from 0.728 to 1.112. The result is consistent with Kariuki (2010), who said that for an organization to ensure that credit management is done various policies effectively should be put in place, one of these policies is a collection policy that is needed since all customers do not pay the firms bills in time.

### 4.5.2 Internal control systems

From the findings above, the majority of the respondents agreed that: internal control systems ensure proper use of organization funds and that a true reflection of organizational activities is presented in the financial statement through the performance of internal control systems. The researcher can, therefore, conclude that there are internal control systems in MFIs due to the large percentage that agreed. A high number of respondents agree that perpetration of fraud and losses of revenue in MFIs are due to weakness in the internal control system. Hence, this may imply that the internal control systems implemented do not meet the demands of the customers thus failing to answer their constant problems of failing to pay back their loans on time.

The majority of the respondents are also in agreement that the internal control system has a significant impact on the financial management of MFIs and hence need for documents verification, internal checks and balances to enhance financial management of

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**Figure 4.3: Statements in relation to internal control systems.**

From the findings above, the majority of the respondents agreed that: internal control systems ensure proper use of organization funds and that a true reflection of organizational activities is presented in the financial statement through the performance of internal control systems. The researcher can, therefore, conclude that there are internal control systems in MFIs due to the large percentage that agreed. A high number of respondents agree that perpetration of fraud and losses of revenue in MFIs are due to weakness in the internal control system. Hence, this may imply that the internal control systems implemented do not meet the demands of the customers thus failing to answer their constant problems of failing to pay back their loans on time.
The majority of the respondents agree that MFIs should closely monitor implementation of internal control systems. The organization and in particular credit department staff should also act with a significant degree of integrity in the execution of their roles and loans should be properly authorized before issue.

The mean value for the statements on internal control systems ranged from 1.37 to 2.23, indicating a strong agreement with all the statements while the standard deviation ranged from .640 to 1.305 as shown in Table 4.9. The result is consistent with Ali (2013), who established that there was a significant positive relationship existing between internal controls and organizational financial performance to some extent.

### 4.5.3 Client Appraisal

From the findings, the majority of the respondents agree that aspects of collateral are considered while appraising clients. The majority of the respondents agree that client appraisal is a viable strategy for debtors management and that client appraisal should consider the character of the customers seeking credit facilities. The respondents also agree that competent personnel should carry out the appraisal and failure to assess customer capacity to repay results in bad debts.

<table>
<thead>
<tr>
<th>Statement in relation to Client appraisal</th>
<th>Count</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to assess customer capacity to repay results in bad debts.</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.50</td>
<td>.820</td>
</tr>
<tr>
<td>Client appraisal is a viable strategy for debtors management.</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.59</td>
<td>.814</td>
</tr>
<tr>
<td>Client appraisal considers the character of the customers seeking credit facilities.</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.67</td>
<td>1.061</td>
</tr>
<tr>
<td>The MFI has the competent personnel for carrying out the appraisal.</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.70</td>
<td>.794</td>
</tr>
<tr>
<td>Aspects of collateral are considered while appraising clients.</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.70</td>
<td>1.055</td>
</tr>
</tbody>
</table>

The mean value for the statements on client appraisal ranged from 1.50 to 1.70, indicating a strong agreement with all the statements while the standard deviation ranged from .794 to 1.055 as shown in Table 4.10. The result is consistent with Kiplimo and Kalio (2014), who indicated that there was a strong relationship between client appraisals and loan performance in Microfinance institutions.

### 4.5.4 Legal framework

From the findings, majority of the respondents agree that detailed statements of steps should be taken regarding when and how past due amounts of debt are to be collected and that the organization should have collection procedure, indicating due dates, grace periods, penalties, date of repossession, date of turnover of delinquent account to a collection agency. A large number of respondents are also in agreement that there should be defined compliance procedures, the body of rules and laws that determine the entry of actors, their operations, and exit within the financial system. The researcher can, therefore, conclude that there is a legal framework in MFIs due to the large percentage that agreed.

<table>
<thead>
<tr>
<th>Statement in relation to Legal framework</th>
<th>Count</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>The organization has a detailed statement of steps taken regarding when and how the past due amounts of debt are to be collected.</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.70</td>
<td>1.022</td>
</tr>
<tr>
<td>The organization makes borrowers aware of the details of the collection process to avoid penalties, and in the case of secured loans or collateral, repossession of the collateral.</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.70</td>
<td>.952</td>
</tr>
<tr>
<td>The organization has its collection procedure, indicating due dates, grace periods, penalties, date of repossession, date of turnover of delinquent account to a collection agency.</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.77</td>
<td>.858</td>
</tr>
<tr>
<td>The organization has defined the compliance procedures, the body of rules and laws that determine the entry of actors, their operations, and exit within the financial system.</td>
<td>30</td>
<td>1</td>
<td>4</td>
<td>1.80</td>
<td>.847</td>
</tr>
</tbody>
</table>

The mean value for the statements on client appraisal ranged from 1.70 to 1.80 in a scale of 1-5, indicating a strong agreement with all the statements while the standard deviation ranged from .847 to 1.022 as shown in the table 4.11. The result is consistent with Robin
and Mitten (2000), who studied the legal frameworks and performance standards for Microfinance and concluded that it is critical to recognize the differences between financial regulation and financial supervision considering legal-regulatory framework reforms.

4.5.5 Debtors management and financial performance

In Table 4.12, the majority of the respondents strongly agree that legal framework affects financial performance of MFI with a mean of 1.67 on a scale of 5 with a standard deviation of 1.184. The majority of the respondents also agree that internal control system affects financial performance of MFIs hence cannot be overlooked by MFIs. On whether Credit appraisal affects financial performance of your MFI majority of the respondents agree that it has a significant effect on financial performance of MFIs with a mean of 1.87 which is in agreement on the Likert scale of 1-5. Lastly on whether the debt collection policy affects financial performance of the MFI organization most of the respondents were in agreement. The results are shown in table 4.12:

Table 4.12: Statement in relation Debtors management and financial performance

<table>
<thead>
<tr>
<th>Statement</th>
<th>Count</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>In my opinion, legal framework affects financial performance of your institution</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.67</td>
<td>1.184</td>
</tr>
<tr>
<td>The organization’s Internal control system affects financial performance</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.77</td>
<td>1.278</td>
</tr>
<tr>
<td>Credit appraisal affects financial performance of your institution</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.87</td>
<td>1.358</td>
</tr>
<tr>
<td>In my opinion debt collection policy affects financial performance of the organization.</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>1.90</td>
<td>1.373</td>
</tr>
</tbody>
</table>

4.6 Regression Analysis

A multiple linear regression analysis was undertaken to examine the effect of debtors’ collection policy, client appraisal, internal control systems and legal framework on financial performance of selected MFI in Nairobi City.

Table 4.13: Regression and Model Summary

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.872 (a)</td>
<td>.695</td>
<td>.631</td>
<td>.230094858</td>
<td></td>
</tr>
<tr>
<td>a. Predictors: (Constant), Systems, Appraisals, Framework, Debtors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adjusted R-squared is coefficient of determination which tells us the variation in the dependent variable due to changes in the independent variable. From the findings in the above table the value of R squared was 0.695 an indication that there was variation of 69.5% of changes in financial performance of MFIs in Kenya are attributed to changes in client appraisal, debt collection policy, internal control systems and legal framework taken jointly at 95% confidence interval. This shows that 69.5% changes in financial performance of MFIs could be accounted for by client appraisal, debt collection policy, internal control systems and legal framework is the correlation coefficient which indicates the relationship between the study variables, from the findings shown in the table above there was a strong positive relationship between the study variables as shown by 0.872.

Table 4.2: ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>.623</td>
<td>4</td>
<td>.156</td>
<td>9.201</td>
<td>.00012b</td>
</tr>
<tr>
<td>Residual</td>
<td>1.423</td>
<td>25</td>
<td>.107</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2.046</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the ANOVA statistics in table above, the processed data, which is the population parameters, had a significance level of 0.0012 (p=0.0012), which is below 0.05 an indication that, client appraisal, debt collection policy, internal control systems and legal framework jointly have a statistically significant effect on financial performance of MFIs in Nairobi city Kenya.

Table 4.3: Coefficient
From the data in the above table, the established regression equation is extracted as shown below:

\[ Y_t = 0.202 + 0.345X_1 + 0.277X_3 + 0.236X_4 \]

The regression equation above revealed that holding client appraisal, internal control systems, legal framework and debt collection policy to a constant zero, financial performance of MFIs would be 0.202, a unit increase in client appraisal leads to increase in performance of MFIs in Kenya by a factor of 0.019, a unit increase in debtors collection policy would lead to 0.345 increase in financial performance of MFIs in Kenya, unit increase in Internal Control systems would result in increase in performance of MFIs by a factor of 0.236 and also unit increase in legal framework would result in increase by factor of 0.277 in financial performance of selected MFIs in Nairobi city Kenya.

The study also found that the p-values of debt collection policy, internal control systems and legal framework were less than 0.05, an indication that the three variables have a statistically significant effect on financial performance of selected MFIs in Nairobi City Kenya. Client appraisal had a P-value of 0.680, which is above 0.05 an indication that, client appraisal did not have a statistically significant effect on financial performance of MFIs in Nairobi city Kenya.

4.7 Key Findings

From the findings in Table 4.12, the value of adjusted R-squared indicated that there was variation of 69.5% on financial performance of MFIs in Nairobi City Kenya due to changes in client appraisal, debt collection policy, internal control systems and legal framework at 95% confidence interval. R is the correlation coefficient which indicates the relationship between the study variables, there was a strong positive relationship between the study variables as shown by R. From research finding, there was a significant effect of client appraisal, debt collection policy, internal control systems and legal framework on financial performance of MFIs in Nairobi city Kenya at the p<0.05 level for the four conditions.

The regression equation established showed that that holding client appraisal, debt collection policy, internal control systems and legal framework to a constant zero, financial performance of selected MFIs in Nairobi City Kenya would be 0.202, a unit increase in client appraisal would lead to increase in financial performance of selected MFIs in Nairobi City Kenya by a factor of 0.119, a unit increase in debt collection policy would result in increase in financial performance of selected MFIs in Nairobi City Kenya by a factor of 0.345, a unit increase in internal control systems would result in increase in financial performance of selected MFIs in Nairobi City Kenya by a factor of 0.236 and also unit increase in legal framework by a factor of 0.277 would lead to increase in financial performance of selected MFIs in Nairobi City Kenya. The significance of the variables was supported by the t values whose significance values were less than 0.05. This indicates that the variables were statistically significant in influencing financial performance of selected MFIs in Nairobi City Kenya.

Finally, the study found out that internal control systems had a significant effect on financial performance of MFIs in Nairobi city Kenya. The respondents strongly agreed that Perpetration of fraud and losses of revenue in MFIs is due to weakness in the internal control system. The majority of the respondents are also in agreement that the internal control system has a significant impact on the financial management of MFIs and hence need for documents verification, internal checks and balances to enhance financial management of MFIs.

4.8 Discussion of the Findings

From the study, debt collection policy had a statistically significant effect on financial performance of selected MFIs in Nairobi City Kenya. The result is consistent with Kariuki (2010), who said that for an organization to ensure that credit management is done various policies effectively should be put in place, one of these policies is a debt collection policy that is needed since all customers do not pay the firms bills in time.

The findings are in agreement with Van Horne et al. (1997) who contend that credit policies are the major influences on the firm’s level of debt management. The study is also consistent with Ayodele, Thomas, Raphael and Ajayi (2014) who carried out a study on the impact of credit policy on the performance of Nigerian Commercial Banks using Zenith Bank as a case study. Primary data was
collected through questionnaires served on sixty (60) respondents of the bank. The findings from the study showed that the incidence of bad debts would be minimized if a sound credit policy is put in place.

The study also found that internal control systems and legal framework have a statistically significant effect on financial performance of selected MFIs in Nairobi City Kenya. The findings are in line with Ali (2013) who studied the relationship between internal control and organizational financial performance of people’s bank Zanzibar Ltd. The study found that the internal controls used in PBZ were efficient and satisfactory; the organizational level of performance was found to be adequate, and there was a significant positive relationship existing between internal controls and organizational financial performance to some extent. The study is also consistent with the studies of Robin and Mitten (2000) who studied the legal frameworks and performance standards for Microfinance. The study found out that it is also critical to recognize the differences between financial regulation and financial supervision considering legal-regulatory framework reforms.

The study revealed that client appraisal did not have a statistically significant effect on financial performance of MFIs in Nairobi city Kenya. These findings contradict the studies of Kiplimo and Kalio (2014) who had sought to find out the Influence of Credit Risk Management Practices on Loan Performance of Microfinance Institutions in Baringo County. The objective of the study was to determine the client appraisal on loan performance of microfinance institutions in Baringo County. The study findings indicated a strong relationship between client appraisals and loan performance in Microfinance institutions. The study showed that an increase in client appraisal led to a rise in the performance of loans in MFIs in Baringo County. Hence, the study concludes that credit risk management practices significantly influenced loan performance of MFIs in Baringo County.

5. Summary, Conclusion, Recommendations and Areas for Further Study

5.1 Summary of the Findings
The study found out that debt collection policy was statistically significant in influencing financial performance of selected MFIs in Nairobi City Kenya. The study further found out that debt collection policies are vital in effective debt management and hence the organization should set strong elaborate debt follow-up procedures on the delayed payments. Also, the respondents agree that the MFIs should formulate, implement and regularly review debt collection policy to ensure that they are harmonized. The respondents also agreed that the collateral should be required before a Loan facility is issued and clear policies should be set in place in case there is delayed payments of the debts. The respondents also agreed that the MFIs should have laid down legal aspects when issuing a credit to customers and all staff involved in debt management should adhere to the debt collection policy.

Also, the study found out that legal framework was statistically significant in influencing financial performance of selected MFIs in Nairobi City Kenya. The respondents strongly agreed that detailed statements of steps should be taken regarding when and how past due amounts of debt are to be collected and that the organization should have collection procedure, indicating due dates, grace periods, penalties, date of repossession, date of turnover of delinquent account to a collection agency. A large number of respondent are also in agreement that there should be defined compliance procedures, the body of rules and laws that determine the entry of actors, their operations, and exit within the financial system.

The study further indicates that client appraisal had no statistically significant effect on financial performance of MFIs in Nairobi city Kenya. However, the study revealed that MFIs use client appraisal in debt Management to a great extent. Aspects of collateral are considered while appraising clients, failure to assess customer’s capacity to repay results in default in loan repayment; client appraisal examines the character of the client looking for credit facilities, and that MFIs have personnel who are competent in carrying out client appraisal.

Finally, the study found out that internal control systems had a significant effect on financial performance of MFIs in Nairobi city Kenya. The study also found out that weakness in internal control system results to the perpetration of fraud and losses of revenue in MFIs. The study also indicates that internal control system has a significant impact on the financial management of MFIs and hence need for documents verification, internal checks, and balances to enhance financial management of MFIs.

5.2 Conclusion
The study concludes that debt collection policy affects financial performance of selected MFIs in Nairobi City Kenya to a great extent. Also, strong elaborate debt follow-up procedures on the delayed payments, laid down legal aspects when issuing a credit to customers, staff competency and integrity in adhering to the debt collection policy, formulation, implementation and regular review of debt collection policy have been observed to be crucial while managing debts in MFIs.
Moreover, the study concludes that internal control systems affect financial performance of selected MFIs in Nairobi City Kenya. The study also concludes that legal framework has statistically significant influence of Legal framework on financial performance of selected MFIs in Nairobi City Kenya to a great extent. Finally, the study concludes that client appraisal had no significant effect on financial performance of MFIs in Nairobi city Kenya.

5.3 Recommendation

The research recommends that all MFIs should have in place well established debt collection policies that clearly outlines the senior management’s view of business development priorities and the terms and conditions that should be adhered to for loans to be approved. The debt collection policy should be reviewed and regularly updated to reflect changes in the economic outlook and the evolution of the MFI’s loan portfolio, and be distributed to all lending/marketing officers. The debt collection policy should be approved by the Managing Director/CEO & Board of Directors of the MFIs based on the endorsement of the MFI’s Head of Credit Risk Management. Also there should be laid down legal aspects when issuing a credit to customers and all staff involved in debt management should adhere to those legal aspects in place.

The research also recommends that all MFIs should adopt internal control system. The MFIs should closely monitor implementation of internal control systems which should be able to define the risk profile of borrower’s to ensure that account management, structure, and pricing are commensurate with the risk involved. A strong internal control system with internal checks and balances will curb perpetration of fraud and losses of revenue in an organization that is as a result of weakness in the internal control system.

Since legal framework, in general, has very significant contribution to financial performance of MFIs, the MFI Managers, and the regulators are advised to put more emphasis on compliance procedures, the body of rules and laws that determine the entry of actors, their operations, and exit within the financial system. The managers should also define detailed statements indicating its collection procedure, due dates, grace periods, penalties, date of repossession, date of turnover of delinquent account to a collection agency and make borrowers aware of the details of the collection process to avoid penalties, and in the case of secured loans or collateral, repossession of the collateral. This will curb non-performing loans and improve financial performance.

The study recommends that there is a need for MFIs to enhance their client appraisal techniques so as to improve their financial performance. Through client appraisal techniques such as assessing customer capacity to repay loans and considering aspects of collateral before issuing loans, the MFIs will be able to know credit worth clients and thus reduce their non-performing loans.

5.4 Areas for Further Study

Further research should be undertaken to find out why customer appraisal does not have a statistically significant effect on financial performance of selected MFIs in Nairobi County Kenya despite the fact that past literature is suggesting otherwise. Further research should also be undertaken on the effect of regulation and supervision on loan performance in microfinance institutions in Kenya. Further research should also be done on the relationship between debt management and non-performing loans on Microfinance Institutions in Kenya and the reasons behind loan default in microfinance organizations from the clients’ perspective.

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Shareholder Activism Compulsory or Option in the Corporate World?

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Abstract- The shareholders are an entity of the company and it is a concern issue that the shareholders need to get their rights. The companies need to keep in mind that setting up a company not only to earn profit and to achieve the aim but also take other issues into consideration.

Those late spates for crises afflicting those corporate What's more financial sectors around the planet need triggered another wave of corporate governance reforms, which call for more stupendous strengthening about regulate more retail shareholders. The require to such changes can't make more amazing over in India, the place where there is regulating shareholders, or promoters, overwhelm the corporate scene.

Reliable for changes clinched alongside a few nations that try to give more amazing control in the hands about shareholders, those later administrative developments over India mean a more stupendous good fortune to shareholder investment in the type of postal ballot, e-voting and the in. Those fast burgeoning from claiming proxy advisory firms, a hitherto non-existent phenomenon in India, bestows shareholders with the exhortation necessary will practice their corporate establishment for an informed manner. The presence of activist institutional shareholders for example, private equity funds and hedge funds has already caused an upheaval in some corporate boardrooms in India.

The researcher in this article has tried to portrait the issues involving the shareholders and the evolution of the Shareholders activism surrounding various countries.

The researcher has included three chapters which will be dressed in doctrinal research.

The five chapters namely the Introduction, second chapter named as the issue concerned the shareholders, third chapter will revolve around the shareholder’s importance in various countries, the fourth chapter, consists of the steps taken by the government in the concerned issue. In the last chapter the conclusion and suggestion.

Index Terms- company, corporate governance, shareholders, Shareholders activism

I. INTRODUCTION

The Company as an entity has importance and a number of legislatures has been made to protect the company’s rights and duties under the Law. Same goes for the other members of the company like the Directors and Shareholders. The Directors and Shareholders are the ones who are real wheels of the company, in absence, of which the Company will not function properly.

It is very important to protect the members to Company can work properly without any obstacles. In the Corporate World, all are working in a proper manner but a question arises when it is seen from a Shareholder point of view, the Shareholder is also an important entity. The protection of the rights in the Company of every single entity is very concerned issue as only gaining profits is not the only issue.

The Companies are formed for a particular reason and which also consists of gaining profits for the particular business for the purpose for which the Company was established. There are many objectives which are mentioned in the Memorandum of Association and Articles of Association of the Company but a point of consideration that is the Shareholders also forms an important part of the Company but they are always dominated by the Directors.

The fact that the Directors are more powerful than the Shareholders, the reason concerned is well versed with the Corporate World that the Directors rule the Shareholders. The Directors are the ones who take decision and run the Company where as the Shareholders are the ones who are the investors and they are not directly involves in the decision making process which may lead to biased decision. The decisions are biased as said before may be not be in the favours of the shareholders as the shareholders are not present in the regular activities such as day to day activities as they are huge in numbers which act as a barrier in the current scenario.

In the globalisation world, there has been lacking of the Corporate Sectors and other Financial Sectors in the area of the Corporate Governance world which has activated the need of development or in other words, there is a need of improvement in the Shareholders Sectors.

The current corporate world sometimes only takes into consideration the controlling of the Shareholders. The Shareholders in this sector has been our dominated by the Directors in the Company. it has been high time that the Company needs to take a serious action in making the legislatures which can favour the Shareholders. No doubt, a number of legislations has been made regarding the Company.

But after much efforts the Directors still dominate the Shareholders, The Legislatures have tried to put forward the Shareholders in the following ways as Postal ballot, E-Voting, etc. Meanwhile in this conservation in the Shareholder Activism concept has tried to evolved in the Indian Corporate World. It is
generally, seen that the efforts made by the legal Indian Market that the Shareholder Activism effects are not at all working the way it was supposed to be.

The Indian Legal system are not willing to invest in the entity of the Shareholders who are trying their level best to put their voices before the court of law by the Shareholder in order to receive justice. It is thus, observed that the remedies this provided to the shareholders are cost effective which is actually giving the flavour of injustice.

The researcher in this paper has tried to portrait one of the protagonist of the Corporate Sector i.e., the Shareholders who deserve to be the part of the system not just by the name or rules but by the reality also.

The paper will observe different phases of the Shareholders which actually revolve around the Shareholders Activism in the Indian Market.

The Shareholders are the protagonist of the company and focus is needed to protect the rights of the Shareholders. History have witnessed a sudden importance towards the improved corporate governance parameters in India. There are many regulations which are brought into existence for the purpose of governance ways of practices and the impression made on the Indian Companies. The regulatory such as Securities and Exchange Board of India (SEBI) have an involvement in the Indian Companies.

SEBI has been regulated the public listed companies, so that they are maintained in a well- manner and for the governance structures such as the independent audit process, discovery of the Independent Directors. Etc. All these structures are made for the better processing the governance implement.

Meanwhile the history has witnessed that the after the existence of the various legislations brought into existence for the purpose of regulating the governance practices in the Corporate Governance, but still there are many cases which proved that the laws made are not sufficient to handle the situation which arise in the Corporate Sector. The cases such as the Satyam Case. To brief about the case, the scandal was regarding the accounting sector. These situations give a view of the lack of Shareholders Activism.

The activist Shareholders in the Corporate World which has shown their need to regulate the laws in the legislature.

To explain further, the researcher was to provide a brief explanation about the concept Shareholder Activism.

II. SHAREHOLDER ACTIVISM

An individual who endeavours to utilize his or her rights as an investor of a traded on a publicly-traded corporation to achieve social change. A portion of the issues frequently tended to by investor activists are identified with nature, interests in politically important phases of the world and workers' rights. In other words, sweatshops.

The term can likewise allude to speculators who trust that an organization's management is making an awful showing with regards to and who endeavour to pick up control of the organization and trade management for the benefit of the investors.

III. SHAREHOLDERS AGREEMENT

The Shareholders Agreement is expected to ensure that investors are dealt with decently and that their rights are secured. The understanding incorporates segments sketching out the reasonable and genuine valuing of offers (especially when sold). It likewise enables investors to settle on choices about what outside gatherings may end up plainly future investors and gives shields to minority positions.

Shareholder activism likewise assumes a part in well-functioning Public markets. For instance, while Shareholder activists much of the time do the truly difficult work, the advantages of activism for the most part accumulate to all investors. Moreover, the dread of turning into the objective of an activist adds to the general effectiveness of capital markets by considering management teams responsible for the persistent stewardship of corporate resources. Progressively, activists display well-conceived capital portion and marketable strategies to management guaranteeing that a wide assortment of significant worth making procedures are investigated. Once in a while do the more shared activists lead with a request to offer the organization. Be that as it may, if management neglects to seek after clear-cut esteem making procedures, activists can and will push for a potential offer of the organization on the off chance that they trust it is to the greatest advantage of investors. Ultimately, Shareholder activism gives the esteem situated financial specialist extra levers to pull by proactively seeking after identifiable organization impetuses. This occasion driven optionality can be helpful to financial specialists over a wide assortment of market situations.

IV. HISTORY OF SHAREHOLDER ACTIVISM

Since its initial origin in the 1920s, investor activism has transformed from a check against oblivious obedience in the meeting room into what numerous specialists are presently calling a noteworthy emergency.

Rise of Institutional Investors: As demonstrated prior, possessions have expanded altogether; have turned out to be more self-assured in advancing interests of their members.

a. Have substantial pieces of stock so difficult to offer if end up plainly disappointed, in this way solid motivation to work to change management strategy
b. Council of Institutional Investors
c. Represents organizations and pension funds with ventures on the whole surpassing $3 trillion in possessions
d. Developed a Shareholder Bill of Rights
e. Research demonstrates association of institutional investors can enhance organization execution

Social investment: Refers to the utilization of stock ownership as a technique for advancing social objectives; additionally, called social responsibility investment

a. Social screening of stock: Some stock buyers pick stocks in view of social or natural criteria, called social screens
b. In 2007, $2.7 trillion invested into socially obligation funds; roughly 1 of every 9 investment dollars

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May, Shareholder activism is a venture system whereby minority investors for a vote at the annual meeting which is held in a Company

a. Has been a huge ascent in social duty investor resolutions lately – around 650 were supported in 2007
   • Sponsorship is frequently from a coalition of gatherings, as Interfaith Centre on Corporate Responsibility

b. Resolutions can be about social issues, not customary business of a Company

c. Only collect around 15% of votes, yet their impact is more grounded as managers of the Company react in front of annual meetings so they will be retained.

Shareholder Activism – Shareholder Lawsuits

a. If proprietors think they or their organization have been harmed by activities of Company officers or directors, they have appropriate to bring claims

b. Can be started to check manhandle, for instance insider trading, insufficient stock buyout cost, or lavish Executive Pensions

c. Some companies have guaranteed were focus of paltry Shareholder’s claims
   1) As result Congress passed enactment making it more troublesome for speculators to sue Company for extortion

V. DEFINITION AND ORIGINS OF SHAREHOLDER ACTIVISM

The term Shareholder activism has turned out to be universal for what as a general rule is a to a great degree wide range of financial specialist action. The inceptions of Shareholder activism lay in the 1980s amid the period of corporate thieves and hostile takeovers. The mass selection of Shareholder’s rights designs, otherwise called the "poison pill" which is conveyed a conclusion to the antagonistic takeover period and introduced the main extremist assets amid the 1990s. By the mid-2000s, the system turned out to be considerably more standard. There are investors who mark themselves "Shareholder activists" that seek after an assorted exhibit of motivation, including:

- Share value underperformance/undervaluation
- Corporate Governance in the area of the Shareholder rights
- ESG - Environmental, Social and Corporate Governance
- Executive pay, among different causes

As the monetary media normally alludes it to, be that as it may, Shareholder activism is a venture system whereby minority Shareholder instead of controlling Shareholders practice and their proprietorship rights with the goal of enhancing investor esteem. Simultaneously, dissident activist investors proactively recognize venture openings in which the usage of activism can open an incentive by filling in as the impetus for change. Where other active investors recognize value-appreciating impetus occasions and afterward seek after that occasion to happen, activate investors supplant trust with activity by practicing their rights as Shareholders to impact change.

Some of the key conceptual issues that this gives rise to:

A portion of the key applied issues that this offers ascend to:

1. The primary issue identifies with who pays the remuneration to the institutional Nominee Directors. The present pattern appears to recommend that the pay is paid by the nominator or the Investor instead of the Company itself, which would limit the impact of the standard issues relating to Executive remuneration on the off chance that it was to be paid by the Company itself.

2. These arrangements could make groups on the board, i.e. between within Directors or the Executive and the alleged outsiders or nominee, along these lines potentially checking productive, if not successful on the basic leadership. A contrarian way to deal with this would propose that such varying perspectives and points of view may really be gainful to the general prosperity of the Company and the enthusiasm of the Shareholders.

3. There could be questions with respect to the adequacy of the chosen one executives. For illustration, given that they are Non-Executive Directors, they may have troubles in getting to data with respect to the matter of the organization or to different officers similarly as an official executive can.

4. It is misty if the candidate Nominee Director might will to go for broke of confronting risk since they may have obligations without the going with power or control inside the Company.

5. As these Directors are assigned by the institutional investors, who may have a noteworthy holding in the organization, it is far-fetch that these executives would be dealt with as Independent Directors. Their arrangement on the board may tilt the adjust of Independent and Non-Independent Directors which may make it hard to conform to the imperative board freedom prerequisites under the Corporate Governance standards without delegating more autonomous executives keep up the fitting parity.

6. Since the chosen Nominee Directors would owe guardian obligations to the organization, they are in an unenviable position whereby they may need to incline toward the interests of the organization over those of their nominating investor if there should be an occurrence of a contention between those interests.

VI. TYPES OF SHAREHOLDER ACTIVISM

The Shareholder Activism has a few parts to play in the organization. There are sorts of Shareholder activism to suit the company’s circumstance. The accompanying are the sorts which are there to mix with the Company’s circumstance:

1. The Investor Focused on Optimizing Yield

The financial specialist concentrated on improving yield, sort of activist deals with the present capital conveyance, and how unique methodologies may better advance Shareholder’s

1 https://indiacorplaw.in/2013/05/shareholder-activism-enters-boardroom.html (last accessed on 24-11-2017)
yield, which implies they look to re-design the accounting report to build Shareholder’s yield, over the briefest measure of time conceivable, which regularly runs between six to a year.

Illustration: Jolly Incorporation is a best performing S&P 500 Listed Companies whose two-year add up to return beat the market by more than 60%. Regardless of measurements indicating noteworthy general Company’s execution, the Company’s capital arrangement procedure was not amplifying Shareholders profits and buybacks. Jolly Incorporation, additionally constantly exchanged at a various forward-looking PEGY, that slackened the S&P 500. Every Public indicator suggested management stayed content with keeping up vast measure of overabundance money and liked to remain generally under-levered. In this way, the contention could be influenced Shareholder to yield was not as high as it could be. The dissident for this situation would persuade senior administration to issue obligation and reallocate free money towards a higher or exceptional profit and a huge offer repurchase.

2. The Investor Who Combines Closely Tied Competitors

Now and then it doesn't bode well for organizations working in a similar space to ceaselessly contend. Particularly inside unpredictable divisions, for example, Industrials and Materials, this can be counterproductive. Activists hope to check whether adversaries could be consolidated to shape a more gainful single substance, one that can profit by economies of scale and consume a given area.

Illustration: Acme Industries and Widget Co. work in an amazingly Competitive or in other words, Borderline oligopolistic sector. The two firms offer basically indistinguishable administrations, keep up comparative customer bases, and seek after practically identical prospects. As of late, the two Companies, displayed in the compacted edges, level income development, and slacking returns. Notwithstanding, free income per share stayed noteworthy at the two Companies, and settled cost proportions remained to some degree in place. Unmistakably, consolidating the two firms would be significantly more useful to general investor esteem. The activist in this circumstance connected with Acme Industries to reconfigure the Company’s capital arrangement procedure was not amplifying Shareholder’s target Companies with the accompanying issues:

3. The Investor Who Separates Different Divisions

At the point when a Company’s works in non-complimentary divisions, it can be hard to keep up a solitary balance sheet report that streamlines general Shareholder’s return. Regardless of whether the two divisions are gainful, the capital necessities of one might be totally unique in relation to the next. So an activist would look to part the divisions with the goal that they have singular capital structures that would enable each to streamline execution.

Case: Happy Co. was a main supplier of both capital-serious apparatus and customer based services. Income got from the apparatus business was exceptionally repetitive, though the shopper based administrations income was repeating and more steady. Large scale monetary factors likewise influenced every division in an unexpected way. The capital prerequisites of the two Companies were different to the point that the accounting report would never be organized in a way that most appropriate both. Subsequently, the activist's technique is cut out the customer based services to shape its own element, with the goal that it could be promoted in a way that streamlines execution. With two separate asset reports, management could design around the hazard factors such as income structure, monetary elements, more effectively.

4. The Investor Who Gets Rid of Dead Weight

Normally, Activist’s pinpoints battling specialty units that debilitate the execution of the general firm and seek after turn offs to dispense with dead weight from the Company.

Case: MineMe Inc. worked in a focused industry that had been persistently dense, basically through mergers, as of late. Inevitably the firm was keeping up two unmistakable complimentary business units, yet while one was showing above market middle levels of development, the other was getting to be noticeably outdated. It showed a 10% lessening in income development while the other unit displayed deals development of 75%. The slacking unit likewise required a prominent measure of capital uses while the developing unit was greatly versatile and capital venture was negligible. So a dissident drew in the Company to auction the slacking unit. Alongside continues of the sale, the recently authorized assets could be reallocated to help the organization's general development.

Shareholder’s target Companies with the accompanying issues

Activist’s investors have been setting their sights on organizations with the accompanying issues:

1. Underperformance issues which has been identified even in the case of great stock execution and it does not make a Company resistant.
2. Poor Governance and board practices in the Company.
3. "Zombie" Directors, are those directors who did not get lion's shareholder’s bolster, but rather some way or another stay on the board.
4. Combined Chairman or the Chief Executive Officer
5. Non-Independent Directors
6. Lack of Shareholder’s rights. For e.g., ideal to assemble a special meeting, composed assent, proxy access.
7. Executive Compensation issues
8. Ongoing concerns with respect to official pay – commonly prodded as a substitute consultant proposals and additionally media examination
9. Shareholder proposition got greater part bolster and your board did not execute it
10. Significant media feedback of late mergers, acquisitions, item dispatches
11. Identified as an exception in natural or social practices

Amid the previous years the shareholder activism and corporate management has been thought about as it has been worried in the Company’s zone, together and in addition alone. Shareholder activism is portrayed by purchasing partakes in Company with a specific end goal to put weight on the board or management of the Company. Done productively, it is a nearly cheap method for picking up impact and hence having the capacity to recreate organizations both from a money related and
a temperate viewpoint. This is in examination with common private value purchase outs where the firm ordinarily purchases the whole enterprise. Corporate Governance looks at the way organizations are coordinated, administrated and controlled through various arrangements of procedures, conventions, strategies and laws.

Corporate Governance takes a wide range of structures yet one focal and vital concern is to ensure the responsibility of the people in an association by limiting the vital specialist issue. Another part of corporate governance is management's effect on financial proficiency, regardless of whether solid investor activism can make a powerful management component keeping in mind the end goal to make better working Companies. Through time, Shareholder activists have utilized a wide range of ways to deal with weight corporate boards and administrators to enhance firm esteem. Customarily, activists have included individuals, pension funds, and mutual funds. As of the current years, hedge funds have come to assume an undeniably critical part. There is much difference on the subject whether shareholder activism can make genuine changes in the esteem, income, and governance structure of target firms.

Along these lines, the researcher has made sense of the accompanying goals of the Shareholder Activism:

- There are various credits that are probably going to draw in activism, for example, relative underperformance, alter in vital course, capital designation, accounting reports and returns approaches, and corporate governance.
- Governance-related crusades frequently give a false representation of some other thought process the specific activist investor may have in pursuing a battle against a Company's board.
- In accordance with the pattern found in the United State of America (U.S.A) around a fraction of the time, activists commonly get what they set out to accomplish. Be that as it may, this isn't a pointer of whether their drives or crusades have prompted estee creation.
- Only a set number of activists will target operational issues, and ordinarily just where they have specific bits of knowledge or industry encounter.

VII. CASE STUDY RELATING TO SHAREHOLDER ACTIVISM

Contextual analysis relating to shareholder activism: Commonwealth Bank of Australia's Annual General Meeting a year ago hurled an intriguing contextual analysis including Shareholder activism that merits remembering.

Preceding the Commonwealth Bank, annual general meeting the Australian centre for corporate responsibility (ACCR), speaking to more than 100 Commonwealth Bank investors, pulled out of proposed resolutions to be considered at the annual general meeting. The corporations act gives that a 5% or more investor or 100 investors in total are qualified for require the consideration of a determination at a meeting of the organization.

The target of Australian centre for corporate responsibility was to attract thoughtfulness regarding ozone harming substance emanations caused by Commonwealth Bank. The three resolutions were as per the following:

- That Commonwealth Bank’s yearly report furnishes investors with a report of its directors on the ozone depleting substance discharges that Commonwealth Bank is in charge of, the present level and nature of dangers to Commonwealth Bank from unburnable carbon and current methodologies embraced by Commonwealth Bank to moderate those dangers;
- That the investors express their worry at the nonattendance of these issues in the yearly report;
- To revise the constitution by unique determination to require that the directors report in the yearly give an account of these issues.

Commonwealth Bank exorted the Australian centre for corporate responsibility that it would exclude the initial two resolutions in its notice of meeting yet would incorporate the third determination, on the premise that the initial two resolutions were matters inside the restrictive energy of the board and were thusly not legitimate and equipped for having lawful impact. In the annual general meeting notice of meeting the board exhorted investors not to vote for the third determination as it didn't view the determination as in light of a legitimate concern for Commonwealth Bank and that it was not clear to the directors how as a pragmatic issue Commonwealth Bank could conform to the determination. The extraordinary determination was crushed at the annual general meeting. The Australian centre for corporate responsibility initiated Court procedures looking for an assertion that each of the three resolutions could be put at a yearly broad meeting. The Federal Court dismissed the application, setting out a genuinely standard investigation of the lawful rule that apply around there.

On the off chance that an organization has a run of the mill constitution that gives that the management and issues of the organization are vested in the directors, any determination of individuals that tries to guide the executives to practice those forces especially will be void and of no impact. Therefore, the initial two resolutions proposed by the centre were unmistakably of no lawful impact and Commonwealth Bank was not required to put the resolutions for thought by investors at the annual general meeting.

The third determination was the main in fact redress path in which the activist motivation could have been sought after – a change to the constitution that looked to expressly shackles the general forces of management vested in the board. Obviously, the trouble for an extremist in seeking after this system is that an extraordinary determination is required to revise the constitution along these lines.

The Australian centre for corporate responsibility additionally looked to contend that the suggestion made by the executives that investors vote against the third determination surpassed the forces of the directors. That contention was likewise dismissed by the federal court on the premise that the energy of the directors to make proposals of that nature gets from the constitution and the obligations of the directors.
VIII. CONCLUSION AND SUGGESTION

Shareholder activism assumes a fundamental part in well-functioning capital markets, in our view, by considering organizations more responsible to Shareholder. It is the Shareholder after all who claim the Company. Regardless of whether you put straightforwardly in a focused on extremist technique, possess a common store or claim offers of regular stock in a traded on a publicly traded organization, it is winding up progressively likely that you will be touched by some type of Shareholder activism amid your contributing lifetime. As we would like to think, when an activist rings the doorbell, it is by and large a smart thought to answer it.

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Effect of Socio-Cultural Practices on Girl-Child Performance in Kenya Certificate of Primary Education Examination in Navakholo Sub-County, Kenya

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Abstract- Over the past five years, Girls performance in the Kenya Certificate of Primary Education (KCPE) Examination in primary schools in Navakholo Sub-County has been dismal. Poor KCPE performance hinders placement of girls in National Schools, quality extra County schools and by extension, admission for good professional careers. The purpose of this study was to assess the influence of socio cultural practices on girl child KCPE examination performance in primary schools in Navakholo Sub-County. This was a descriptive study that employed a mixed methods designs approach. Questionnaires were used to collect data from 360 standard eight girls recruited through Stratified Random sampling. Interview guides were used to collect data from 15 Key Informants and 6 Focus groups purposively selected. Quantitative data obtained was analysed using descriptive statistics with the aid of SPSS computer software program. Qualitative data was analysed by content analysis. The study established that stereotypic gender role dispositions are the major socio cultural factors that lead to girls’ poor performance in KCPE Examination. The study recommends that parents be encouraged to minimize domestic chores for girls, and that Policy decisions should focus on increase Free Primary Education Funds to so that schools’ can cater for girls needs as well to enhance girl child KCPE Examination performance.

Index Terms- Socio cultural practices, stereotypic gender role dispositions Girl- Child, Performance, KCPE Examination

I. INTRODUCTION

Worldwide, there is still a problem of gender equality in access, retention and transition in education (UNESCO, 2010). This problem is severe in developing nations partly because of limited resources to meet all budgetary requirements for education. In the Sub-Saharan Africa (SSA), Lewin, & Sabates (2011) have reported that girls are now enrolling in schools more than the past, but still, more girls drop out and do not progress to complete education because of poor performances in national examinations at the end of the primary school cycle. According to UNESCO (2008), the Education for All (EFA) goals commitments to girls’ education go beyond the primary education; and Education for All means quality education, and more access to secondary and post-secondary education, with gender equality. Girls are less likely than boys to complete the first schooling cycle, particularly in South Asian countries, where the primary completion rate is estimated at 84 per cent for boys and only 63 per cent for girls; and sub-Saharan Africa, where the primary school completion rate is 56 per cent for boys and 46 per cent for girls (Levine and Birdsal, 2010). It has also been estimated that less than 15 per cent of girls from rural households in Benin, Burkina Faso, Guinea, Madagascar, Mozambique, and Niger complete primary school (Lewin & Sabates, 2011). In Pakistan in the late 1990s, only 36 per cent of rural girls were attending primary school and 16 per cent secondary school (Levine and Birdsal, 2010).

There are several reasons for girl’s non completion of primary school education. Studies identify reasons as disadvantaged groups such as children living in poor communities, children on wage labor and orphaned children as most vulnerable to poor attendance, repetition, early dropout and exclusion (Ngware et al, 2012). In the developing countries, these factors have been isolated as School-related factors (ineffective teaching, insufficient qualification of teacher, absence of textbooks and inappropriate learning assessment system), Student characteristics (poor motivation, learning difficulties, health and nutrition status, and behavioral problems) and Family-related factors (illiteracy or low education of parents, income of family) (Sabates et al, 2011).

In Kenya, Basic Education is now a right in the current Constitution of Kenya (GOK, 2010). The Constitution provides for children’s right to free and compulsory basic education. Other notable reform initiatives in education by the GOK include provision of Free Primary Education (Malenya, 2008), legislation through the Children’s Act (GOK, 2001) and the formulation of the gender policy in Education (GOK, 2008). Despite progress made over the last decade towards completion rates and gender parity, the Ministry of Education (MOE) reports indicate that there are still some challenges (MOE, 2011; 2010; 2009). One major challenge to completion of girl child basic education has been the poor performance and failure in National examinations and this hinders the transition of girls to higher levels of learning particularly from primary school.

The Kenya Certificate of Primary Education (KCPE) Examination has been used to measure academic achievement after completion of primary school since the year 1985. KCPE has five examinable subjects including Science, Mathematics, Kiswahili, Social studies and English. These subjects are scored equally out of a total of 500 marks. Secondary school placement,
and to some extent admission, depend on performance in KCPE (Oketch, 2010). In effect, KCPE is used as a basis for selection for educational advancement and by extension, future career and employment. KCPE is a summative assessment and does not adequately measure all learner abilities and experiences. School based assessment would be better, but it is still not standardized and is therefore less useful as a measure to be used for transition to secondary education.

Variations in KCPE Examination performance are sometimes due to unique factors that affect specific regions (KNEC, 2010). Consequently, reliance on KCPE scores for transition leads to tragic wastage of human, social and economic potential in Kenya. In some cases bright students have failed to excel in KCPE while weak students have excelled because of certain factors (Jagero, 2013).

The purpose of this study was to assess the influence of Socio-cultural practices on girl child KCPE performance in Navakholo Sub-County in Kenya. Over the past five years (2009-2013), girls in Navakholo Sub County have been performing poorly in KCPE. In the year 2013, 67% of the Girls scored less than half (250 marks out of the possible 500 marks) in KCPE as illustrated in Table 1.

Table 1: A summary of KCPE Performance in public primary schools Navakholo Sub-County by Gender over the period 2008-2013

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Boy's who scored at least 250 out of the possible 500 KCPE marks.</td>
<td>45%</td>
<td>49.6%</td>
<td>49.9%</td>
<td>52%</td>
<td>51.6%</td>
</tr>
<tr>
<td>Percentage of Girl's who scored at least 250 out of the possible 500 KCPE marks.</td>
<td>38%</td>
<td>39.5%</td>
<td>39%</td>
<td>38.4%</td>
<td>33%</td>
</tr>
</tbody>
</table>

(Source: Sub County Education office, Kakamega Central Sub County, 2013).

Navakholo Sub County is in Western Kenya. It is one of the twelve Sub Counties that make up Kakamega County. Navakholo Sub County an overtly rural settlement. The inhabitants of the Navakholo are mainly the Luhya ethnic group. The major economic activities in the study area are agriculture, Jua Kali artistry, hawking, businesses etc. Farming of food crops is done mainly to sustain livelihoods. The major stable food crops grown are maize, beans, and cassava. Sugarcane is grown for commercial purposes. Residents also keep livestock including cattle, sheep, goats and local chickens (Kakamega County Data Sheets-K.C.D.S., 2012).

The gender disparity in KCPE Examination performance in primary schools in Navakholo sub-county where boys and girls learn under the same school environment is questionable. Ideally, girls should attain almost the same scores of marks as the boys. Poor performance in KCPE examinations negatively affects secondary school placement because Girls in Navakholo Sub County miss out placement in National schools, good Extra County schools and by extension, future career opportunities. Previous studies have reported that barriers to full and equal access to, and achievement in basic education for the girl child include hardships in environments that that not learner friendly, cultural factors like early marriage and female genital mutilation, lack of role models, sexual harassments, poor school management practices, poor attitude of girls towards mathematics and science subjects, and school location (Oketch & Somerset, 2010). Since the boys and girls learn under the same school environment, the assumption of the study was that factors out of school could be the major cause of the gender disparity in KCPE performance in primary schools in Navakholo sub-county. Moreover, in one recent study, Achoka et al (2013) reported that the cultural forces, mainly traditional practices, negatively influencing girls’ academic achievement in Western Kenya include early marriages, stereotypic gender role disposition and Female Genital mutilation. A clear identification and understanding of how sociocultural factors influence KCPE examination performance in Navakholo Sub County will contribute invaluable information for the design and implementation intervention strategies to help improve girl child KCPE performance. Ultimately, the girl child will be able to compete favorably in the job market and improve in the quality of life.

II. METHODS

This was a descriptive survey study with a mixed methods approach. Both Quantitative and Qualitative approaches were adopted since the nature of data required and the procedures of analysis involved integrating both qualitative and quantitative data, merging and connecting to answer the research questions (Creswell, 2013). The designs were considered suitable to evaluate Socio cultural practices and behavior patterns of the community, parents and the girls regarding girl child academic performance in primary schools in Navakholo.

A sample of the standard eight girl pupils in primary schools was recruited using stratified random sampling. The strata were based on the kind of school shared attributes or characteristics of either public or private. Of the 74 primary schools, 66 were public schools and 8 were private. Thus, the proportion was 89.2% Public primary schools to 10.8 % private primary schools. A random sample from each stratum was taken in a number proportional to the stratum's size when compared to the population estimates. Subsets of randomly selected standard eight girl pupils from the different strata were then pooled to form a random sample of 360 standard eight girls. 15 Key informants were purposively selected based on their knowledge and experiences on issues related to socio cultural practices affecting the girl-child in Navakholo (Table 2).
Table 2: Summary information on the sample size used in the research study

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Method of recruitment</th>
<th>Number of respondents recruited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard eight Girls</td>
<td>Stratified random sampling</td>
<td>360</td>
</tr>
<tr>
<td>Key informants</td>
<td>Purposive</td>
<td>15</td>
</tr>
<tr>
<td>Focus Groups</td>
<td>Purposive</td>
<td>6 groups of 6-8 girls</td>
</tr>
</tbody>
</table>

Source, Field Data

Prior to actual data collection, the instruments pre-tested with the help of Experts from Mount Kenya University School of Education and four trained research assistants during the month of September, 2014. The research study was approved by Kenya National Commission for Science, Technology and Innovation (NACOSTI) vide a research permit (Ref. NACOSTI/P/14/7592/3931). Structured questionnaires were used to collect data from the standard eight girls during the first three weeks of October, 2014. The questionnaires were completed with the assistance of research assistants, lasting about Forty Five minutes. Six (6) Focus Groups Discussions were also conducted with standard eight for one hour discussions captured through group discussion and worksheet analysis. Key informant interviews lasting about One and a half hours were conducted during the last week of October, 2014 with the help of research assistants

Quantitative data obtained was coded, cleaned and analyzed using SPSS version 17 computer software program. The data is summarized and presented in form of Narratives, tables and figures showing descriptive statistics for each variable. Analysis was by determining the percentages of girls who engage in sociocultural role duties and the frequency with which they undertake the sociocultural role duties within a week. Chi-square test analysis was used to assess for statistically significant associations between variables. The Key informant interview responses were thoroughly read and scrutinized for patterns; the study sought views on the challenges girls face from sociocultural beliefs and role duties. Data was then transcribed and analyzed for content manually using a meaning centered approach to derive key Themes. Findings from both arms are used complementarily.

III. STUDY FINDINGS

It was observed that the age of girls mainly ranged between 13-18 years but was skewed towards the range 13-16 years (Mean age = 14.4 years: ±1.2 S.D.). Most girls (> 90%) reside near their schools (within 1-2Km). School levies are mainly paid by their parents. Only a few parents (about 11%) to the girls had beyond form four level of education. Most parents (>80%) were not in formal employment (Table 3).
**Table 3: Socio Demographic Characteristics of the Sample population**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>COUNT</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE (COMPLETED YEARS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-14 YEARS</td>
<td>214</td>
<td>59.44%</td>
</tr>
<tr>
<td>15-16 YEARS</td>
<td>126</td>
<td>35.00%</td>
</tr>
<tr>
<td>17-18 YEARS</td>
<td>18</td>
<td>0.050%</td>
</tr>
<tr>
<td>ABOVE 18 YEARS</td>
<td>2</td>
<td>0.006%</td>
</tr>
<tr>
<td>TOTALS</td>
<td>360</td>
<td>100%</td>
</tr>
<tr>
<td>DISTANCE FROM SCHOOL TO HOME (Km).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within 2 Km</td>
<td>330</td>
<td>91.6%</td>
</tr>
<tr>
<td>3-5 Km</td>
<td>15</td>
<td>4.2%</td>
</tr>
<tr>
<td>Above 5 Km</td>
<td>15</td>
<td>4.2%</td>
</tr>
<tr>
<td>TOTALS</td>
<td>360</td>
<td>100%</td>
</tr>
<tr>
<td>PERSON WHO PAYS SCHOOL LEVIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>300</td>
<td>83.33%</td>
</tr>
<tr>
<td>Brother/Sister</td>
<td>10</td>
<td>2.7%</td>
</tr>
<tr>
<td>Other relative</td>
<td>18</td>
<td>5.0%</td>
</tr>
<tr>
<td>Sponsor/Guardian</td>
<td>22</td>
<td>6.10%</td>
</tr>
<tr>
<td>TOTALS</td>
<td>360</td>
<td>100%</td>
</tr>
<tr>
<td>LEVEL EDUCATION OF PARENT/GUARDIAN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below standard 8</td>
<td>10</td>
<td>2.7%</td>
</tr>
<tr>
<td>KCPE/Standard 8</td>
<td>270</td>
<td>75.0%</td>
</tr>
<tr>
<td>O level/Form 4</td>
<td>40</td>
<td>11.1%</td>
</tr>
<tr>
<td>Diploma</td>
<td>20</td>
<td>5.5%</td>
</tr>
<tr>
<td>Degree/Undergraduate.</td>
<td>15</td>
<td>4.2%</td>
</tr>
<tr>
<td>Post Graduate</td>
<td>5</td>
<td>1.3%</td>
</tr>
<tr>
<td>TOTALS</td>
<td>360</td>
<td>100%</td>
</tr>
<tr>
<td>PARENT’S/GUARDIAN’S OCCUPATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td>240</td>
<td>66.6%</td>
</tr>
<tr>
<td>Business/Jua kali/Hawker</td>
<td>50</td>
<td>13.9%</td>
</tr>
<tr>
<td>Temporary/Informal/Contracts</td>
<td>10</td>
<td>2.7%</td>
</tr>
<tr>
<td>Permanent/Formal</td>
<td>60</td>
<td>16.7%</td>
</tr>
<tr>
<td>TOTALS</td>
<td>360</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source, Field Data, 2014

**Influence of socio-cultural practices on girl child KCPE performance**

Socio cultural practices reported in the study area are normally manifested through socio-cultural role duties which are stereotypic. These included fetching water, taking care of children, looking after cattle, preparing the farm, preparing meals, being sent to the market, milking cow(s) and domestic chores such as sweeping, baby sitting and washing Clothes.

It was observed that preparing meals and fetching water were the most frequent socio cultural role duties performed by girls (>95%), while milking cows and looking after the cattle were the least performed sociocultural role duties (Table 4). The girls reported that most of these sociocultural role duties were undertaken after school time (After 4.00Pm).
Table 4: Weekly rating on number of times socio-cultural role duties are undertaken by the girl child  

<table>
<thead>
<tr>
<th>Socio-Cultural role duty</th>
<th>Percentage of girls who undertake duty</th>
<th>Weekly Mean rating (number of times)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fetching water</td>
<td>95.2%</td>
<td>4.8</td>
</tr>
<tr>
<td>2. Fetching firewood</td>
<td>61.3%</td>
<td>2.0</td>
</tr>
<tr>
<td>3. Taking care of children</td>
<td>28.5%</td>
<td>2.0</td>
</tr>
<tr>
<td>4. Looking after cattle</td>
<td>3.7%</td>
<td>0.1</td>
</tr>
<tr>
<td>5. Preparing the farm</td>
<td>45.0%</td>
<td>0.8</td>
</tr>
<tr>
<td>6. Preparing meals</td>
<td>97.2%</td>
<td>4.87</td>
</tr>
<tr>
<td>7. Being sent to the market</td>
<td>39.8%</td>
<td>2.0</td>
</tr>
<tr>
<td>8. Milking cow(s)</td>
<td>3.6%</td>
<td>0.1</td>
</tr>
<tr>
<td>9. Domestic chores such as Sweeping, Baby sitting and Washing Clothes</td>
<td>68.4%</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Source: Field Data, (2014)

Challenges due socio-cultural role duties

The greatest challenges that face girls are activities at home which deny them a chance to study (95%), being given too much work at home (93.1%), parents attitude that girls do not require as much education as boys (78%) and the feeling that boys are better than girls when it comes to academic work (Table 5). This finding was also consistent with teachers’ views during interviews. Teachers were of the view that domestic chores seriously interfered with girls’ concentration on school work and enhanced girls’ flight from academics, particularly the weak pupils. Girls also confirmed that activities at home, particularly domestic duties were the biggest challenge they faced. As one of the girl respondent remarked in desperation; I know I need time to rest and read, but I have fear of how my family members would look at me if I refuse to carry out these tasks (domestic chores). They all know that these are duties for a girl. I have never seen in any home around where girls just sit unless they are spoilt or are girls from town who do not know how to cook and sweep the house. [Focus Group summary note]

The Education officers interviewed also submitted that due to poverty, parents in Navakholo Sub County engage their daughters in labor such as house-helps or working on peoples farms in order to lessen the financial burden on the family. All head teachers interviewed, said some girl pupils are asked by their parents to quit school during some time (particularly the planting seasons of January to February and help them with planting and household chores, but some often fall prey large number of idle young leading to un intended pregnancies and drop out of schools. During the FGDs, girls suggested that standard 6, 7 and 8 girls should board in schools to reduce the burden of activities and to give girls ample time to concentrate on their studies.
Table 5: Frequency of challenges on performance of the girl child in KCPE  (n=340)

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Always</th>
<th>sometimes</th>
<th>rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Parents delay/ do not pay school levies</td>
<td>2.9%</td>
<td>60%</td>
<td>26%</td>
<td>11.1%</td>
</tr>
<tr>
<td>2. Parents failure to buy me certain basic items</td>
<td>5%</td>
<td>60%</td>
<td>25%</td>
<td>10%</td>
</tr>
<tr>
<td>3. I am given too much work at home compared to boys</td>
<td>93.1%</td>
<td>4%</td>
<td>2%</td>
<td>0.9%</td>
</tr>
<tr>
<td>4. Activities at home deny me study time besides leaving me fatigued</td>
<td>95%</td>
<td>2%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>5. Parents view has been that I do not require as much education as boys</td>
<td>78%</td>
<td>12.3%</td>
<td>3.7%</td>
<td>6%</td>
</tr>
<tr>
<td>6. Parents feeling that I should marry after class eight</td>
<td>3%</td>
<td>68%</td>
<td>10%</td>
<td>19%</td>
</tr>
<tr>
<td>7. Parents feeling that Boys are better than girls when it comes to academic work</td>
<td>71.9%</td>
<td>11%</td>
<td>16.1%</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

Source: Field Data, (2014)

This study findings corroborate with findings of a study by Juma et al. (2014) who found that girls are normally overburdened with family and household chores and thus do not enjoy plenty of time to study and freedom to choose what to engage in. This finally leads to poor academic performance in examinations such as the KCPE examination.

However, parents were not ignorant of the potential harm of their attitudes towards girls. One mother noted, for example, that they do not give girls the same freedom they give to boys because girls are more vulnerable and more dependent and lack confidence in themselves and their education. During this study, a father suggested that parents control girls through lots of domestic chores for their own good: he also argued that, although girl’s responsibilities were numerous, the tasks undertaken require less energy. The respondent further asserted that:

If the girl is not controlled, she will lose her virginity and even get pregnant. A boy has nothing to lose. Girls normally are victims and are also afraid. [Male Key informant Observation]

Another key finding was that parents tended to discourage too much education for their daughters. There is always the fear that if a girl is highly educated she may find it difficult to get a husband or be a good wife. They argue that women stay away from too much education in order to remain manageable and to avoid entering fields, which would make it difficult to follow their husbands in case of transfer of residence. This perhaps explains why most parent’s (>90%) have their daughters educated in schools near to their homes (less than 2 Km away) so that they do not only cover long journeys to school but also, so they believe that they can be monitored.

Parents interviewed complained that sending a girl to school is expensive because most of them depend on farming for their livelihood. This fact is further supported by data on parents’/ guardians’ occupation. A Chi Square test conducted on the distribution of parents’/ guardians’ occupation data showed that there was a highly significant (p<0.01) variation ($\chi^2 = 348.89$). The situation is made worse when occupation for most parents is that most are peasant subsistence farmers.

When the girls were asked how they expected to score in KCPE, only 9.1% of the girls perceived themselves as being able to score above 350 marks (Table 6). A Chi Square test conducted on the data showed that there was a highly significant (p<0.01) variation in the distribution of perceived marks to be scored by ($\chi^2 = 774.07$). This finding points at girl’s low self-efficacy and low esteem. A similar pattern of low self efficacy was observed when the girls were asked their preferred career choice of the future. Less than 10 (~2%) girls aspired to be either doctors or engineers; majority (>70%) wanted to be nurses (Figure 3).

Table 6: Projected KCPE marks to be scored by girls  (n=360)

<table>
<thead>
<tr>
<th>PROJECTED MARKS TO BE SCORED BY GIRLS IN KCPE</th>
<th>COUNT</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>250-280 marks</td>
<td>11</td>
<td>3.05%</td>
</tr>
<tr>
<td>281-300 marks</td>
<td>10</td>
<td>2.7%</td>
</tr>
<tr>
<td>301-350 marks</td>
<td>316</td>
<td>87.8%</td>
</tr>
<tr>
<td>Above 350 marks</td>
<td>33</td>
<td>9.1%</td>
</tr>
<tr>
<td>TOTALS</td>
<td>360</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Field Data
IV. DISCUSSION

The pattern of mean weekly ratings results on socio-cultural role duties undertaken by the girls suggest that most girls fetch water and prepare meals virtually every day of the school week. It is also possible that the girls could be involved in more than one sociocultural role duties within a single day and within the week. These socio-cultural role duty activities are likely to have an impact on the girl child’s academic performance in school, because, besides leaving the girls exhausted, such sociocultural role duties can take much of the time required for revision and study. This argument is in line with the findings of Kiptui and Mbugua (2009) who established that a lot of work at home was one of the problems affecting girl-students’ KCSE achievement in English in day schools in Kerio Valley, Kenya. In Kerio Valley, the chores included cleaning the home, working on family farm or business, cooking and taking care of the young ones among others.

Girls engage in these sociocultural role duties mainly because of the patriarchal nature of the society where the cultural perception is that the women, and in this case girls, should be the ones to carry out such domestic duties related to keeping the home (Mutambo, 2013). As cultural norms, stories are told to facilitate the telling of the young girls’ expected experiences and stories enable them to explore their experiences in working so hard in carrying domestic chores and to be good mothers. Such household chores and other ‘community’ perceptions keep girls out of school and divert their attention from learning.

Listening to these young ‘mothers’ diverse narratives and in reinterpreting them within the broader social and cultural landscape leaves one with a perception of the girls are overburdened but have no place in society to complain. As one of the girl respondent remarked in desperation;

I know I need time to rest and read, but I have fear of how my family members would look at me if I refuse to carry out these tasks (domestic chores). They all know that these are duties for a girl. I have never seen in any home around where girls just sit unless they are spoilt or are girls from town who do not know how to cook and sweep the house.

This assertion implies that the Socio cultural practices have been inculcated into the girls such that the practices are part of their daily lives. Similar study findings have been reported by Achoka, et al (2013) in Bungoma County, also established that the stereotypic gender role dispositions tended to favor male children against girls, hence girls are given so much work at home that they can hardly find time to read.

This argument implies that the Socio cultural practices have been inculcated into the girls such that the practices are part of their daily lives. Similar study findings have been reported by Achoka, et al (2013) in Bungoma County, also established that the stereotypic gender role dispositions tended to favor male children against girls, hence girls are given so much work at home that they can hardly find time to read.

Findings of this study reveal great interference from socio-cultural practices on the girl child academic performance which concurs with findings of studies by UNESCO (2010) & Batoya et al, (2013), which have reported that there was a general trend across all countries which reported on the matter in which girl Child academic performance appears to weaken relative to the performance of boys at some point in the school cycle; for example, in Botswana performance by female starts to decline at the age of ten years, while in Madagascar and Rwanda.
girls performance weakens at the age of thirteen years and nine years respectively. Girls often become victims of circumstances. In Navakholo Sub County, domestic chores undertaken by girls are a reflection of the community’s expectations. The gender division of labor is also a reflection of the overall community’s expectations of gender roles. The significant contribution that girls make to household, preparing food, cooking, fetching water, looking after siblings sometimes hinders girls from concentrating at school. This societal perception leads to overburdening girls with domestic chores leaving them with little study time. However, this could sometimes be due to low income, where the parents cannot afford to pay for the services of house helps. However, it appeared that parents were also scared of the delicate nature of their girl children.

Another significant finding is the ‘preference’ of boys which often ends up disadvantaging girls. Patriarchal societies such as that of Navakholo are influenced by patriarchal systems, which give preferences for investment in schooling to boys who are believed to retain responsibility for their parents when they grow older, compared to girls, who are incorporated into their husbands’ families. According to head teachers, socio cultural impediments do provide girls with less exposure to the information that allows individuals to develop self-efficacy hence it make girls loose morale for school since girls would traditionally depend on men. This also could perhaps explain why most girls preferred to be nurses! This findings concur with those of Juma et al, (2014) in a study of cultural factors affecting academic achievement in Kisumu East, Kenya, where it was reported that some girls believed that their success and future depended on the success of their husbands and therefore it was used as an excuse for girls not to be taken to school. This is likely to have a negative effect on the academic performance of the girls. This perhaps explains why most parents would prefer to invest in boys and give girls less education. However this unfortunate situation coupled with poverty leads to girls sometimes failure to get basic needs which ultimately lead to poor academic performance. As one Head Teacher put it:

When basic needs are fulfilled, girls’ performance becomes one of the top priorities’.

During interviews with teachers, it emerged that fulfillment of basic needs supports the acquisition of knowledge and skills that enable girls to increase their concentration and improve their academic prowess. This finding is supported with findings of another study by Juma, simatwa & Ayodo (2011) which established that girls whose parents do not provide basic needs such as sanitary towels totally lose concentration in academic work and become more vulnerable to sexual abuse in order to fend for themselves.

Socio- cultural practices lead to girl’s low self-esteem and could have also an impact on parent’s perceptions of their daughters’ abilities. Although many parents recognized that the poor performance of girls was related to their work burden in the home, others were not convinced of this and considered it to be a natural phenomenon. For example, one parent proposed that enrollment is higher for boys in secondary schools because they have greater aspirations, since girls are usually only interested in their work in the house and marriage. The parent added that girls are therefore less interested in school and make less effort to join secondary school and, as a result, parents send boys to better secondary schools. However, this view was not supported by girls themselves, who, expressed a desire to continue to high school and obtain professional employment as reflected by the collected data.

Girls’ low levels of achievement over the past few years, in comparison to boys, could also contribute to parents feeling that the time girls spend in school is wasted. Although most girls (>90%) indicated that they would consider their education complete after attaining university education (degree level), to some extend the girls have also perceived their self-efficacy poorly. This finding also points at poor self-efficacy by the girls about. People’s beliefs about their abilities where domains are thought to be important in motivating them to do, and what they can do to achieve (Hawthorne, 2004). Self-efficacy - defined as confidence in one's abilities to successfully perform particular tasks appeared to be low in the girls because very few of them see their ability as only being able to achieve careers in nursing and teaching. This finding could be a reflection of lack of role models in these professional careers, lack of career counselling services and also because of the cultural deposition on the common female gendered role careers. The finding could also be a reflection of the parents and cultural perceptions on career choice for women. Such poor self-efficacy would make girls less ambitious and limit their education to achieve certain careers in education, and perhaps that is why most of them perceive themselves as only being able to be nurses or teachers and not Doctors or Engineers.

V. CONCLUSIONS

The study established that Socio Cultural stereotypic gender role dispositions are the major socio cultural factors that lead to girls’ underperformance in KCPE Examinations. Socio Cultural factors in almost all circumstances depict girls as inferior to boys, a factor that demeans girls and indeed impedes girls’ aspirations in life. Girls even fail to consider education as the best investment in good life free from poverty, slavery, ignorance and diseases. The consequence of which is laxity and negative attitude towards education. This lowers girls’ morale and eventually leads to low academic performance including KCPE examination performance. The study recommends that parents be encouraged to minimize domestic chores for girls, so that they can concentrate on their studies. This would ensure that the girls have adequate time to carry out their studies. Policy decisions should focus on increasing Free Primary Education Funds to so that schools’ can cater for girls needs as well to enhance academic achievement.

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ISSN 2250-3153


500


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Prescribing Trends Affordability and Compliance to Osteoporosis Pharmacotherapy in Private and Public Sector Hospitals of Lahore

Arfa Hameed, Iqra Zafar, Dr. Bushra Ali, Dr. Munazza Riaz

Institute of Pharmacy, Lahore College for Women University

Abstract- Objective: The aim of the study was to compare the current prescribing pattern, affordability and compliance rate to osteoporosis pharmacotherapy in Public and Private sector hospitals of Lahore.

Materials and Methods: An observational cross-sectional study was conducted on 204 pre and postmenopausal women’s. Subjects were selected randomly from three each public and private sector hospitals of Lahore. Pre-designed questionnaire was filled by the osteoporotic patients. The questionnaire comprised of patient’s demographics, family history, socioeconomic status and medications regimen. Data was evaluated in percentage and displayed in graphical form.

Results: Bisphosphonates were considered as the first line agent in treating patients with osteoporosis. 98.03% & 95.09% patients were prescribed with bisphosphonates while all the patients were prescribed with calcium, vitamin D supplements and pain killers to combat the disease in public & private sector hospitals. Compliance rate was found to be 79.4% in public sector and 94.1% in private sector. Osteoporosis therapy was unaffordable to 55.8% patients in public and 28.4% patients in private sector hospitals.

Conclusion: The study concludes that osteoporosis is more prevalent in postmenopausal women’s. Bisphosphonates are prescribed as the first line agent for slowing the progression of disease. Cost of treatment in public sector makes the therapy unaffordable to the patients. Compliance rate is found to be satisfactory in both hospitals.

Index Terms- Bisphosphonates, compliance, Osteoporosis, postmenopausal, premenopausal.

I. INTRODUCTION

Bones are the integral support system of the body, so their health and preservation is of prime importance. Osteoporosis has become a major public bone health problem worldwide with an estimated prevalence of over 200 million. 9.9 million People in Pakistan have osteoporosis of which 7.2 million are women. Occurrence of osteoporosis in Pakistan is expected to rise in the coming years with an estimated prevalence of 11.3 million in 2020 and 12.9 million in 2050. [1]

Osteoporosis is a disease having low bone mass and micro-architectural degeneration of bone tissue, leading to bone fragility and increase risk of fractures of the hip, spine and wrist. Spine, wrist and hip are the most commonly affected sites in osteoporosis. WHO defines osteoporosis as (BMD) T-score <-2.5. The disease is broadly classified into two main types: primary osteoporosis, the cause may be the age-related bone loss (sometimes called senile osteoporosis) or may be unknown (called idiopathic osteoporosis), while in secondary osteoporosis, the loss of bone mass is caused by certain lifestyle factors, diseases or medications. [2]

Risk factors in osteoporosis that are out of control include older age, female gender, small, thin bones body shape, Caucasian and Asian women, family history. Lifestyle factors that increases the risk of developing disease are low calcium and vitamin D intake, anorexia nervosa, lack of exercise, alcohol intake, cigarette smoking. [3] Regular weight-bearing (e.g., walking and stair climbing) and muscle-strengthening (e.g. weight training) exercise can improve agility, strength, posture, and balance which will ultimately reduce the subsequent fracture risk.

Diagnostic tools to identify patient with osteoporosis include dual-energy X-ray absorptiometry (DXA), Quantitative computed tomography (QCT) and Biochemical markers of bone turnover. The Fracture Risk Assessment Tool (FRAX) is a diagnostic tool used to evaluate the 10-year probability of bone fracture risk. [4]

Osteoporosis treatment is extensively classified into non pharmacological and pharmacological treatment. Non pharmacological approach includes fall prevention; formal home safety evaluations and physical therapy. Pharmacological treatment includes bisphosphonates; Oral bisphosphonates inhibit osteoclastic activity and are also called antiresorptive agents. The intravenous bisphosphonates currently approved by the FDA for the treatment of postmenopausal osteoporosis are zoledronic acid, ibandronate. Raloxifene, a selective estrogen receptor modulator, is approved for the treatment of postmenopausal osteoporosis. Teriparatide is a recombinant human parathyroid hormone that has bone anabolic activity. [5]

The purpose of the current study was to determine the current prescribing trends for osteoporosis therapy to observe and study the affordability of osteoporosis and to determine compliance rate to that therapy in Public and Private Hospitals of Lahore.

II. MATERIALS AND METHODS

An observational cross-sectional study was conducted from June to July, 2017 to observe the prescribing pattern and to study the affordability and compliance rate to osteoporosis pharmacotherapy. A convenient random sampling of 204 patients...
was done in which 102 was from each public and private sector hospitals.

Data collection form was designed covering the following aspects including patient demographics, family history, dietary habits, counseling, prescribing trends, medication usage, discontinuation of therapy, exercise pattern, socio-economic status, cost of treatment and compliance to bisphosphonates therapy.

Study was performed by filling data collection form, analyzing prescriptions and face to face interview with patients. Data was analyzed and displayed in the form of graphs.

III. RESULTS

The data was collected from 204 osteoporotic patients. Socio-economic status in public sector was 23.52% patients fall in the monthly income range of less than 10,000 while only 7.84% of patients fall in this category in private sector. 68.62% public patients fall in Rs 11,000-30,000 while 19.60% had an income of Rs 31,000-60,000(Table 1).

The pharmacotherapy prescribed for postmenopausal and premenopausal osteoporotic patients included bisphosphonates as the fine line agents along with calcium and vitamin-D analogues (Table 2). Pain killers were also prescribed to subside the pain associated with bone fragility (Table 3). Medications were prescribed by brand names. Figure 1 shows the comparison of bisphosphonates prescribed in public and private sector hospitals. Alendronate Na was prescribed to 24.4% patients in private hospitals while combination of alendronate Na and cholecalciferol was prescribed to16.6% in public hospitals (Fig 1).

Pain killers mostly prescribed in public hospitals were a combination of paracetamol and orphenadrine citrate to 51.9% patients whereas diclofenac Na was prescribed to 22.5% in private sector hospitals (Table 1).

Common calcium analogue prescribed to public and private patients was combination of calcium carbonate plus cholecalciferol in 78.4% and 85.2% respectively (Fig 2).

Vitamin-D supplementation prescribed included cholecalciferol to 68.6% patients in public and 41.1% patients in private hospitals(Fig 3).

Percentage of patients who can and cannot afford osteoporosis pharmacotherapy in public and private hospitals 55.8% patients in public and 28.4% patients in private (Fig 4). Average cost of medications prescribed per day was Rs: 47 in public hospitals and Rs: 45 in private hospitals. Higher average cost in public hospital is due to the prescribing of expensive brands and polypharmacy (Table 4).

83.8% patients were compliant to bisphosphonates therapy in public and 98% patients in private hospitals(Fig 5).
Figure 2: Calcium analogues prescribed

Figure 3: Vitamin-D supplement prescribed
Figure 4: Affordability to osteoporosis therapy

<table>
<thead>
<tr>
<th>Monthly Income</th>
<th>F</th>
<th>Public</th>
<th>F</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10,000</td>
<td>24</td>
<td>23.52%</td>
<td>8</td>
<td>7.84%</td>
</tr>
<tr>
<td>Rs. 11,000 - Rs. 30,000</td>
<td>70</td>
<td>68.62%</td>
<td>20</td>
<td>19.60%</td>
</tr>
<tr>
<td>Rs. 31,000 - 60,000</td>
<td>8</td>
<td>7.84%</td>
<td>31</td>
<td>40.19%</td>
</tr>
<tr>
<td>Rs. 61,000 - Rs. 100,000</td>
<td>0</td>
<td>0%</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>More than 100,000</td>
<td>0</td>
<td>0%</td>
<td>16</td>
<td>16.32%</td>
</tr>
</tbody>
</table>

Table 1: Monthly Income

Figure 5: Compliance to osteoporosis pharmacotherapy

Table 2: Medications prescribed to osteoporosis patients

<table>
<thead>
<tr>
<th>Medications</th>
<th>F</th>
<th>Public</th>
<th>F</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisphosphonates</td>
<td>100</td>
<td>98.03%</td>
<td>93</td>
<td>95.09%</td>
</tr>
<tr>
<td>Calcium Analogue</td>
<td>102</td>
<td>100%</td>
<td>102</td>
<td>100%</td>
</tr>
<tr>
<td>Vitamin D Analogue</td>
<td>102</td>
<td>100%</td>
<td>102</td>
<td>100%</td>
</tr>
<tr>
<td>Pain killers</td>
<td>102</td>
<td>100%</td>
<td>102</td>
<td>100%</td>
</tr>
</tbody>
</table>
Osteoporosis is one of the significant problems faced by women of the older age resulting in a decreased bone mass and is linked with high risk of fracture. In this study patients were asked about family history and it was found that hypertension and diabetes had high rates both in public and private sector hospitals; few patients had a family history of asthma and high cholesterol. Socioeconomic status in patients visiting public sector hospitals was low. 60.7% patients had a monthly income of Rs 10,000-30,000 in public hospitals while in private 32.6% fell in this range. 40.9% patients had an income of Rs 60,000-100,000. 64.7% and 88.2% women’s did exercise in public and private hospitals. Pattern of exercise that was followed was either walking/jogging or as instructed by their respective orthopedic doctors while in a previous study it was shown that Regular weight-bearing (eg, walking and stair climbing) and muscle-strengthening (e.g. weight training) exercise can improve agility, strength, posture, and balance, that will result in decreasing the risk of falls and eventually fractures. In this study it was observed that combination of Alendronate Na plus cholecalciferol and Alendronate Na alone was prescribed at a dose of 70mg once weekly while Risedronate Na 150mg monthly both are in with FDA guidelines. However in another study it was found that risedronate and alendronate have only assessed adverse events or surrogate efficacy outcomes (bone resorption and bone density), so there is no clear rationale for choosing one agent over the other.

In this study it was observed that calcium supplement was prescribed to pre & postmenopausal women’s with daily intake of 1250mg/125IU. Qalsan-D calcium supplement was prescribed at high rates with regard to other brands. A previous study showed that the treatment effect is greatest with calcium doses of greater than 1200 mg. Whereas vitamin-D supplement was prescribed once monthly or fortnightly alone or in combination with calcium. Indrp-D(cholecalciferol) was most common prescribed brand of vitamin D. A previous study showed that of the two forms of vitamin D, ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3), appears to be more strong in increasing the level of circulating vitamin D and is the preferred form of supplementation. The more effective is observed with doses of vitamin D of greater than 800 UI.

Pain management include nonsteroidal anti-inflammatory drugs (NSAIDs), topical pain relieving agents, nerve blocks, or nerve ablation (nerve removal). In this research, either one pain killer or two were prescribed twice daily. Paracetamol/orphenadrine citrate (Nuberol forte) 650/50mg & Diclofenac Na 50mg(Dicloran) were prescribed commonly. Whereas vitamin -D supplement was prescribed once monthly or fortnightly alone or in combination with calcium. Indrp-D(cholecalciferol) was most common prescribed brand of vitamin D. A previous study showed that of the two forms of vitamin D, ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3), appears to be more strong in increasing the level of circulating vitamin D and is the preferred form of supplementation. The more effective is observed with doses of vitamin D of greater than 800 UI.

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IV. DISCUSSION

An observational study of osteoporosis patients was conducted to study the current prescribing pattern for osteoporosis therapy, affordability and compliance rate to the therapy in Public and Private sector hospitals of Lahore. 204 patients were studied in Public Sector Hospitals and Private Sector Hospitals during the 2 months duration.

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Table 3: Pain killers prescribed

<table>
<thead>
<tr>
<th>Pain killer</th>
<th>F Public</th>
<th></th>
<th>F Private</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol/orphenadrine citrate</td>
<td>53</td>
<td>51.9%</td>
<td>41</td>
<td>40.19%</td>
</tr>
<tr>
<td>Diclofenac Na</td>
<td>29</td>
<td>28.4%</td>
<td>43</td>
<td>42.1%</td>
</tr>
<tr>
<td>Meloxicam</td>
<td>2</td>
<td>1.96%</td>
<td>1</td>
<td>0.98%</td>
</tr>
<tr>
<td>Celecoxib</td>
<td>15</td>
<td>14.7%</td>
<td>17</td>
<td>16.6%</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>3</td>
<td>2.94%</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 4: Average Cost of Prescribed Medicines per Day

<table>
<thead>
<tr>
<th>Cost Per Day</th>
<th>Public</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rs</td>
<td>47 Pkr</td>
<td>45 Pkr</td>
</tr>
</tbody>
</table>

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Our study revealed that 76.4% of patients in public and 89.2% in the private sector had experience side-effects with the therapy. Stomach upset and abdominal pain were the most common problems with the ratio of 43.2% and 38.2% in public sector while 38.7% and 25.2% in private sector. However, patients also reported constipation, dizziness, nausea and fatigue. In previous study it emerged that esophageal irritation occurred as a result of oral administration of bisphosphonates.

We found that all the patients were counseled about the medicines in both sectors while 79.4% patients in public sector and 94.1% in private sector were following the instructions. The study revealed that 96% patients were counseled about bisphosphonates in public sector whereas 100% were counseled in private sector. In our study, 83.3% patients were following the instructions of bisphosphonates in public sector while 98% were following in private sector, in previous study conducted in large populations, overall adherence for all osteoporosis therapies was low, ranging from approximately 40–70%.

The current study showed that 34.3% patients in public and 13.7% patients in private sector had discontinued their therapy. 21.2% patients restart their therapy after 1-3 weeks, 69.6% after 1-6 months and 9% after 1 year in public sector while 15.8% patients restart after 1-3 weeks, 63% after 1-3 months and 21%
after 1 year in private sector while in a previous study it was concluded that treatment with Alendronate is characterized by an important “tail effect”. Thus, after five years of optimal adherence, a treatment discontinuation might be planned in low-moderate risk patients, but the treatment holiday should rarely exceed 1–2 years with Alendronate. [12]

We concluded that 36.3% patients in public sector and 63.7% in private sector visited their doctor/pharmacist every 3-6 months.

Average cost of prescribed medicines per day of patient in public sector was found to be Rs.47 and Rs.45 in private sector while the direct cost of osteoporotic fractures is 5-10 billion annually in USA [15]. Discussion with the patients revealed that 84.2% & 72.4% patients in public & private hospitals respectively quit therapy because of affordability issue. While 15.7% & 27.5% restarted therapy when pain becomes intolerable. 44.1% patients in public and 71.5% in private sector said they can afford their therapy while 55.8% patients in public and 28.4% in private said they cannot afford their therapy.

Current study also drafted out some important points which states that expanding osteoporosis awareness to the rural areas will help to spread awareness of the disease, Government should be the flag bearer in developing programmes for osteoporosis that are similar to the existing Family Planning and the Extended Program of Immunization (EPI) programmes. Poor diagnosis leads to the complications of disease therefore, DEXA (gold standard for osteoporosis diagnosis) should be made available to all public and private hospitals. Pharmacists should be employed in orthopedic departments of very hospital to reduce the burden of osteoporosis by improving the identification of high risk patients.

V. CONCLUSION

Antiresorptive agents particularly bisphosphonates along with calcium and vitamin-D supplements are used to treat premenopausal & postmenopausal osteoporotic women in both the sectors. Socioeconomic status of patients visiting public hospitals showed that pharmacotherapy treatment is not affordable for them, which led to the discontinuation of therapy. Comparison of the compliance rate showed that private sector hospital patients were compliant to therapy but in public sector compliance is more related to the affordability and economic status. Effective treatment techniques have allowed many to beat the condition, at least in terms of being able to lead a normal life. Expanding osteoporosis awareness to the rural communities will help to spread awareness and an early diagnosis of the disease to the more remote areas of Pakistan.

ACKNOWLEDGMENT

It is my radiant sentiment to place on record my best regards, deepest sense of gratitude to the executive directors & orthopedic surgeons of all six hospitals that I covered during the entire research project, for their careful and precious guidance which was extremely valuable for my study.

REFERENCES


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Assessment of Fruit and Vegetable Dealers Awareness about Lead Contamination at Bahri Locality, Khartoum North

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Abstract: Fresh fruits and vegetables are rich in vitamins, minerals, mineral salts, proteins, carbohydrates, and fiber. All these nutrients are very essential for health maintenance and diseases prevention. Also, they play an important role in neutralizing acidic substances produced during digestion. These products will be used either fresh or for culinary purposes. Recently, fruits and vegetables free of heavy metals contamination have a great concern by the consumers worldwide. Long-term use of contaminated fruits and vegetables with lead will be a health threat for humans. Thus, the aim of this research is to assess fruit and vegetable dealer’s awareness about lead contamination at the areas of heavy traffic densities at Bahri locality in Khartoum North. Descriptive systematic method used for assessment. The study was based on the primary data collected from 150 fruit and vegetables sellers using structured questionnaire. The age group of 21-40 recorded the highest percent (58%). Results showed that most of the respondents (73.3%) received medium to low level of education and the illiteracy level among them was 24.7%. All interviewees displayed their products uncovered to the street on the shelves, tables ground, in wooden boxes, carton, and plastic boxes near heavy traffic areas. They did not have special place for fruits and vegetables storage at their places. More than third (37.3%) of the participants re-displayed the remaining fruits and vegetables in the next day. Generally, all fruit and vegetable vendors had a poor knowledge about hygienic practices and procedures that followed during displaying and selling of their products. The majority (98.7%) of them did not know anything about fruits and vegetables contamination with lead. However, there were no regulations to control fruits and vegetables displaying and selling. These products are exposed to the pollution at the areas of heavy traffic and are considered as a potentially health hazard for the consumers. Long consumption may lead to the accumulation of this element and then death. Therefore, food regulations should prohibit selling and displaying of foods in such areas. Health education lectures are recommended to increase fruit and vegetable sellers’ awareness.

Keywords: Bahri locality, Fruits and vegetables, Khartoum North, Lead, Heavy Metals.

Introduction

Fruits and vegetables are nutritious products that enhance human health and it can be used to improve soup quality particularly leafy vegetables (Sobukola et al., 2010). Heavy metals are dangerous contaminants resulted in a great risk of health due to their bioaccumulation in human body (Bhagure and Mirgane, 2010). Generally, heavy metals are not biodegradable substances, have long biological half-lives, and have a potential effect on human body due to their accumulation in different body organs, leading to serious health problems (Järup, 2003; Sathawara et al., 2004). Different plants parts absorb heavy metals from air in polluted environments as...
well as from contaminated soils through roots. Water used for irrigation may contaminate fruits and vegetables with heavy metals (Al Jassir et al., 2005).

Lead is wildly distributed in different habitats due to the increase of population activities, the application of new technologies, industrial and urban areas where it can be introduced into food items from different sources. These sources include petrol containing alkalyly which combusted and emitted into the atmosphere causing contamination in roadside, soil and air (Fernandes et al., 2000; Beavington et al., 2004). Moreover, manufacturing processes, incineration of refuse and combustion of coal considered as another sources of environments pollution. Age, sex, route of exposure, level of intake, solubility, metal oxidation state, retention percentage, duration of exposure, frequency of intake, absorption rate as well as the mechanisms and efficiency of excretion determine lead toxicity and its effect (Mertz, 1986). In addition, the inhalation of lead can permanently lower intelligence quotients (IQ), damage emotional stability, cause hyperactivity, poor school performance and hearing loss (Goyer, 1996).

Fruits and vegetables are safety for human consumption but the consumption of fruits and vegetables contaminated with lead for a long time will lead to the accumulation of these hazards in human bodies and it results in serious health problems. Accumulation of lead in edible plant products has been reported by many researchers. In Tika in Kenya, vegetables grown in urban areas revealed higher levels of lead, zinc and cadmium than that established by World Health Organization Standard (Inoti et al., 2012). Another study conducted by Elbagermi et al., (2012) who found that fruits and vegetables samples collected from different areas in Misurata in Libya contained measurable level of heavy metals within the permissible level set by WHO1999. Zied (2010) reported that lead can be found everywhere in the environment and the long exposure to lead is an important health concern worldwide. Also he revealed that lead can reach all food items through air, water, soil, during cultivation, processing and packaging.

In Sudan, few researches about vended foods e.g. fruits and vegetables contaminated with lead were conducted. Ehsan (2003) found that 76.19% of vended food investigated samples were contaminated with Lead (Pb). She claimed that 38.10% of the examined samples had higher level of lead than in other foods. Fruits and vegetables are very essential food items for health maintenance and diseases prevention for both children and adults. Sudanese food vendors and hawkers like other vendors in developing countries. Most of them display food products near heavy traffic areas (Plate 1, 2, 3). They have a poor knowledge, poor hygienic practices and lack of awareness about food contamination from different sources. Assessment of awareness data about food items contaminated with lead in Sudan is not available; therefore the aim of this research is to assess the awareness of vendors and hawkers about fruits and vegetables contamination with lead in area of heavy traffic.

Materials and Methods

Study area

This study was conducted at Bahri locality which located at the Northern part of Khartoum State at altitudes 8-15 and longitudes 24-25 and 31-16. It bordered with Nile State from the North, Blue Nile State from the South, Sharg El Neel locality from the East and the Nile River from the West. The estimated area is 455907Km² with total population of 9040749. The main activities of the residents at this area are the agriculture and industrial activities beside the other economical activities. It composed of 10 administrative units including Bahri El Kubra, Bahri Shreg, El Safia, Halfiat El Mulook, El Sambrab, Drdoug, Droasahb, El Kadro, El Selate and El Jili unit.
A descriptive systematic method was used to collect data. In January 2017, a total of 150 vegetables and fruit dealers at traffic density areas at Bahri locality were selected (Suque Sitta, Bus station, Almahatuh alwasti, Alkudru lafah janub, Super Markets and Alssuqe Almarkazi Shamabat) using a systematic descriptive technique. A structured questionnaire was used to collect information about the socio-demographic status of fruits and vegetables sellers, types of building and containers, displaying methods, hygienic washing and wiping practices, storage and transportation methods, sources of fruit and vegetables, chemical and organic treatments after receiving their products, knowledge about lead contamination and the diseases caused by this element, the effect of cars exhausted pipes, control of flies and insects, lectures or forums and training about lead contamination and its effect on human health, medical investigation and medical cards. Face to face dialog bases was used. The data was analyzed by descriptive statistics method using SPSS version 20.

Results

Demographic status of fruits and vegetables vendors presented in Table. 1. The age group of 21-40 recorded the highest percent (58%) while the group of less than ten years reported the lowest percent (2%). More than the third (34%) of the participants were primary graduate, 29.3% secondary graduate, 24.7 % illiterate, 10% university graduate and 2% others (Khalwa). The majority of the fruits dealers were male (91.3%). The types of building used for selling and displaying of fruits and vegetables were stalls 54%, movable cars 4.7%, barrow cars 5.3%, cars 4.7%, improved food centers 4% and sacs on the ground 27.3% (Fig.1). However, 42 % of the interviewees displayed their products uncovered on the shelves to the street, 2.7% in wooden boxes, 0.7 % in plastic boxes, 22% in carton containers, 25.3% on the ground and 6.7% on covered tables (Fig. 2). According to the abuse of cigarettes and snuff by vegetables dealers during selling and displaying of their products, results revealed that half (52%) of the respondents answered that they did not abused cigarettes and snuff, 32% of them abused cigarettes, 10% abused snuff and 6% of them did not abused any one of them. However, results recorded that 52% of fruit sellers answered that there were toilets near the displaying and selling area of their products while 48% answered no.
Regarding the hygienic washing and wiping practices, results showed that 58.7% of the fruits and vegetables vendors answered that there was no specific places for hands washing and all of them washed their hands before touching fruits and vegetables. Additionally, the majority (98%) of them answered that they washed their hands after using toilets. With regards to the washing methods of the fruits and vegetables, 47.3% of the participants washed fruits and vegetables once, 12.7% two times, 6.7% three times and 4% washed them more than three times. Fifty eight of the interviewees used water public network for washing their fruits and vegetables. Generally, more than third (37.3%) of the fruits and vegetables dealers wiped these products with clean cloths, 2% used clean cloth and oil for wiping, 1.3% used piece of cloth that used to clean serving tables, 0.1% used handkerchief and 16% used others ways as wiping with their hands and their clothes (Table 2). All fruits and vegetables vendors and hawkers did not have a uniform for selling their products.

Results reported in Fig 3 shows the types of containers that used for fruits and vegetables washing. The majority (90%) of the respondents used plastic containers for washing, 8% of them used metal containers and 2% used wooden containers.

As it can be observed from the results, 51.3% obtained their fruits and vegetables from local market, 38% Wholesales, 7% from farm and 3% from refrigerator (Table 3). Survey claimed that 3.3% of the participants used organic compounds to treat fruits and vegetables that purchased from farms, 2% of them used chemical substance and 2% answered that they did not know. However, most of the fruits and vegetables dealers (69.3%) answered that they did not store their products; while 30.7% answered that they stored them. The storage methods followed by sellers recorded that 6% of them stored their fruits and vegetables uncovered at the ordinary room, 6.7% in the refrigerator, 4% on the table, 2.7% in carton, 9.3% in packages and 2% in plastic sacks (Table 3).

### Table 1. Demographic status of fruits and vegetables dealers.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 10 year</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>11-20 years</td>
<td>22</td>
<td>14.7</td>
</tr>
<tr>
<td>21-40 year</td>
<td>87</td>
<td>58.0</td>
</tr>
<tr>
<td>more than 40</td>
<td>38</td>
<td>25.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>37</td>
<td>24.7</td>
</tr>
<tr>
<td>Primary</td>
<td>51</td>
<td>34.0</td>
</tr>
<tr>
<td>Secondary</td>
<td>44</td>
<td>29.3</td>
</tr>
<tr>
<td>University</td>
<td>15</td>
<td>10.0</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Sex

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>13</td>
<td>8.7</td>
</tr>
<tr>
<td>Male</td>
<td>137</td>
<td>91.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Fig. 1. Type of buildings used for displaying and selling of vegetables and fruits.
Fig. 2. Types of containers for displaying and selling of fruits and vegetables.
Table 2. Hygienic washing and wiping practices of hands, fruits and vegetables.

<table>
<thead>
<tr>
<th>Specific place for hand washing</th>
<th>Answers</th>
<th>Frequency</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>62</td>
<td>41.3</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>88</td>
<td>58.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Do you wash your hands after using toilet?

<table>
<thead>
<tr>
<th>Answers</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>147</td>
<td>98.0</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Do you wash your hand before dealing with vegetables and fruits?

<table>
<thead>
<tr>
<th>Answers</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

If the answer is yes, how do you wash your hands?

<table>
<thead>
<tr>
<th>Method of washing</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>only with water</td>
<td>147</td>
<td>98.0</td>
</tr>
<tr>
<td>with water and soap</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Do you wash fruits and vegetables before selling?

<table>
<thead>
<tr>
<th>Answers</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>106</td>
<td>70.7</td>
</tr>
<tr>
<td>No</td>
<td>44</td>
<td>29.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

How many times do you wash them?

<table>
<thead>
<tr>
<th>Times</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once</td>
<td>71</td>
<td>47.3</td>
</tr>
<tr>
<td>two times</td>
<td>19</td>
<td>12.7</td>
</tr>
<tr>
<td>Three times</td>
<td>10</td>
<td>6.7</td>
</tr>
<tr>
<td>more than three times</td>
<td>6</td>
<td>4.0</td>
</tr>
<tr>
<td>Missing</td>
<td>44</td>
<td>29.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Con. Table. 2. Hygienic washing and wiping practices of hands, fruits and vegetables.

<table>
<thead>
<tr>
<th>Sources of washing water</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water network</td>
<td>87</td>
<td>58.0</td>
</tr>
<tr>
<td>Water stored in barrels</td>
<td>34</td>
<td>22.7</td>
</tr>
<tr>
<td>Missing</td>
<td>29</td>
<td>19.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Do you wipe fruits and vegetables at your shop?

<table>
<thead>
<tr>
<th>Methods of wiping</th>
<th>Frequency</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>clean piece of clothes</td>
<td>56</td>
<td>37.3</td>
</tr>
<tr>
<td>clean clothes+ oil</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>clean clothes that used to clean the serving tables</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Handkerchief</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Others</td>
<td>24</td>
<td>16.0</td>
</tr>
<tr>
<td>Missing</td>
<td>64</td>
<td>42.7</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Fig. 3. Types of containers used for fruits and vegetables washing.
Table. 3. Sources, treatment with chemical compounds, storage and transportation of fruits and vegetables.

<table>
<thead>
<tr>
<th>Fruits and vegetables sources</th>
<th>Source</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farm</td>
<td>11</td>
<td>7.3</td>
</tr>
<tr>
<td></td>
<td>Wholesales</td>
<td>57</td>
<td>38.0</td>
</tr>
<tr>
<td></td>
<td>local markets</td>
<td>77</td>
<td>51.3</td>
</tr>
<tr>
<td></td>
<td>Refrigerator</td>
<td>5</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

If the answer is from the farm, do they treat their products with chemicals or organic materials?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>Organic materials</td>
<td>5</td>
<td>3.3</td>
</tr>
<tr>
<td>I do not know</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>6.7</td>
</tr>
</tbody>
</table>

If the answer is wholesales trader are fruits and vegetables stored or directly transported from the farm?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stored</td>
<td>29</td>
<td>19.3</td>
</tr>
<tr>
<td>Directly transported from farm</td>
<td>30</td>
<td>20.0</td>
</tr>
<tr>
<td>Missing</td>
<td>91</td>
<td>60.7</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>
### Con. Table. 3. Sources, treatment with chemical compounds, storage and transportation of fruits and vegetables.

<table>
<thead>
<tr>
<th>Do you store vegetable</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>46</td>
<td></td>
<td>30.7</td>
</tr>
<tr>
<td>No</td>
<td>104</td>
<td></td>
<td>69.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How vegetables are stored in your place</th>
<th>Storage</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary room</td>
<td>9</td>
<td></td>
<td>6.0</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>10</td>
<td></td>
<td>6.7</td>
</tr>
<tr>
<td>On tables</td>
<td>6</td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td>In cartons</td>
<td>4</td>
<td></td>
<td>2.7</td>
</tr>
<tr>
<td>Packages</td>
<td>14</td>
<td></td>
<td>9.3</td>
</tr>
<tr>
<td>In plastic sacks</td>
<td>3</td>
<td></td>
<td>2.0</td>
</tr>
<tr>
<td>Missing</td>
<td>104</td>
<td></td>
<td>69.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How the vegetables are transported from the source</th>
<th>Transported</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncovered cars</td>
<td>110</td>
<td></td>
<td>73.3</td>
</tr>
<tr>
<td>Covered car</td>
<td>30</td>
<td></td>
<td>20.0</td>
</tr>
<tr>
<td>Freezing refrigerators</td>
<td>3</td>
<td></td>
<td>2.0</td>
</tr>
<tr>
<td>Rickshaw</td>
<td>7</td>
<td></td>
<td>4.7</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>
With respect to the selling and rejection of fruits and vegetables, results recorded that 66.7% of fruits and vegetables dealers answered yes that they consumed and sold the whole quantity of fruits and vegetables, 33.3% of them answered they did not consume the whole quantity of the fruits and vegetables. Generally, 29.3% of them answered that they stored the remaining fruits and vegetables, while 5.3% of the rejected their products (Table 4). Regarding the displaying of their products next day, results declared that 37.3% of the participants stored the remaining products and displayed them next day, while 5.3% of them answered that they did not display the remaining one. Additionally, 26% of the participants answered that they separated the fresh fruits and vegetables from the old ones, while 20% of them did not. More than half (58%) of the respondents get rid of the remained fruits and vegetables by organized way, 18% they rejected them by the random way on the street and 7.3% of them used the remaining one for the personal consumption.

Results reported in Table.5 reveals the awareness about lead and pesticides contamination. The majority of the the participants (98.7%) answered that they did not know anything about the pollution of fruits and vegetables with lead substance. However, all fruits and vegetables venders didn’t know any information about the diseases that caused by lead and they did not know that cars exhausted pipes will contaminate fruits and vegetables with lead. The majority (94.7%) of them answered that there was no smell of remaining pesticides in fruits and vegetables, while 5.3% of them smell the remaining pesticides.

The majority (96.7%) of fruits and vegetables venders did not spray their places with pesticides while 3.3% of them use pesticides for pest control. Information about legislations that set for hygienic selling and displaying were presented in Table 6. All fruits and vegetables dealers answered that there was no regulations and lows set to control selling and displaying. Most of them (77.3%) answered that there was a place for garbage collection and half of them suffered from flies and insects presents. Additionally, 65.3% of the interviewees had a health card and 34.7% had not. Generally, results revealed that 60.7% of the participants renewed their cards every six months, 58.7% of them answered that they did the medical investigation, and 14.7% they did not (Table6). However all fruits and vegetables sellers answered that there was no training about fruits and vegetables hygiene, safety, awareness about heavy metals contamination and no any sector responsible for this training.

**Discussion**

Results showed that the aged group of 21-40 years recorded the highest percentage (58%) among fruits and vegetables sellers, while the group of less than ten years reported the lowest percent (2%) which was higher than that obtained by Elhaj et al., (2012) who found that the majority of food vendors of age group 21-30 comprises 40% in Gizan, Saudi Arabia. It is a fact that both knowledge and experience increases with the age. Generally, results revealed that most of the participants (65.3%) had a low to medium education level, while the illiterate level was 24.7% among them. Similar result obtained by Federal Ministry of Health (2011) who recorded that the most of the participants (80%) of the Sudanese communities attained low to medium level of education. These findings may be referred to the socio-economical conditions of the fruits and vegetables handlers. High percent of illiteracy among the respondents reflected the poor knowledge and awareness about the prober hygienic practices, lead
Table 4. Selling and hygienic rejection of fruits and vegetables.

<table>
<thead>
<tr>
<th>Do you consume or sell all the available quantity of vegetables and fruits at your place?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>100</td>
<td>66.7</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>50</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you store the remaining fruits and vegetables or do you reject it?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stored the item</td>
<td>44</td>
<td>29.3</td>
<td></td>
</tr>
<tr>
<td>get rid of the item</td>
<td>8</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>98</td>
<td>65.3</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

If they are stored, how they are stored?

<table>
<thead>
<tr>
<th>Storage</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ordinary room</td>
<td>18</td>
<td>12.0</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>10</td>
<td>6.7</td>
</tr>
<tr>
<td>Others</td>
<td>19</td>
<td>12.7</td>
</tr>
<tr>
<td>Missing</td>
<td>103</td>
<td>68.7</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Are the stored vegetables will be displayed for the next day?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>56</td>
<td>37.3</td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>5.3</td>
</tr>
<tr>
<td>Missing</td>
<td>86</td>
<td>57.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Do you separate the fresh vegetables from old ones?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>39</td>
<td>26.0</td>
</tr>
<tr>
<td>No</td>
<td>30</td>
<td>20.0</td>
</tr>
<tr>
<td>Missing</td>
<td>81</td>
<td>54.0</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>

How do you get rid of the useless fruits and vegetables?

<table>
<thead>
<tr>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>In a well-organized way</td>
<td>87</td>
<td>58.0</td>
</tr>
<tr>
<td>In random way</td>
<td>27</td>
<td>18.0</td>
</tr>
<tr>
<td>Personal consumption</td>
<td>11</td>
<td>7.3</td>
</tr>
<tr>
<td>Others</td>
<td>17</td>
<td>11.3</td>
</tr>
<tr>
<td>Missing</td>
<td>8</td>
<td>5.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 5. Awareness of fruits and vegetables dealers about lead and pesticides pollution.

<table>
<thead>
<tr>
<th>Do you know anything about fruits and vegetables pollution with lead substance</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>2</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>148</td>
<td>98.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you know that lead causes diseases?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If your answer is yes mention these diseases?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you think that cars exhaust pipes contaminate fruits and vegetables with lead/</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you observe any smell of remaining pesticides in fruits and vegetables?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>8</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>142</td>
<td>94.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you spray your place by pesticides?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>5</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>145</td>
<td>96.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Legislations and laws set for hygienic selling of fruits and vegetables.

<table>
<thead>
<tr>
<th>Are there any regulations and laws to control fruits and vegetables selling?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Are there any places for garbage collection?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>116</td>
<td>77.3</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>34</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you have a health card?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>98</td>
<td>65.3</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>52</td>
<td>34.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If the answer is yes do you renew it every six months?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes every six months</td>
<td>91</td>
<td>60.7</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>20</td>
<td>13.3</td>
<td></td>
</tr>
<tr>
<td>Every year</td>
<td>39</td>
<td>26.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is there a periodic medical check?</th>
<th>Answer</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>88</td>
<td>58.7</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>22</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>40</td>
<td>26.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
contamination and their effect on human health. Moreover, 42% of the respondents displayed their products on the shelves to the street in wooden boxes, in plastic boxes, in carton, on the ground and on covered tables. The way of displaying these products may enhance the absorption of Pb from polluted air on the side road of heavy traffic. High percentage (32%) of the respondents abusing cigarettes also may contaminate the air inside the shops and lead to the products contamination. Levels of lead in indoor air are affected by the presence of cigarette smoke (Reilly, 1980). The presence of toilet near the fruits and vegetables retail outlets considered as source of contamination with microorganisms, flies and insects.

However, more than half (58%) of the fruits and vegetables vendors had not specific place for hands washing, while 2% did not wash their hands after using the toilet. Unwashed hands and improper hands washing practice may increase the probability of fruits and vegetables contamination. Most of the containers used in fruits and vegetables washing were made of plastic materials and some of them use metal containers. Metal containers may affect fruits and vegetables quality. After the receiving of fruits and vegetables from farm 5.3% of the participants treated their products with organic and chemical substances. These treatments may introduced different elements (as Pb) into fruits and vegetables and then increase the level of these elements. These products could also be contaminated by various substances including traces of metals as farmers wash them with unhygienic water before bringing them into the market (Divrikli et al., 2006).

The result showed that third of the participants stored their fruits and vegetables and redisplay and re-sell them on the next day. This unhygienic practice may lead to the prolonging subjection of these products to the polluted air which leads to the accumulation of lead inside the products. Vegetables and fruits absorb lead from the soil (Mapanda et al., 2005) contaminated irrigation water (Demirezen, and Ahmet, 2006) and polluted air. Khairiah et al., (2004) reported that the most important source of contamination is the atmospheric pollution from industrial or motor vehicle emission, where it represents 73 to 95% of the total lead in plants (Delenberg and Van Dried, 1994). Generally, 70%.3 of fruit and vegetable vendors transport their products by open car and this lead to the exposure of fruits and vegetables to the dust, house fly, vehicles exhaustion and increase the level of lead in these products. On the other hand, vegetables and fruits grown near highways or downwind of industrial plants may contain lead (Abou-Arab et al., 2011). It was also observed that these foods are sold and displayed adjacent to the exhaust emission in areas of heavy traffic which lead to more deposition and absorption of Pb. There is relationship between the displaying distance and the degree of lead contamination. As the food products displayed close to the heavy traffic areas more lead will be absorbed by these products and vis versa (Hassan and Gewifed (1998). Abou-Arab et al., (2015) found that the highest levels of lead was detected in samples collected from industrial areas and the lowest level was found in samples collected from rural areas.

The majority of fruit and vegetable dealers did not know any things about the fruits and vegetables pollution by lead and all of them did not know that lead causes disease. Moreover, they did not know that car exhaustion pipes
contaminated fruit and vegetable with lead. Similar results reported by Shafie et al., (2016) who found that the level of awareness regarding the presence of toxic metals in daily-consumed rice was low in 78.2% and moderate in 21.8% of the participants in Iran. The lack of awareness among fruits and vegetables sellers in this research may be attributed to both medium level of education and the high level of illiteracy among them. is alarming signs for health authorities to set and conduct programs on the risk factors that affect vegetables and fruits safety. Additionally, half of them suffered from flies and other insects. The presence and the increase number of flies and insects at the area of selling may lead to the increase of pesticides use, thus it increases the contamination with lead and other chemicals. Lead is poisonous compounds can enter human body via inhalation or swallowing and it affect the internal organs. This element is harmful for all humans particularly children and fetuses because it interferes with the development of the nervous system. It is dangerous for human health even at low levels in the blood. Low levels of lead may cause nervous system and kidney damage, learning disabilities, attention deficit disorder, and decreased intelligence, while high levels have devastating effects on children, including seizures, unconsciousness and in some times lead to death (USEPA, 1985). The accumulation of lead have damaging effects on the hematopoetical, hematic, renal and gastrointestinal systems (Correia et al., 2000). In addition, lead has been associated with various forms of cancer, nephrotoxicity, central nervous system effects and cardiovascular diseases in human (Ryan et al., 2000).

Result reported that all fruits and vegetable vendors had no regulations to control fruits and vegetables displaying and selling. The lack of the regulations and lows may increase the physical, microbiological and chemical contamination. However, 22.7% had not specific place for garbage collection and this may lead to the soil and environment contamination, production of bad odor, insects, rodents, and microorganisms multiplication. With regards to the health cards, results showed that more than third (34%) of the interviewees have no health card and this can transmit different diseases from vendors to vegetables and fruits and lastly to the consumers.

References


N. G. Sathawara, D. J. Parikh, and Y. K. Agarwal, “Essential heavy metals in environmental samples from Western India,” Bulletin of Environmental Contamination and Toxicology, vol. 73, no. 4, pp. 756–761, 2004. View at Publisher · View at Google Scholar · View at Scopus.


Plate 1. Displaying and selling of vegetables in a car. Plate 2. Displaying and selling near heavy traffic areas.

Plate 3. Displaying and selling in the market near bus station.
**Good Governance, Organizational Culture, and Performance of Higher Education in Indonesia: A Conceptual Framework**

Melvie Paramitha, Dian Agustia, Noorlailie Soewarno

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**Abstract** - The quality of human resources is determined by the learning process in educational institutions, especially higher education. In Indonesia, the process of managing education in higher education is regulated in Act no. 12/2012. The quality of higher education can be determined by aspects of governance and organizational culture that exists in organization. With good governance and good culture, it can support the performance of educational institutions. This is a literature review research to describe conceptual framework between good governance to organizational culture and organizational culture to organizational performance especially in higher education in Indonesia. This conceptual framework has not been widely discussed by researchers. The researcher hopes that the results of this study can serve as a guide for further research to prove empirically the conceptual framework.

**Index Terms** - good governance, organizational culture, performance, higher education

I. **INTRODUCTION**

Education is a cornerstone for development that is useful in any country (Akomolafe and Ibibola, 2014). With a well-educated society, it is expected to make a good contribution and useful for the development of the country. Society is expected to achieve the highest level of education. Because education is a fundamental base in a country, Indonesia issued Act no. 20/2003 about the National Education System that guides the direction for the implementation of education in Indonesia.

The highest level of education in Indonesia is taken at the university’s level. To ensure the implementation of the education process in universities can work well, the government of Indonesia issued its own regulation on the management of education in higher education. Ainun Naim (Secretary General of the Ministry of Technology and Higher Education of Indonesia) assesses that universities are a place for intellectuals and wisdom people. Therefore, it is good to be able to comply with the existing rules (www.republika.co.id). This is considering that universities have their own autonomy in the implementation of education.

In 2012, Minister of Education and Culture Muhammad Nuh launched the start of good university governance. As the highest educational institution in Indonesia, universities have become role models in implementing good university governance. Muhammad Nuh hopes that with this declaration, the management of higher education will be better, transparent and accountable and can be an example for the management of companies in general, and other educational institutions in particular (www.kampus.okezone.com). In the same year, the government established Act no. 12 of 2012 about Higher Education that regulate the management and organization of education conducted by universities.

Saint (2009) states that university management in Indonesia has high autonomy. In addition, Act no. 12/2012 article 62 states that higher education has the autonomy to manage its own institution as the center of the implementation of *tridharma*. *Tridharma* consists of teach, research, and community service. Autonomy of university as referred to in article 62 covers academic and non-academic fields.

By applying the principles of good governance and in accordance with existing regulations, it is expected to have an impact on organizational culture on the management of universities. Director of the Directorate of Institutional and Cooperation of Directorate General of Higher Education, Hermawan Kresno Dipojono, said to build a good academic culture in a university requires a not instant process. One of the conditions required to achieve this is good governance of universities (www.dikti.go.id).

In managing universities, the academic civitas within the university should uphold the good governance that has been proclaimed by the government. With good governance and good culture in universities, expected to support the achievement of optimal performance for universities. Achievement of these performance can be seen in terms of financial and non-financial. For universities that are non-profit organizations, non-financial performance is a major concern. The performance can be observed in terms of *tridharma* college.

Several studies have been conducted aim to see the relationship between culture and good governance in the organization. The view of the research is that organizational culture will have an impact on organizational governance. Different cultures will shape different governance.

In this study, I have different views. The view is that the governance formed by the leadership of the organization, it can create an organizational culture as desired from the leaders of the organization. Good governance will create a good organizational culture as well. Improper governance will also create the organizational culture that is less good as well. Research on the relationship between good governance and culture is still rare. Researchers who have conducted research on these relationships are Sopper (2014) and Popadak (2016).
This research is a literature review study related to good governance, organizational culture, and organizational performance. The purpose of this study is to describe the relationship between good governance to organizational culture and organizational culture to organizational performance. This research seeks to present a conceptual framework on the relationship between good governance, organizational culture, and organizational performance.

II. LITERATURE REVIEW

Agency Theory

Agency theory is a contract between a person or more (called principal) who appoints another person (called agent) to perform services in accordance with the principal's interests, including the delegation of some decision-making authority to the agent. Agency theory basically governs the relationship between a group that gives work (principals) with the assignee (agent) to carry out the work.

According to Jensen and Meckling (1976), agency theory states that agency relationships arise when one or more people (principals) employ another person (agent) to provide a service and then delegate authority in making decisions to the agent. In the company, managers as organizers of the company certainly know more internal information and prospects of the company in the future better than to owners or shareholders. So managers have the obligation to provide information about the condition of the company to the owner. But in this case the information submitted by the manager sometimes does not match the actual company condition. The information asymmetry between management (agent) and the owner (principal) can provide an opportunity for managers to make earnings management (Richardson, 1998).

Agency theory can be applied to a universities. Principal position and the existing agent at the universities are different from the company. For state universities, it can be assumed that the employer (principal) is the government, and for private universities, the employer is the foundation. For the position of the assignee (agent) can be assumed are the structural leaders and academicians of a college. Some research on good governance in universities based on agency theory has been done by researchers such as Puspitarini (2012), Sari (2012), Wilkesmann and Schmid (2012), and Siswanto et al (2013).

Puspitarini (2012) describes the role of the internal control unit in supporting the achievement of good university governance. The research indicates that a unit or part of internal control at university plays an important role in supporting university governance. Sari (2012) conducted a study showing that an internal auditor has a significant role in efforts to achieve the university governance of an educational institution.

Study of Wilkesmann and Schmid (2012) aims to present findings from a national survey that the impact of new governance structures in German universities on academic teaching performance for professors. The results show that there is no direct effect of the provision of new incentives with the academic teaching performance of the professor. Siswanto et al (2013) conducted a study that found the problem is quite important in universities that high dependence on income sources from students become a significant issue on the implementation of independent principles.

III. STAKEHOLDER THEORY

Stakeholder theory can be defined as several groups or individuals that can impact or receive impacts from the process of achieving organizational goals (Abdullah and Valentine, 2009). According to Freeman (1994), the focus of stakeholder theory is defined in two questions. First, stakeholder theory asks, what is the purpose of the company? This encourages managers to articulate a sense of togetherness of the value that managers make, and what brings stakeholders being together. This encourages companies to look at the future and makes it possible to produce optimal performance.

Second, stakeholder theory asks, what responsibilities should management provide to the stakeholders? This encourages managers to articulate how they want to manage organizations to create the business managers want, especially how they want and need relationships with their stakeholders in order to meet the goals of the stakeholders. Donaldson and Preston (1995) argue that this theory focuses on the managerial decision-making process of the interests of all stakeholders who have intrinsic value and none of their dominant interests.

Universities are public and nonprofit organizations. Many stakeholders around of universities have different interests in the process of managing higher education. The stakeholders include students, students' parents, employees, government, graduate users, company, and alumni. Universities should still consider the interests of stakeholders in implementing the management of education. Universities will strive to satisfy what the stakeholders desire and in accordance with existing regulations. Some research on university governance using the basic stakeholder theory has been done by the researchers Brown (2001), Melo et al (2008), Akomolafe and Ibijola (2014), Nurhayati (2014), Dela Cruz and Jimenez (2015), and Maganga and Vutete (2015).

Brown's (2001) study shows that results are consistent with the idea that faculty participation is important in decisions making because faculty members have better information and better incentives than administrators. Melo et al (2008) conducted a study showing that university governance structures are used as a basis for performance appraisal and system improvement and reflect the structure applied within the university.

Study of Akomolafe and Ibijola (2014) aims to examine the perceptions of staff and students regarding student participation in university governance and organizational effectiveness. The results show that there is no difference in staff and student perceptions regarding the level of student participation in university governance.

Dela Cruz and Jimenez’s (2015) study show that political governance and financial governance, the participation of faculty, that can influence the governance of state universities in the Philippines. Maganga and Vutete (2015) conducted a study that show generally universities follow and meet the established standards and legislation set by stakeholders.

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IV. GOOD CORPORATE GOVERNANCE (GCG) IN INDONESIA

Forming of principles in GCG was first undertaken by National Committee on Governance Policy in 2001 which was later renewed in 2006. Based on GCG principles, the government strives to develop principles of education management and implementation. The government issued Government Regulations no. 66/2010 and Act no. 12/2012. The differences and similarities of GCG principles and principles of education are as follows:

Table 1. GCG Principles and Educational Implementation

<table>
<thead>
<tr>
<th>GCG Principles</th>
<th>Government Regulations no. 66/2010</th>
<th>Act no. 12/2012</th>
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<tbody>
<tr>
<td>Transparency</td>
<td>Nonprofit</td>
<td>Accountability</td>
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<tr>
<td>Responsibility</td>
<td>Accountability</td>
<td>Transparency</td>
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<tr>
<td>Accountability</td>
<td>Quality Assurance</td>
<td>Nonprofit</td>
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<tr>
<td>Independence</td>
<td>Transparency</td>
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<td>Equality and fairness</td>
<td>Fair access</td>
<td>Effectiveness and efficiency</td>
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There is a major difference between GCG principles and the organize of education which is the nonprofit principle. In GCG principle there is no nonprofit principle as found in the principle of education implementation. Management of higher education has no main purpose to seek profit. The results of the fund management process for education are used for the development of human resources, facilities, and infrastructure of higher education. While in the company, the main purpose of the company's operations is to seek profit.

Another difference between the principles of GCG and the principle of the implementation of education is the principle of quality assurance. In the principle of GCG there is no quality assurance principle as found in the principle of education implementation. Educational institutions, especially universities, are institutions that create and produce graduates who are expected to have good competence and quality. To produce graduates who have good quality, it takes the learning process, curriculum, lecturers, facilities and infrastructure quality and standards that have been determined. Thus, in the education process there should be a quality assurance that the graduates produced will be in accordance with the standards and have a good quality.

V. GOOD GOVERNANCE OF HIGHER EDUCATION IN INDONESIA

According to Merchant and Stede (2012, p.603), an organization's governance refers to a set of mechanisms and processes that help ensure that organizations are directed and managed to create value for their owners and simultaneously fulfill responsibilities to other shareholders (e.g., employees, suppliers, and society). Organizational governance systems are complex and how various governance mechanisms interact with each other, and with the characteristics of situations when they operate to deliver good (or bad) results, are not always well understood.

Good governance also applies to higher education. Good university governance reflects the success of universities that produce qualified graduates who are ready to compete in the global world. For that, it takes hard work and high discipline in educating, and teach the cultural values and association of global society.

In article 19 of Act no. 20/2003 states that higher education is organized with an open system. Open system has definition that the work program and the implementation of higher education can be known by the stakeholders, especially students so that work programs and systems in the university there is nothing to hide. The open also applies to the financial usage obtained by the college. In article 24 states that universities have autonomy to manage and organize educational activities that include teach, scientific research, and community service. With the authority of autonomy, the universities are free to organize the activities and finances that exist within the organization, so that necessary supervision and control that supports the creation of good university governance.

Based on table 1, there is a principle difference in PP no. 66/2010 with Act no. 12/2012. In the Government Regulations no. 66/2010, there is a principle of fair access which has the understanding of providing formal education services to prospective students and students. In Act no. 12/2012, that principle is replaced with the efficiency and effectiveness principles. Understanding efficiency and effectiveness is that the use of resources obtained by the college should be right on target and does not occur waste. Universities can find their own sources of funding, self-reliance, autonomy, which comes from outside the admission of student. These funds can be obtained from the government (e.g., research grants and non-research), donors, foundations, collaboration with institutions or companies within the country and abroad. Funds obtained should be used in accordance with the objectives of the implementation of education, development of targeted resources. Also not used arbitrarily resulting in waste or for personal or group interests.

Act no. 12/2012 about Higher Education can be used as a guide to state that a university has fulfilled good governance. Article to be used as a reference that is article 63 which states the principles in the management of universities autonomously. The principles are as follows:

1. Accountability Principle

Understanding accountability is the commitment of universities to report for all activities undertaken in the process of organizing education to stakeholders. To support the accountability of universities, it is necessary to clarify the mission and objectives of universities in line with the mandate of the government. The process of management and organization of higher education should also be supported by the permission of university establishment and the implementation of the study programme.

Universities have stakeholders who have their own interests. Students want a quality education, employees want
Universities in Indonesia have great autonomy in the activities and work programs of the rector and dean. Structure, Academic Senate universities and faculty can control conflict of interest and multiple positions. Organizational necessary to apply checks and balances mechanism and to avoid 2. Transparency Principle

Understanding transparency is openness of relevant information about the activities and processes of the implementation of education in a timely and accurate to stakeholders. To support the transparency of universities, it is necessary to apply checks and balances mechanism and to avoid conflict of interest and multiple positions. Organizational structure, Academic Senate universities and faculty can control the activities and work programs of the rector and dean.

Universities in Indonesia have great autonomy in organizing the educational process (Saint, 2009). According to Gillies (2011), the autonomy of a college may include recruitment and promotion of employees at all levels and sections, approving the opening of new study programs or institutes / departments, conducting and selecting research activities, and determining direction, vision, mission and policy College. With high autonomy in the university, the activities and the implementation process is determined and decided by the leaders of the universities concerned. Whatever activities and work programs undertaken by universities / colleges, should be communicated openly so that transparency principles in universities can be achieved.

3. Nonprofit Principle

Non-profit is the implementation of education is not intended to seek profits so that funds obtained are used to improve service quality and development of infrastructure facilities so as to support the establishment of qualified graduates. Another understanding is that all remaining budget activities should not be distributed, should be reinvested for quality improvement and higher education development.

Universities are institutions engaged in services in order to form an educated graduate. Both state and private universities each have autonomy to manage their finances. State universities is responsible to the government, while the private universities is responsible to the foundation. Hope is that both universities do not justify any means to seek funds and profits only solely motivation from certain parties for their interests. Management of funds obtained by universities should still pay attention to the interests of various stakeholders that exist around the college.

4. Quality Assurance Principle

Understanding quality assurance is the activities, work programs and services of universities implemented by meeting / exceeding national standards and continuously strive to improve the quality of education services. To support the quality assurance of universities, then established Internal Quality Assurance System and external in the form of accreditation of study program and accreditation institution. Other supporting activities include lecturer profession certification, student feedback, graduate study tracer, and user survey.

Universities are institutions in the field of services that produce qualified and educated graduates. That's what all parties expect. The process of management and implementation of education is guided by the predetermined standard of education so that the graduates produced have the standard quality according to the expectations of the stakeholders. The end result of the process of education is graduated quality and in accordance with the standards. For that, it takes the cooperation of all parties within the university. Not just the task of educators, but all parties in service delivery also play a role in quality assurance.

5. Effectiveness and Efficiency Principle

Understanding the effectiveness and efficiency is the activities and work programs of universities that use various resources strive to be on target and does not occur waste. In the organization of education, universities need resources and funds to be able to provide optimal service. Funds obtained can come from the admissions of students, government, foundations, institutions / companies, and donors. Universities have the autonomy and independence to obtain these funds. Funds obtained should be used as well as possible to support quality education process.

Research on university governance has often been done. In America, research on university governance has been done since the 1970's (Sceifor and Wheeler, 1970; Deegan and Mortimer, 1970). Research in Indonesia related to the variable of university governance principle has been done by several researchers. Hatmodjosoewito (2010) conducts research on the relationship of transparency with employee performance in universities. Harjono Muljo et al (2014) conducted a study using eight principles of good governance that are not guided by the law. Muhi (2012) and Soegiono and Sebastian (2012) conducted a study using the five principles of good corporate governance applied and elaborated on the universities. Nurhayati (2014) conducted a study using the autonomy and accountability variables associated with the managerial performance of universities. Research on good governance of universities in Indonesia no one uses the five principles based on Act no. 12/2012 as a measure of good governance. This encourages me to use good governance measurements according to these five principles in subsequent research.

VI. HIGHER EDUCATION PERFORMANCE

Public organizations are organizations established with the aim of providing services to the public. This causes the public organization to be measured by its effectiveness and efficiency in providing services to the public. Although public organizations are not for profit, the organization is made up of interrelated units that share the same mission of serving the community.

Performance measurement is defined by Neely (2005) as the process of quantifying the efficiency and effectiveness of action. Performance measurement requires alignment with the organization's mission, policies, and objectives (Kaplan and Norton, 2004). Universities help to improve the nation's knowledge base and play an important role in shaping the
nation's future. Universities need strategic planning. Strategic planning describes the direction from the present position to the desired position in the future that is translated into its vision. Colleges are now facing a competitive market. It has implications for the utilization of its resources in order to attract market interest.

Performance measurement is defined by Otley (1999) as a financial or non-financial measure used at various levels within an organization to evaluate success in achieving their goals, key success factors, strategy and planning. The purpose of performance measurement is to meet the expectations of stakeholders through measurable quantitative results. In general, the measurement of organizational performance is measured using financial indicators. To complement the measurement of financial performance, non-financial measurements have been developed to assess the non-quantitative aspects of the organization's activities.

Research on the performance of universities has been conducted by several researchers. Study of Philippe et al (2010) shows the result that when state universities receive substantial funds, they generate more patents if they are more autonomous and gain competition from private universities. Brown's research (2001) uses a university performance variable proxied into the university ranking variables and funds held by the faculty.

Melo et al (2008) states that although students lack the power in decision making, but students are customers in the system of higher education. They pay a fortune to get results commensurate with costs incurred. Students are often invited to university meetings and seek advice from them. Festo and Nkote (2013) conducted a study showing the result that organizational governance variables negatively impacted financial performance when policy and decision making were significant predictors of financial performance. Dela Cruz and Jimenez (2015) use the dependent variable that is performance measured using quality and relevance, research capability and output, services to the community, and management of resources.

VII. ORGANIZATIONAL CULTURE

Hofstede (2011) puts the definition of culture as a collective programming that distinguishes members from one another in groups or categories / characteristics of one person to another. Culture is the result of complex and partially influenced group learning processes by the behavior of leaders (Schein, 2004, p.11). Culture is always associated with collective phenomena. In each group there are various individuals who have various characteristics or categories.

Organizational culture is a shared system and meaning shared by its members that distinguishes organizations from other organizations (Robbins and Judge, 2013: 512). Greenberg and Baron (2008: 544) state that organizational culture is a cognitive framework consisting of attitudes, values, norms of behavior and expectations shared by members of the organization. Hofstede (2011) states that organizational culture is an individual way of looking at what's happening within their organization. Organizational culture is in a work environment or practice within the organization.

Organizational culture within a company is certainly different from the organizational culture owned by other companies. This is because in the culture of the organization reflects the personality or characteristics that distinguish the organization with other organizations. These characteristics can be in the form of visible things such as organizational rules or can also be things that are not visible as the mindset of the organization. These characteristics directly describe the organizational culture.

The culture that the leader creates is vital. Organizational culture is used not to win awards or make employees satisfied, but to drive the results of business and achieve maximum performance (Williamson, 2012). Research and observers have recognized that organizational culture has a strong impact on the organization's long-term performance and effectiveness (Cameron and Quinn, 2006, p.5). Organizational culture has become an area for researchers and organizers of organizational concepts to be able to provide guidance and direction for managers who seek ways to improve the effectiveness of their organizations.

Based on some argument of organizational culture according to some experts above, it can be concluded that organizational culture is anything that contains values, symbols, rituals, attitudes, and some practices within organizations that are shared by members of the organization as a guide to action which then affects the way work and behave from members of the organization. Organizational culture shows a certain identity how the organization works according to the value held so that organizational culture can distinguish one organization with other organizations.

Research on culture has been done by many experts. One instrument used as a cultural dimension is the cultural dimension proposed by Hofstede (Hofstede, 1980, 1983, 1984). The cultural dimension conveyed by Hofstede is a national culture. At first, Hofstede conveys four dimensions of national culture. Then in 1988, Hofstede conducted a study with Michael Harris Bond a psychologist and added a dimension of national culture. Then in 2010, Hofstede conducted research with his son and Michael Minkov and added a dimension of national culture. Thus, there are six dimensions of national culture proposed by Hofstede. The six national cultures are (Hofstede, 2011):

1. Power distance, related to the distance from human inequality
2. Uncertainty avoidance, related to the level of stress in society in the face of the unknown future
3. Individualism versus collectivism, associated with the integration of individuals into groups
4. Masculinity versus femininity, related to the emotional role between women and men
5. Long term versus short term orientation, relating to the choice of focus on human endeavor: the future or the present or the past
6. Indulgence versus restraint, relating to satisfaction versus controlling the basic human desires in enjoying life.

These six dimensions of national culture are often used by researchers to view organizational culture. Meanwhile, in 1990, Hofstede undertook research to expose the organizational culture dimension.

Study of Hofstede et al (1990) aims to identifying organizational culture dimensions using 20 units of work from 10
different organizations in Danish and Dutch countries. Six organizational cultures according to Hofstede (1990, 2011) are:

1. Process-oriented versus results-oriented
   Process-oriented is dominated by technical and routine, while results-oriented are related to outcomes. In process-oriented, there are different perceptions between the levels of the units. In results-oriented, each individual accepts the organization’s existing practice on existing perceptions.

2. Job-oriented versus employee-oriented
   Job-oriented deals with responsibility for job performance and employee duties only, whereas employee-oriented deals with responsibility for welfare and all aspects related to employees, not just on the job alone.

3. Professional versus parochial
   Professionals deal with that employees are identified in accordance with what their profession dictates, whereas parochials are related to that employees have the identity of the organization they work for.

4. Open systems versus closed systems
   This dimension relates to the internal and external communication styles that are open or closed.

5. Tight versus loose control
   This dimension relates to the degree of formality and timeliness in the organization.

6. Pragmatic versus normative
   This dimension describes the prevailing way in the environment around the organization, especially with customers. Pragmatic has a more flexible sense, while normative has a more rigid understanding. This dimension measures the level of customer orientation.

VIII. GOOD GOVERNANCE AND ORGANIZATIONAL CULTURE

An understanding of the relationship between good governance and organizational culture has not been widely shared by researchers. Researchers are more likely to examine the relationship between culture and good governance. In the conceptual framework of this study, I want to explain that there is a relationship between good governance and organizational culture. The concept of thinking has also underpinned some of the opinions and research that have been done before.

Director of the Directorate of Institutional and Cooperation of Directorate General of Higher Education, Hermawan Kresno Dipojono, said to build a good academic culture in a university requires a not instant process. One of the conditions required to achieve this is good governance of universities (www.dikti.go.id).


a. To realize a moral attitude in running a business, companies must formulate business ethics that has been agreed by the organization and all employees. The ongoing implementation of business ethics is a corporate culture that is a manifestation of company values.

b. The ongoing implementation of corporate values and business ethics will support the creation of corporate culture.

From these statements, it can be seen that business ethics or corporate values that result from the governance of an organization will have an impact in the creation of an organizational culture. It is expected that good and continuous business ethics and corporate values will shape a good organizational culture as well.

Sopper (2014) conducted research with the aim of providing a better understanding of the logical structure of governance and cultural relationships. The results of this study introduce a comprehensive approach that combines governance and organizational culture into one analysis. The analysis is known as The Culture-Based Governance Analysis. Governance analyzes existing structures in the environment including their quality and intensity, while the culture is used to analyze the underlying mindsets and ideas of the stakeholders involved.

Study of Popadak (2016) aims to demonstrate the importance of organizational culture as a source of long-term sustainability of organizational values. The researchers also described a balanced relationship between governance and culture. This is because the behavior patterns implicitly employed by employees can be reinforced by corporate governance standards that are at this point a critical point in finding their balance equally appropriately. The results of this study indicate that investors need to consider the balance of governance and culture with caution if the goal is the creation of long-term value is sustainable. Strong and good governance is not always the best solution for corporate flaws. Another factor to consider is the culture within the organization.

IX. ORGANIZATIONAL CULTURE AND ORGANIZATIONAL PERFORMANCE

Denison (1984) is the first quantitative study that links between culture and performance. The results suggest that firms with higher positive perceptions in the work environment will have a better performance impact compared to lower positive perception firms. Denison and Mishra (1995) conducted a study that produced evidence of the existence of four cultural traits: involvement, consistency, adaptability, and mission. These four properties are positively related to performance measured by ROA and sales growth.

Tierney (1988) states that culture influences decision making. Organizational culture reflects what it does, how to do it, and who does it. Understanding organizational culture will help administrators to resolve potential conflicts and manage change more effectively and efficiently. Marcoulides and Heck (1993) are using the latent variables of organizational culture are organizational structure and purpose, organizational values, task organization, climate, and individual values and beliefs. The results show that there is a relationship between organizational culture variables and organizational performance.

X. CONCEPTUAL FRAMEWORK OF GOOD GOVERNANCE, ORGANIZATIONAL CULTURE, AND ORGANIZATIONAL PERFORMANCE

Of all the studies described above, I attempts to propose a conceptual framework model that may be developed and proven
by empirical research. The conceptual framework is described as follows:

![Conceptual Framework](source: prepared by me)

From the picture above can be seen that good governance gives influence to organizational culture and organizational culture give influence to performance. In this literature study, the organization used as an object in the explanation of the framework is a university especially in Indonesia. Universities that have good quality are believed to provide qualified graduates. The quality of higher education can be seen from the academic quality and quality of administrative services. Related to the quality of administrative services there are two important aspects that need to be considered namely the aspects of management and culture applied in the college concerned. According to Antonius, Chief Product Officer of Jobplanet Indonesia, stated that aspects of management and culture of universities play a role in determining the quality of administrative services in universities (www.beritagar.id).

The quality of higher education is important to support the students' selection. At present, prospective students can assess the quality of college from various sources. The quality of a college is not something that a university gained from the government or other outside parties. Universities must realize that the quality of higher education comes from the internal organization by considering the quality of lecturers to the learning system found in universities. Improving the quality of human resources must start from the quality of higher education. The organizational culture in the university is different from the organizational culture in the company. In the company, the relationship between management and staff is hierarchical. Culture that exist in college is collegial culture. The relationship between the rector, the dean, the head of the study program is collegial. In higher education, there is a leadership rotation. The Rector will one day become a regular faculty member and become a colleague. This is what makes college culture interesting to studied.

Governance can have an impact on the formation of organizational culture. Good governance is expected to form a good organizational culture as well. Within higher education, governance and culture will support the creation of a college quality that will have an impact on the performance of universities. The quality of higher education is reflected in the quality of lecturers, good learning systems, the quality of graduates, research and publications undertaken, and administrative services. These things will directly support and support the performance of universities viewed from the financial and non-financial aspects. Based on the existing research review literature, the opinions of experts, and the thinking of the researcher, a conceptual framework set forth above can be used as a basis for empirical research.

Figure 1. Conceptual Framework

XI. CONCLUSION

Organizational culture is an important thing to consider in supporting organizational performance. Organizational culture varies between organizations that are likely to have different performance impacts. Good governance is developed and implemented so that the governance in universities become well-controlled in accordance with Act no. 12/2012. Good governance and standardized will form a good organizational culture so as to realize the performance of a good college as well.

The conceptual framework proposed by the researcher is based on literature review, expert opinion, and thought of the previous researchers. This conceptual framework will become strong and become a new theory with empirical research to prove it. It is a task for researchers and me to prove it. I hope that the results of this exposure can be a guide for further research.

ACKNOWLEDGEMENTS

I would like to thank the Ministry of Research, Technology and Higher Education who has given the trust of grants who are very helpful me in taking the study in Doctoral Program of Accounting Science Faculty of Economics and Business of Airlangga University. The grant decision is in accordance with the Decision Letter of the Director General of Research and Development No. 01/E/KPT/2017 dated January 6, 2017 about the Acceptance of Research Funding and Community Service 2017.

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Analysing compressed AKP file with BMP and TIFF format by considering number of colors of the image.

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Abstract- Image processing is one of the widely used computation problem specifically identifying, understanding, beautification and compression. Today wide variety of image file formats is available with different clarity and size. This paper describes the basic process of compressing the bitmap image file and then comparing the compressed file with original one. The process involves lossless compression. Entire process is implemented in programming language and tries to understand various segments of bitmap file. Based on the number of unique colors in bitmap file, it compresses the file to store only single value for each different color and then comparative study of both the formats is applied using different charts to reach to a specific conclusion to achieve the desired performance criteria in form of size of the compressed file. File is compressed at some level of different colors and then after the technique applied is not suitable. To find out these criteria experiments are made on different colored image to reach to a conclusion. At last paper is concluded with future scope and enhancement.

Index Terms- Image processing, Bitmap, Image Compression, lossless format, RGB model, Java API.

I. INTRODUCTION

Image processing refers to identifying, understanding and performing various operations on image files. Today we have wide image formats available including .bmp, .gif, .jpeg, .png, .tiff etc. each with different encoding scheme and different criteria. Selection of particular image format depends on the needs of an application. Some formats are lossy like jpeg [3] where some are lossless image compression formats. Each format has its own characteristics one of these is file size which is import due to space require to store it. Bitmap image file format is lossless format stores each pixel value with different values of Red, Green and Blues colors along with alpha value denoting the transparency of pixel. Today’s computing area involves storing and managing images as part of its application. Storing images with minimum storage space is one of the requirements of computer applications. Bitmap image file is a good solution where quality matters but it requires more size on disk.

So researcher has made an effort to compress the bit map image file by developing an algorithm to compress the image file using the number of different colors existed in a given image file. Algorithm is implemented to achieve the desired compression ratio [6] and experimented on different image files to reach to a conclusion where the algorithm is suitable to implement and defines the criteria to use this compression technique. Conclusion criteria are achieved by comparing the compressed file with original one and one other format that demonstrate the success criteria of derived algorithm. Algorithm is implemented in Java programming language with the use of Java API. All experiments are performed on fixed size with different set of colored images.

II. BITMAP IMAGE FORMAT

A BMP file contains four set of information.

1. File Heading Information
2. Bitmap Heading Information
3. Color Table Information
4. Image Data Information

File heading contains 14 bytes. These 14 bytes are divided into different bytes with the details of file type, file size, some reserved bytes and pointer information from where image data of BMP file begins. Bitmap heading contains 40 bytes about detailed information of bitmap image. Color table contains the color information of image for bitmap indexing. Image data contains actual color of pixel values in binary form.

Monochrome image requires only a single bit of value to store black and white. Gray scale image requires byte information to store 128 different shades of black and white image. Color image uses RGB color model storing each pixel’s red, green and blue color information [4]. The resultant color is the combination of all three color values. For example all three bytes having each bit value 1 represent color white where all bits 0 represents black. All other colors comes in between these two colors. Total $2^{24}$ combination resulting 16777216 different colors can be achieved. Researchers have taken width 400 pixels and height 300 pixels with 24 bit of color information so size of the given bitmap file is computed as $400*300*3+54$ which equals to 360054 bytes results in 351 KB. This file is compressed using the technique of analyzing and identifying unique number of colors and compression is performed by reducing the color information of redundant colored pixels [5].

III. BITMAP COMPRESSION MODEL : AKP

Bitmap compression model uses Java API to extract 24 bit color information to find out the unique colors held in a given bitmap image. After finding each 24 bit pixel value it counts the
occurrence of each color. Image compression is performed to store only once each color value instead of storing the same color value for each and every pixel. Algorithm keeps track of pixel numbers sharing the same color. Compressed file contains heading information storing the information of image with resolution in pixel height and width. It stores the compressed binary file on disk drive. Compression ratio of image file is in reverse order of number of colors meaning that if file contains less number of color, high compression rate can be achieved while image having more number of colors compression performance may be deteriorate. Images having different color information having same number of different colors will have same compressed file size because to store any color three bytes are necessary but storing individual pixel color as used by bitmap format this techniques stores only a single color value for all similar pixels with indices of all sharing pixels. This compression model is named as AKP.

IV. COMPARATIVE STUDY OF IMAGES WITH ONLY SINGLE COLOR OF INFORMATION

Once the given image file is compressed then it is compared with the original one with other format .tiff. All the experiments are performed on the image file with height 400 and width 300 resolutions. The compressed image file is a binary file with extension .apk is taken. Following table contains information of each file with unique color and file size. Seven different colored image files are tested and result of compression is listed in form of number of bytes required to store image file. Name of files are chosen to directly reflect the colors used in the image file. All files having a single color regardless of color compressed in a same sized image file as it removes color redundancy.

### Analysis of Single colored file size

<table>
<thead>
<tr>
<th>File Name</th>
<th>BMP</th>
<th>TIFF</th>
<th>AKP</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>BLUE-RED-SHADED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>GREEN</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>GREEN-BLUE-SHADED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>RED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>RED-GREEN-BLUE-SHADED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>RED-GREEN-SHADED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
</tbody>
</table>

Table 1: Analysis of Single colored file size

The above table shows information about 7 single colored images originally drawn using paint tool in BMP format and then converted to other formats using java tool developed by the researcher. To better compare the given file sizes following chart represents the graphical comparison of the above tabular data.

V. COMPARATIVE STUDY OF IMAGES WITH MULTI COLORS OF INFORMATION

Algorithm is tested for images having two different colors. Following table contains information of each file with two different colors and file size. Three different colored image files with two different colors are tested and result of compression is listed in form of number of bytes required to store image file. Name of files are chosen to directly reflect the colors used in the image file. All files having two colors regardless of colors used compression takes place as same sized image files after removing color redundancy.

<table>
<thead>
<tr>
<th>File Name</th>
<th>BMP</th>
<th>TIFF</th>
<th>AKP</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE-RED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>GREEN-BLUE-SHADED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>RED-GREEN-BLUE-SHADED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
<tr>
<td>RED-GREEN-SHADED</td>
<td>360054</td>
<td>360484</td>
<td>120012</td>
</tr>
</tbody>
</table>

Table 2: Analysis of Two Colored Image Compression

In above chart the stacked column chart shows file size analysis of AKP, BMP, and TIFF file. The X axis shows file name where Y axis shows file size in bytes. AKP file type is compressed file type. From the above graph it can be observed that AKP file format requires less storage compared to BMP and TIFF formats. In chart Blue color represents AKP, Red color represents BMP and Green color represents TIFF.
The above table shows information about 3 two colored images originally drawn using paint tool in BMP format and then converted to other formats using java API. The following chart gives better visual comparison of image data given above in the tabular form.

<table>
<thead>
<tr>
<th>Colors</th>
<th>BMP</th>
<th>TIFF</th>
<th>AKP</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE-RED</td>
<td>360054</td>
<td>360484</td>
<td>120015</td>
</tr>
<tr>
<td>GREEN-BLUE</td>
<td>360054</td>
<td>360484</td>
<td>120015</td>
</tr>
<tr>
<td>RED-GREEN</td>
<td>360054</td>
<td>360484</td>
<td>120015</td>
</tr>
</tbody>
</table>

Table 2 : Analysis of Two Colored Image Compression

To better compare the given file sizes following chart represents the graphical comparison of the above tabular data. Comparison is based on single file with three color image file.

To better compare the given file sizes following chart represents the graphical comparison of the above tabular data. Comparison is based on single file with three color image file.

![Two Colored Image Size Analysis](image1)

Figure 2: Stacked Column chart for comparison of two colored image compression

In above chart the stacked column chart shows file size analysis of AKP, BMP, and TIFF file. The X axis shows file name where Y axis shows file size in bytes. AKP file type is compressed file type. From the above graph it can be observed that AKP file format requires less storage compared to BMP and TIFF formats. In chart Blue color represents AKP, Red color represents BMP and Green color represents TIFF.

![Three Colored Image Size Analysis](image2)

Figure 3: Stacked column chart for comparison of three colored image compression

The above stacked column chart shows comparison of three colored image file size analysis of AKP, BMP, and TIFF file. The X axis shows file name where Y axis shows file size in bytes. AKP file type is compressed file type. From the above graph it can be observed that AKP file format requires less storage compared to BMP and TIFF formats. In chart Blue color represents AKP, Red color represents BMP and Green color represents TIFF.

VI. COMPARATIVE STUDY OF IMAGES WITH THREE OR MORE COLORS OF INFORMATION

Algorithm is tested for images having three or more different colors. Following table contains information of a file with three different colors and file size. Three different colored image file with three different colors are tested and result of compression is listed in form of number of bytes required to store this image file. Name of files is chosen to directly reflect the colors used in the image file.

Colors are used as Red, Green and Blue as three different colors. First column is the name of the image file, second column is the size required by BMP file and third column is the size of TIFF file format. Comparing the compressed file having one or two colors with compressed file having three colors increases by very few bytes. Following Table 3 represents the three color image analysis with different file formats.

<table>
<thead>
<tr>
<th>File Name</th>
<th>BMP</th>
<th>TIFF</th>
<th>AKP</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED-GREEN-BLUE</td>
<td>360054</td>
<td>360484</td>
<td>120018</td>
</tr>
</tbody>
</table>

Table 3 : Analysis of Three Colored Image Compression

To better compare the given file sizes following chart represents the graphical comparison of the above tabular data. Comparison is based on single file with three color image file.
VII. COMPARATIVE STUDY OF IMAGES WITH DIFFERENT FILE FORMATS AND THREE COLORS.

By analyzing of the above file compression data and chart comparative study of different colored images with different file formats is obtained.

All above different colored image compression is analyzed by gathering data and obtaining the chart for better comparison, it can be observed that compressed file of AKP format requires less storage than other two types of formats. Following table shows the average file size for all three different formats with different number of colors image files.

<table>
<thead>
<tr>
<th>Color Count</th>
<th>AKP SIZE</th>
<th>BMP SIZE</th>
<th>TIFF SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>120012</td>
<td>360054</td>
<td>360484</td>
</tr>
<tr>
<td>2</td>
<td>120015</td>
<td>360054</td>
<td>360484</td>
</tr>
<tr>
<td>3</td>
<td>120018</td>
<td>360054</td>
<td>360484</td>
</tr>
</tbody>
</table>

Table 4: Average size of image with different color count.

The above table shows summary information of 11 images containing single or multiple colors from RED, GREEN and BLUE, originally drawn using paint tool in BMP format and then converted to other formats like AKP and TIFF using java tool developed by the researcher.

In the table, first column shows Color Count of files which is ONE, TWO or THREE. Second column shows size of AKP file in bytes, third column shows size of BMP file in bytes, forth column shows size of TIFF file in bytes respectively.

It is observed from the above table that average file size for each of the images is less in AKP format as compared to BMP and TIFF formats. Graphical representation using stacked column chart of the tabular data gives effective visualization. Chart contains three parts in which first represents average size of single colored images, second represents average size of two colored image and third one represents average size of three colored image.

VIII. CONCLUSION

By analyzing the table-1 to table-4 and figure 1 to figure 4, following conclusion can be drawn.

1. Size of compressed AKP file is smaller as compare to BMP and TIFF in case color count being ONE.
2. Size of compressed AKP file is smaller as compare to BMP and TIFF in case color count being TWO.
3. Size of compressed AKP file is smaller as compare to BMP and TIFF in case color count being THREE.
4. The size of BMP and TIFF are almost similar but greater than compressed AKP file.
5. Size of BMP and TIFF can be determined by the following presented formula[1]
   
   Image size = width * height * color model (bytes) + header size.

   Researchers have taken width:400 pixels, height:300 pixels and color mode: 24bits.

   So size of BMP images =400*300*3+54.
   =360054 bytes.
   =351KB

   The size of TIFF images =400*300*3+484.
   =360484 bytes.
   =352 KB.

   This outcome is exactly similar to the outcome of BMP column of table-1 and table-2, which proves the success of formula.

   In the similar way TIFF file has header size of 484 bytes.

   The size of TIFF images =400*300*3+484.
   =360484 bytes.
   =352 KB.

   The idea here is implemented is image compression based on number of different colors but more experiments and improvement is required in order to compress files with more number of colors. For multi color images, this compression technique should be verified and analyzed. But when the number of colors is less this mechanism improves size performance criteria far better than formats like BMP and TIFF. Further experiments and optimization to this technique can be obtained as a future scope.

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The Importance of Feminist Ethnography in Modern Folklore Studies

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Abstract- Ethnography is the research method that describes a culture and its “wisdom” as its members share implied common meanings in their habits, attitudes, beliefs and values systems and symbols i.e. in everything that composes their culture. Ethnography is also interested on the reasons for changing the culture and/or the ways of disrupting and restoring the dominant cultural class. So it is obvious that every folk group is ideal for ethnographic analysis.

Index Terms- Feminism, Ethnography, Folk Studies, Approach

Research fields and traditional folklore have analytical purposes. They are governed by fundamental principles and conceptual frameworks in order to formulate their questions that need to be answered. Ethnography that has been widening in Folklore Studies over the last decades is the method that describes a culture and its “wisdom”. Ethnography approaches the members of this particular culture as its expressions and carriers as they share tacitly common meanings of their habits, their attitudes, beliefs and their value systems, their symbols and in everything that composes their culture. However, is the ethnographic method really interested in the reasons of cultural change and/or ways of restoration of the dominant cultural class? Ethnography is interested in understanding the fragile and fluid nature of social control processes, as well as the rules that the society members make to maintain their cultural boundaries. At its center the belief exists that human behavior is the product of social life, and this explains its interest about the individual within the group or the community, as well as the “practice” of everyday life, the lived experience. So, it is obvious that every folk group is offered for ethnographic analysis.

The issue about the accession of the feminist Ethnography into Folklore Studies is linked to the practical and analytical work of the researchers and the cover of the gap between their expectation and the reality. It is not surprising that many folklorists admit that when they start using Ethnography in their research they experience a crisis of self-confidence, and they need special perseverance and effort to achieve it. It is natural to wonder about where they will start and equally natural to be concerned about the fact that Ethnography is a time-consuming and costly research method. In any case, both the time available and the involved cost vary according to the plans and aspirations of male and female researchers. At the same time, it remains the fact that field research is currently being carried out in much easier conditions, especially in terms of technological equipment than in the past. Through the use of film and video during the research field we have a new section for folklore, the “Optical Folklore”. The importance of Optical Folklore is that it offers important knowledge about the significant “Other”, especially in the field of symbolic systems and behaviors, contributing to the revelation of structures and recording heterogeneity [1]. Also, it has greatly facilitated access to pre-existing surveys and studies and the volume of existing knowledge often covers the ethnographer's lack of experience.

Feminist Folklore as mentioned above has led to the conclusion that male and often female folklorists have failed to understand the real dimensions of the female worlds in the traditional communities that they have explored. The feminist perception in Folklore and Ethnographic Studies challenges the female and male observers/researchers of traditional communities that they considered that women were granted in them. They often used the phrase “They were just there” and they were not interested in discovering the important of their social roles in their communities. Most folklore surveys lead to the conclusion that traditional communities consist mainly of men, and the usual reference to women identifies them as the mothers or spouses of these men. When feminist folklorists rethink today the investigations of the past, they can approach the women of traditional communities with the help of the analytical category of gender. Especially the women who are excluded from ownership and production, as a symbolic chapter, useful in the field of men’s exchange and negotiation [2] closely associated with the custom of the dowry. It is no coincidence that in many and different societies the historical connection of monogamy to the land property has been established, since it preserves not only the property but also the production relations. Normally, at least in Greece, the dowry is not a traditional custom or universal phenomenon of Greek traditional society, the “which is maintained over the centuries as a survivor” [3], but it is a changing phenomenon that depends on the current social and economic conditions [4].
Also, in the most communities that investigated by folklorists, the reproductive role of women was greatly underestimated as it was under the control of their husbands and their family environment. Women in traditional communities worked for a long period of their lives as men “producers”, which ensured at the “lucky” ones social recognition and prestige [5]. This is a part of the wider social control that exists for the women in traditional communities, that grid of methods with which the community leads its members to adopt behaviors, measures, rules of morality, etc. which they consider socially “normal” and “good” and which have a strong gender dimension. In traditional (and in some contemporary) societies, the myths and fairy tales, the collective community imaginary and its representations, the “forbidden” and the indolent, etc. are important tools of community control and a fact that is profoundly political. Thus, we think it is necessary in the above context the review of a series of “sensitive” issues from a gender perspective. For example, the extent and content of femininity, the violence against women and in particular their involuntary abductions that often resulted in the obligation to marry their rapist, the family and community control of virginity and its function as a material value during the wedding negotiations, the gender division of ethics, the concepts of honor and shame, and their connection to the community post of male superiority, etc. From our point of view folklorists, especially in Greece, can no longer treat sexuality as a taboo or as non-existent in the context of folk culture [6]. About fifteen years ago, in Finnish folklore Sarkar-Arola [7] speaking about the “heterosexual matrix” studied the construction of heterosexuality in her work “Magic, Body and Social Order” through the customs and rituals of pregnancy, childbirth and postpartum. In their context heterosexuality does not arise “naturally”, but it is constructed socially, it is not self-evident and that is why it needs to be evident through ritual and often magic. Also the Discourse that their members articulate and which is very important to feminist ethnographers and/or the ritual speech as it is recorded, it often conceals and reveals, apart from the genders, other kinds of irresistible instincts [7]. We should not forget that Rousseau [8] is the first who introduced the view/idea about linking gender inequality to individual property and surplus wealth. Engels [9] accepts this opinion and recognizes gender asymmetry as a primary and fundamental distinction and provides the major difficulties of its overcome. But all these symbolic structures, rituals, etc. can only investigated in connection with the difficulties and obstacles which arise from the socio-economic conditions that govern the lives of the people of the different communities and which are the basis of a difficult daily routine. However, we do not claim that women have been inactive victims at the male-dominated traditional communities of which they were members.

On the contrary women have always been visible and with a continuous presence in folk culture, unlike the “other”, the folk culture in which they were not invisible and their presence was occasional and discontinuous. The presence of women in folk culture governs by a dialectic contrast: from the one they consent, accept and internalize the mastery of men and on the other hand, they are not remaining non-participatory or passive. They interfere in the creation of this culture, influence its formation, enrich it and become not only its operators but also those who transmit it to future generations [10] [11]. In the framework of folk culture, the negotiating power of women is visible. Women play a decisive role in the shape and operation of the community structures, such as neighborhood communication networks [1] or female networks that perform religious duties. And if in the real world women need to confront with the prevailing community ideology and its grid of gender prejudices claiming a place in the public life; in the sphere of magic and metaphysics they appear to dominate [1].

Women have been displaced from the world of rationalism, i.e. from the logic of the social organization where men prevail, they turn to the world of the irrational and the transcendental, to the one which consists of religion, dreams, riots, spells and mischief, mediation with the transcendent, care of the dead, passports and especially the rites of transition to the “other world” [12]. It is not difficult to link the ambiguity of the woman’s position with her unbroken resistance and the conflict that this entails. Its dedication to religious function is without a doubt an effective way of entering the public space from the other door. Exactly the same ambiguity has the Fairies which an essential feature of social life [13].

Feminist folklorists soon understood that they called, through Ethnography, to overcome the andocentric of the dominant research. They study the different categories of women within the same community or group, reveal all their living conditions, break the patriarchal silence that surrounds them and evaluate their social contribution. Searching through Ethnography the female worlds and their essence, it is necessary to take into account the fact that usually the unequal and discrete relationships within the traditional communities and other folk groups are surrounded by the strongest with prestige, leading to their deterioration, the prestige to intensify [1]. So, in spite of the deprivation that has been for a rather long time, folklorists with a conscience of gender can boast that they have contributed and they continue to make a significant contribution to the new orientations of folk science and, in particular, to its negotiation with post modernity [14]. They also considered the issues of interdisciplinary, gender-specific and inter culturality crucial for the evolution of science [11]. At the same time, they highlighted the importance of ethnographic research on Folklore and they argued that the detailed categories “Gender” and “Sexuality” often guided both the choice of the research method and the phenomena they decided to study. In their view, the relationships between theory and research, but also the relationship between science itself and the folklorists is becoming more fluid, as open discussions substitute planned interviews and friendly relationships substitute standardized relationships between researchers and their research subjects [6] [11]. This is the collective
process where researchers and participants in research negotiate meanings, identities and texts, with the last ones to intervene decisively in the process and interpretation. Finally, they argued that Ethnography, which includes in its context the category of the “Other”, is crucial for modern folklore studies [14].

Feminist ethnographic research in modern folk studies is based on the following axes: a) the recognition of gender diversity, b) the necessity and the importance of a survey that focuses on women under their own perspective, c) the initiation of the research with an in-depth study of the social status of women and the predominant community culture of genders, the exploration of those factors that explain the inferiority and subordination of women, or the forms of power which they have, d) The historical evolution and possible differences in the social roles of genders and the historical relationships between them in combination with the changes in reproductive forces and relationships that may have occurred in the community, e) the critical evaluation of data from a gender perspective. However, it is important to point out that all the above is not an easy task, in the absence of more comparable information, but sometimes also of the inability of members of the community or of the folk group to the researchers intentions. However, as Sachs [15] notes researching rural women's groups, studying the invisible, looking at the unpretentious, looking to find out why a series of events (many of which are associated with peasants) are systematically ignored. By mimicking Stone [16] and paraphrasing her, we would speak of Ethnography of “neglected knowledge” which among other things explores how and why the knowledge associates with the female reality, and in the context of the folkloric studies deleted or is not part of the scientific rules. And this is exactly which makes feminist Ethnography valuable to the women of Folklore: the fact that it makes the invisible visible, the insignificant significant the fact that it puts women in its "scene" as worthwhile "actors" approaches them as subjects rather than objects. Beyer and Holtzblatt [17] point that Ethnography: a) articulates the uninhabited and silent knowledge that is essential to the success of research and b) in its context usually insignificant or invisible details are transformed into visible and exploitable research material. The introduction of feminist Ethnography into Folklore Studies was based on the dual status of women researchers as folklorists and women. Women researchers have managed to prove that the focus on the lives of women in traditional communities and folk groups had as consequence the redefinition of men’s life [18] [19]. At the same time, they proposed to the predominantly male models of folk theory alternative and often oppositional models that integrate female experience into the study of folk culture [10] [11]. Also, they highlighted the importance of ethnographic research in Folklore and they supported how the analytical categories of “Gender” and “Sexuality” have often both guided researchers to the choice of the research method and its subject.

In conclusion, we note that Ethnography in the context of Folklore Studies, apart from gender relations, can of course have as its object the real and symbolic universe of a community or folk groups, customs, habits, networks of cooperation, exchange, power structures, etc. What, however, is the emergence of the world of the community or of the folk group from the perspective of its own “actors”. Ethnography must be the product of cooperation and its content to be judged and accepted by the subjects of the research as a reasonable and adequate description [20]. The younger generation of women and men folklorists has now surpassed the arbitrary and deeply ideological division between folk and traditional culture. They focus on “folk cultures”, on the interactions of the specific cultural systems; they explore the role of modern folk culture and its actors, the folk groups of the city in its political and social life. We could say that in a totally unusual way we are inadvertently returning to a similar proposal by Herder, at least a century before the appearance of Sociology, Folklore and Anthropology. This new concept of folk culture results in a transformation of modern folkloric studies and the redefinition of many of their research fields that characterized by interdisciplinarity.

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Exercise and Its Corresponding Effect on Cardiac Output

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Abstract- The study focuses on examining the effect of exercise on the cardiovascular system. A sample size of twenty athletes and non-athletes were chosen of which we have five regular or seasoned athletes who were male, five regular or seasoned athletes who were female, five non regular athletes male and five non regular female athletes. These non-regular or untrained athletes and trained athletes were put together to have ten weeks session of training so as to see the effect that exercise will have on their cardiac output. After this exercise, the data generated were analyzed using simple descriptive statistics technique and physiological calculation of the stroke volume and the Heart rate to arrive at the cardiac output. It was realized that the cardiac output of both groups varied as some had a reduced hate rate while others had an increase in heart rate that leads to the various results on the cardiac output.

Index Terms- stroke volume, cardiac output, cardio-vascular, heart rate, athletes

I. INTRODUCTION

Physical activity is recognized as a risk factor for coronary artery disease. The circulatory system responds to an increase need for blood by adjusting the width of the blood vessels, primarily the arterioles and venues. The dependence of vessels resistance on the radius of the tube is described by Poiseulles law. It could be seen that blood flow depends very sensitively on the width of the blood vessels, so that changing the radius slightly has a large impact on the flow of blood.

Cardiac output applies to the amount of blood pumped by the heart, which in return depends on the heart rate and he stroke volume. An increase in the maximum cardiac output is the most considerable change in cardiovascular function which is as a result of training. Even though the heart rate decreases moderately with this type of training there will still be increase in cardiac output due to the improved stroke volume. Cardiac output will continue to increase till the point where a plateau is reached. During aerobic training blood flows to the muscles in considerable amount in relation to other tissue. This consequence happens due to vasoconstriction of the sympathetic system. Working muscles are considerably larger in relation and need all the blood and oxygen that they can get. In response to this, the parasympathetic system will constrict since it is not working as hard and does need as much blood. In other words, an increase in muscle blood flow is related to the increase in cardiac output, as well as, the redistribution of blood to muscles from non-active areas that can temporarily compromise their blood flow, and the increase in cross-sectional area of the large and small arteries and veins.

These are only some or the occurrences that happen to the cardiovascular system as we do aerobic training. Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy persons as well as in most subjects with cardiovascular disease. Regular activity is required to maintain these training effects. The potential risk of physical activity can be reduced by medical evaluation, risk stratification, supervision and evaluation.

Exercise can help control lipid abnormalities, diabetes and obesity. In addition, aerobic exercise adds an independent blood pressure-lowering effect in certain hypertensive groups with of 8-10 mm hg in both systolic and diastolic blood pressure measurements. There is a direct relation between physical inactivity and cardiovascular mortality and physical inactivity is an independent risk factor for the development of coronary artery disease. The greatest potential for reduced mortality is in the sedentary who become moderately active. Most beneficial effect of physical activity on cardiovascular disease mortality can be trained through moderate intensity activity (40%-60%) of maximal oxygen training programmes or leisure time physical activities.

A fit heart muscle can handle extra demands placed on it. Through regular exercise, the heart muscles get stronger, contacts more forcefully and therefore pumps more blood with each beat. The heart is just like any other muscle it must be exercised regularly to stay fit. The fit heart has open; clear arteries free of atherosclerosis is a condition that contributed to heart attack, stroke, hypertension, angina pectoris, and peripheral vascular disease.

Deposits on the walls of arteries of arteries restrict blood flow and oxygen supply to the tissues. Atherosclerosis of the coronary arteries, the vessels that supply the heart muscles with oxygen, is particularly harmful. If these arteries become narrowed, the blood supply to the heart muscles is diminished, and angina pectoris may occur. Atherosclerosis increases the risk of heart attack because a fibrous clot is more likely to obstruct a narrowed artery than a healthy open one.
1.2 STATEMENT OF THE PROBLEM

The heart is rendered inefficient by one or more circumstances ranging from high heart rate, high blood pressure, and excessive stimulation. All of these conditions require the heart to use more oxygen than is normal and decrease its ability to adapt to stressful situations.

The inefficient heart is one that beats rapidly because it’s dominated by the sympathetic nervous system, which speeds up the heart rate. Thus, the heart continuously beats rapidly, even at rest, and never has a true rest period. Because of lack of physical activities, there has been:

An increase in sudden death from ventricular fibrillation (arrhythmic heartbeat, other coronary heart disease.
An increase in the number of diabetic and cancer person
An increase in stroke cases
An increase in obesity victims which instance, may lead to death.
Deterioration in performance in sporting activities, especially professional sportsmen

This research will therefore look into the effect of exercise in reducing the effect of the above stated issues,

1.3 OBJECTIVE OF THE STUDY

1.3.1 MAIN OBJECTIVES

The main objective of my study is
To highlight the rationale of exercise and its corresponding effects on cardiac output

SPECIFIC OBJECTIVE
To highlight the effect of inadequate exercise to the human system with reference to cardiac output
To identify the effect of hyperactivity to heart rate and stroke volume
To give specific advice on the value of exercise to the entire body with more emphasis on the cardiovascular system.
The relationship between exercises an heart rate –resting heart rate.

SIGNIFICANCE OF THE STUDY

The study could be of great interest to the trainers and to a greater level of interest to the athletes because they are the ones who will justify the use of the basic theories used. This study will make the trainer and trainee know that an increase in the maximum cardiac output will one of the most considerable change in cardiovascular function which is as a result of training.

It will also point out that even though the heart rate decreases moderately with this type of training there will still be increase in cardiac output due to the improved stroke volume. Also the cardiac output will continue to increase till the point where a plateau is reached. In other words, an increase in muscle blood flow is related to the increase in cardiac output, as well as, the redistribution of blood to muscles from non-active areas that can temporarily compromise their blood flow, and the increase in cross-sectional area of the large and small arteries and veins.

These are only some or the occurrences that happen to the cardiovascular system as we do aerobic training. Exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy persons as well as in most subjects with cardiovascular disease. This research work will ignite trainees to realize that regular activity is required to maintain these training effects. The potential risk of physical activity can be reduced by medical evaluation, risk stratification, supervision and evaluation.

Exercise can help control lipid abnormalities, diabetes and obesity. In addition, aerobic exercise adds an independent blood pressure-lowering effect in certain hypertensive groups with of 8-10 mm hg in both systolic and diastolic blood pressure measurements. There is a direct relation between physical inactivity and cardiovascular mortality and physical inactivity is an independent risk factor for the development of coronary artery disease.

II. REVIEW OF LITERATURE

2.1 INTRODUCTION

This chapter reviews related literature on the effect of exercise on the cardiovascular system.

Cardiovascular fitness is the ability to exercise at an elevated heart rate for a designated time while supplying adequate oxygen to the body. According to Honey Bourne, Hill and Moore (1996) in their book “Physical Education and Sports” states that

“The heart rate needs to increase during exercise in order to increase the supply of oxygen to working muscles and to remove waste products such as carbon dioxide and lactic acid”.

It could be seen from this statement that before you begin to exercise your heart rate is caused by the release of cleaner acting directly on the heart and the impact of emotional excitement on the medulla. As soon as exercise begins the heart rate rises rapidly, mainly due to a nerve reflex response initiated by the muscle receptors that stimulates the cardiac control centre. Also within the muscles chemo receptors respond to the cardiac control centre to increase heart rate. As the body continue to exercise the heart muscles begins to get warmer and venous return increase, increasing e h t hear rate further. It is certain the when you stop exercising the muscle receptors stop stimulating the cardiac control centre and the heart rate begins the fall quite rapidly. The activity of the chemoreceptor also reduces and this, combined with the reduced levels of adrenaline, the drop in venous return an the drop in body
temperature returns in heart rate to normal within a matter of minute. According to Hellen Moors (2000) in his second edition book in advance Physical Education and Sports State that: “The heart rate increases in direct proportion to the increases in exercise intensity”. One could believe that initially the cardiac output increases as a result of both the heart rate and the stroke volume increasing, but maximum stroke volume is achieved during submaximal work and any exercise in “cardiac output during maximal exercise is due solely to an increase in heart rate. If there is a progressive treadmill workout you will realize a change in both the heart rate steadily rise to a maximum heart rate is reached. During this stage, most of the energy is being produced anaerobically and you will soon have to stop exercising because of fatigue. Usually when one is working sub maximally the heart rate will usually rise until you reach a point where the oxygen delivered to the working muscles is sufficient to release enough energy aerobically to cope with the demand of the exercising. The heart rate will then reach a plateau. When you stop exercising, your heart rate does not immediately return to normal, but takes a number of minutes to recover? This is because the one exercising need to maintain an elevated rate of aerobic respiration in order to replenish some of the energy stores you have used during the exercise and also to remove some of the waste product that have accumulate for example lactic acid and carbon dioxide.

2.2 THE INCREASE AND DECREASE RATE OF STROKE VOLUME AND HEART RATE

According to Arnheim and Prentice (200) tenth edition revealed that in training or exercise, “Stroke volume increase while heart rate is reduced at a given exercise load.

From the above statement, it is clear that his heart is the main pumping mechanism circulating oxygenated blood throughout the body to the working tissue. As the body begins to exercise, the muscle use oxygen at a much higher rate and the heart must pump more oxygenated blood to meet this increased demand. The heart is capable of adapting to this increase demand through several mechanisms. Heart rate shows a gradual adaptation to an increase work load by increasing proportionally to the intensity of the exercise will plateau at a given after about two or three minutes.

During higher intensity activities, maximal heart rate may be achieved before maximal oxygen consumption, which will continue to rise. The greater the intensity of the exercise the higher the heart rate will be.

A second mechanism by which the heart is able to adapt to increased demand during exercise is to increase only to the point which there is simply not enough time between hearts for the heart to fill up. Stroke volume and the heart rate together determine the volume of blood being pumped through the heart in a given unit of time. Approximately 5 liters of blood are pumped through the heart during each minute. Thus cardiac output is the primary determinant of the maximal rate of oxygen consumption possible. During exercise, cardiac output increase to approximately four times that experienced during rest in the normal individual and may increase as much as six times in the elite endurance athlete.

2.3 EXERCISE EFFECT ON THE CARDIO VASCULAR SYSTEM

A training or exercise affect that occurs with regard to cardiac output of the heart is that the stroke volume increases, which in exercise heart rate is reduced at a given standard exercise load. The heart becomes more efficient because it is capable of pumping more blood with each stroke. Because the heart is a muscle, it will hypertrophy to some extent, but this hypertrophy is in no way a negative effect of training.

Cardiovascular fitness is the most important aspect of any fitness programme. Cardiovascular fitness should be the mainstay of any fitness programme. This section is designed to explain the definition of cardiovascular fitness, the benefits of cardiovascular fitness, the different modes of cardiovascular fitness, and the criteria of cardiovascular fitness.

During exercise, blood pressure can decrease (both systolic and diastolic pressures) at rest and during sub maximal exercise by as much as 10mm/hg in people with hypertension. However, at maximal exercise intensity systolic blood pressure is decreased caped to pre-training.

It is interesting to note that although resistance exercise can raise systolic and diastolic blood pressure significantly during the activity, it also leads to a long term reduction in blood pressure.

Endurance training increases blood volume while plasma volume accounts for a majority of the increase, a greater production of red blood cells also contributory factor.

Recall that homoerotic is the concentration of hemoglobin per unit of blood. An increase in red blood cells should increase hematocrit but this is mostly the case. Because blood cells hematocrit actually reduces following training exercise

It is clear that the research has some expected outcomes. This expected outcome is as a result of review of related literature of similar research conducted. For this particular research, the researcher believes that:

a. The greatest percentage of maximum aerobic may be performed.
b. Stroke volume increases while heart rate is reduced a given exercise load
c. Heart rate increases in anticipation before exercise even begins.
d. Cardiac output increases proportionally with exercise intensity which is predictable from understanding the response of heart rate, stroke volume to activity.
III. RESEARCH METHODOLOGY

3.1 INTRODUCTION

This research is carried out in the Northern-Western part of Sierra Leone, especially at the district town of Kamakwie. The chapter focuses on the methodology used in carrying out the research. The method ranges from subjects selection, instrumentation, procedures and method of analysis.

3.2 RESEARCH DESIGN.

The research design used for the study was experimental research method. Regardless of the series of research design methods, the researcher believes this method will serve him better for the research.

3.3 POPULATION AND SAMPLE SELECTION

The population for the research includes all those who the researcher believes will respond accurately to the questions posed to them and who will allow to be observed. The researcher selected twenty persons as a sample size. The sample is drawn from four categories of persons whose efforts when put together will yield the intended result. They are selected through the stratified random sampling method because the sample size targeted was heterogeneous set, and then the simple Random sampling method consideration is also given to the specific groups because of their orientations.

The parameter and categories of groups that were under consideration were:

- athletes
- cardiac patients
- the elderly
- medical personnel
- sedentary or non-athletes

Considering the wide range of categories the researcher decided to use the composition of the heart rate and stroke volume to calculate the cardiac output on athletes and non-athlete/sedentary. As per the sample size, five persons were selected from these four categories: trained male athletes, trained female athletes, untrained female, and untrained male.

3.4 RESEARCH INSTRUMENT/TECHNIQUE

In a bid to get the requisite data or information for this piece of work, observation was the instrument used alongside sphygmomanometer, stethoscope, and hand watch to get the required result.

3.5 DATA COLLECTION

The approach used was observation. In the area of monitoring the heart rate per minute, the researcher has to do participatory observation in other to ascertain if there is any increase in the pulse rate. The researcher has to observe the pulse (radial) before the activity and after the activity. The Heart Rate was also measured using a stethoscope, and the stroke volume (SV) measured using the End Diastolic Volume (EDV) with a sphygmomanometer.

3.6 DATA ANALYSIS

The study will entail both quantitative and qualitative process to make the analysis. A majority of the aspects assessed were numerical values and because the variables gathered are in the form of numerical values, it has to be in a tabularized form. These tables were used to measure, compare, and analyze the result using rating scales. In this, we use the quantitative approach in some aspect of the research design is also qualitative because it involves the description in many words the effect of exercise on the cardiovascular system.

IV. FINDINGS AND DISCUSSIONS

4.1 INTRODUCTION

This chapter deals with the analysis of the collected data. The data is analyzed qualitative and quantitatively. Below are the charts that are analyzed.

However, despite about twenty athletes and none athlete were used in the research process, only few of them will be used in the analysis.
In chart one, the individual under observation, was a non-athletes untrained female A). She was put on the field to train as a novice so as to see how the cardiac output reacts to exercise. During the first week, before training commences, her heart rate (HR) was sixty-eight beat per minutes and her stroke volume was eight-six (86mls) per beat which summed up to five thousand, eight hundred and forty-eight milliliter which is about six (6) liters. As training continues, there is a steady decrease in the HR and a sizeable increase in the stroke volume (SV) at the start until it maintained a steady increase. Because IV. After ten (10) weeks of training the cardiac output (Q) increased from about six (6) liters to about ten (10) liters. The linear cardiac output shows that the training schedule was not standard as it has a low correlation.

In chart two, the athlete started with a cardiac output (Q) of about six (6) liters. The HR shows little difference in the rate of declining. Though in week three (3) there was an increase in the beats per minute, yet she maintained a steady HR in the subsequent weeks. Though the HR was not moving within these weeks, there was a steady increase in the SV and subsequently in the Cardiac output (Q). At the end, there was an increase in cardiac output by three litres, making it to be about nine (9) litres pumped by the heart per minutes. In this athlete, there was a steady increase in workload, but the reaction to adaptation was slow:
Considering the linear cardiac output of athlete C, there is an appositive correlation between the HR and SV. The athlete was not putting on her training schedule. The HR during the start of training ended up being the same after a ten (10) week period. The SV was increasing at a steady rate going a steady rate going a steady rise to the cardiac output.

This category of the investigation shows athletes who are seasoned athletes. Referring to chart 6, the heart rate of this athlete is below the threshold through her starting cardiac output was about 5.7 litres per minute during her first week, also there was a slight increase in the HR in weeks two and three but began to realize a steady decline as she progresses. From the graph, the linear cardiac output shows that the athlete heart was giving more output that expected. By the end of the tenth week, she was able to give out over eleven litres of blood meaning the heart has become large in size and the releasing rate of the blood reduced.

FIG. 3  CHARTS SHOWING THE CARDIAC OUTPUT OF UNTRAINED ATHLETE C (FEMALE)

FIG. 4  CHARTS SHOWING THE CARDIAC OUTPUT OF TRAINED ATHLETE A (FEMALE)
Female B shows just a slight drop in the beat of the HR and an increase in the SV gives a rise in the Cardiac output. The increase in Q could not be seen much as the starting output was about 6.3 litres and after ten weeks of straining; there was an increase of about 5.7 litres. The increase in the stroke volume was because the athlete was a hypertensive patient during the weeks under review. The HR signifies that no significant impact was created that would have given rise to the SV.

This chart shows an increase and decrease during the period of review, especially the first five weeks. When the athlete made a comeback for illness, she had wanted to go straight into her usual threshold (point of start) when on usual training, but because she was not fully recovered the HR was therefore not stable out was having a steady rise in the SV. At the end of the tenth week, she was just on the point that the HR started but still maintains an increase in the cardiac output. She falls below the linear cardiac output signifying little relationship between the HR and SV.
FIG. 7  CHARTS SHOWING THE CARDIAC OUTPUT OF UNTRAINED ATHLETE A (MALE)

The cardiac output of this athlete starts in the usual way, but begins to follow a trend that leads to the output going above the linear column. Both the heart rate and the stroke volume started increasing instead of the heart rate decreasing and the stroke volume increasing. It measures an irregular work schedule and could not increase up to eight(8) liters of blood pumped per minute at the end of the tenth week.

![Graph showing cardiac output for untrained athlete A](image_url)

FIG. 8  CHARTS SHOWING THE CARDIAC OUTPUT OF UNTRAINED ATHLETE B (MALE)

Though the heart rate and stroke volume took their appropriate line by decreasing and increasing respectively, the cardiac output did not increase much and the linear output fall above the cardiac output itself. The trend was not maintained, however, there is an increase in the cardiac output.

![Graph showing cardiac output for untrained athlete B](image_url)

FIG. 9  CHARTS SHOWING THE CARDIAC OUTPUT OF UNTRAINED ATHLETE C (MALE)

In chart 13, the difference between the cardiac output and the linear output is not too far off. The athlete after started training in the first two weeks there was an increase in the heart rate because of the introduction of an increase workload that he has not been doing before, therefore the heart has to adjust itself so as to meet to the demands of the body. At the end of the tenth week, there was a little increase in the cardiac output.
FIG. 10 CHARTS SHOWING THE CARDIAC OUTPUT OF TRAINED ATHLETE A (MALE)

With this athlete, his starting heart rate was 50 beat per minute denoting the fact that he has being a trained athlete. His output was 5.7 liters per minute and as the week go by, the output began to increase steadily. At the end of the tenth week, the output had increased up to about 11.4 litres per minute. The heart rate only decreased slightly as the stroke volume increases significantly.

FIG. 11 CHARTS SHOWING THE CARDIAC OUTPUT OF TRAINED ATHLETE B (MALE)

The starting heart rate of this athlete shows that he has been training before now. The cardiac output was about 6.3 litres per minute and by the end of the tenth week it has increased to about 11.3 litres per minute which was an increase of about 5 liters. The cardiac output followed the usual trend that is supplied by the heart rate and the stroke volume.

FIG. 12 CHARTS SHOWING THE CARDIAC OUTPUT OF TRAINED ATHLETE C (MALE)

The heart rate of this athlete did not show any difference by the end of the tenth week. He started with 52 beats per minute and was increasing and falling intermittently. Though the stroke volume had increased yet the cardiac output shows a little difference at the end of the observed week. He started with 5.9 litres per minute and only increase just by 4.1 litres per minute, which ended up to a cardiac output of 9.9 litres per minute.

5.1 SUMMARY

The main aim of this study was to examine the effect of exercise on the cardiovascular system. A sample size of twenty athletes was chosen of which we have five regular or seasoned athletes who were male, five regular or seasoned athletes who were female, five non regular athletes male and five non regular female athletes. These non-regular or untrained athletes were put together to have this ten week session of training so as to see the effect that exercise will have on their cardiac output. After this exercise, the data
generated were analyzed using simple descriptive statistics technique and physiological calculation of the stroke volume and the Heart rate to arrive at the cardiac output: The main findings of the study were as follows.

In the untrained female, there is a slight difference between the Resting Heart Rate and the Heart Rate after exercise. The increase in cardiac output is minimal. The average increase in the cardiac output after the ten weeks of training was 3.74 litres through there were differences of individuals. Athlete A in the untrained female category recorded an increase of about 4.2 litre/minutes, athlete B, 3.3 litre/minute, athlete C 3.5 litres/minutes, athlete D 4.3 litres/minute /min and athlete an increase of 3.4 litre/min.

- The Heart Rate of the non- seasonized athlete is higher than the seasonized athlete while the stroke volume of the seasonized athletes is higher than that of the non-seasonized athletes.
- As the athletes increase their workload, so the heart increase in size and give out an increase in stroke volume and a decrease in Heart Rate so as to accommodate the extra or excess job that it has to do.
- With the non-athletes or the sedentary, after a period of ten weeks of equal training, their Cardiac output could only increase by an average of about 3.7 litres per minute while the trained athletes have an average of about 5.2 litres added to their output when it was in a resting state.
- From the study, one has noticed that the cardiac output increases proportionally with exercise intensity, which is predictable from understanding the response of heart rate and stroke volume of activity.
- Exercise places an increase demand on the cardiovascular system as oxygen demanded by the muscles increase sharply.
- During exercise the cardiovascular system performs the following functions.
  i) Delivers oxygen to working muscles.
  ii) Oxygenates blood by returning it to the lungs faster than when it is at rest.
  iii) Transport heart, which is a by-product from the core to the skin.
  iv) Delivers nutrients and fuel to active tissues so as to keep them active.
  v) Transport hormones.

CONCLUSION

Exercising can affect the cardiovascular system in many different ways depending on the health status of the exerciser and the type of exercise that is being executed. With these athletes, the type of sub maximal exercise used was aerobic training. Aerobic training was viewed as an endurance workout that can lead to functional and dimensional changes in the cardiovascular system. When the exercises were done, the heart shows a moderate increase in size. This cardiac hypertrophy was because the heart was trying to adapt to the changes that occurring in the cardiovascular system.

During the recordings, I realized an increase in the end diastolic volume because it will eventually cause an increase in the weight and volume of the heart. As a consequence, the heart has to adjust to the overload by increasing the left ventricular volume, which will cause an enlargement of the left ventricle.

Cardiac output applies to the amount of blood pumped by the heart, which in return depends on the heart rate and stroke volume. An increase in the maximum cardiac output is the most considerable change in the cardiovascular function with result to aerobic training. Even though the heart rate decreases moderately with this type of training there will still be an increase in cardiac output due to the improved stroke volume. Cardiac output will continue to increase until the point where a plateau is reached. This plateau means that the blood flow is sufficient enough to meet all of the metabolic requirements of exercise.

RECOMMENDATIONS

5.1 As a result of the findings, it is recommended that:

- Athletes are to exercise regularly as exercise reduces the possibility of suffering from osteoporosis and certain neoplastic disease.
- Athlete should note the workload they are taking so that the heart will not be overworked which will lead to heart or cardiac attack.
- Physical inactivity is recognized as a risk factor for coronary artery disease, but exercise prevents the increase in cardiovascular diseases.
- People should exercise because exercise can help control blood lipid abnormalities, diabetes, and obesity.
- There is a direct relation between physical inactivity and cardiovascular mortality, and physical inactivity is an independent risk factor for cardiac attack so far mortality rate to be reduce, athlete should embark on exercise.

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The Importance of Palliative Care in Patient Therapy

Abstract- Palliative cancer care is the integration into cancer care of therapies to address the multiple issues that cause suffering for patients and their families and have an impact on the quality of their lives. Palliative cancer care aims to give patients and their families the capacity to realize their full potential, when their cancer is curable as well as when the end of life is near. Toward the end of life, specifically in with a terminal diagnosis, when curative therapies are no longer being pursued, family and caregivers may experience tensions as the shift happens in accepting the terminality of a disease. By potentially improving the quality of life, the overall cost of care is reduced by eliminating frequent hospital and emergency room visits, and even a slight increase in survival rates of patients with metastatic cancer, palliative care has an increased relevance in the healthcare system. The introduction of community based palliative care could play a key role in providing this essential form of healthcare for the aging population, as the numbers increase of people who not only have cancer, but are also living with long term chronic illness.

I. INTRODUCTION

Shifting ones focus from finding and working towards a cure for a disease, to seeking therapies for symptom relief from the disease process itself, is not always an easy transition for patients or doctors. As patients face their own terminality, their focus shifts to a quality of life, as opposed to quantity. However, what if the mention of the word ‘palliative’, is the ultimate deterrent from physician making the necessary referral for patients with greater symptom management needs? Could a mere change in words used by a physician change the outlook a patient may have to becoming more agreeable to palliative care, by introducing the term, supportive care?

Palliative care should be incorporated as a routine and universal service provided by physicians; it’s holistic approach to the healthcare system embodies the psychological, spiritual, and physical needs of a patient. Unlike hospice care, palliative care is shown to be appropriate early during illness. Discussions of what patients view as a quality of life should be incorporated into an initial treatment plan, with careful consideration to not pursue overaggressive treatments. If the idea of palliative care were introduced sooner to patient diagnosis, patients could potentially learn not to become attached to an expected medical outcome. Palliative and hospice providers help families reframe their curative mindset, to providing hope and supportive therapies for everyday living. Hope is an important psychological resource, that can be used as a coping mechanism and life-affirming treatment that can protect against despair in end of life situations. Toward the end of life, specifically in with a terminal diagnosis, when curative therapies are no longer being pursued, family and caregivers may experience tensions as the shift happens in accepting the terminality of a disease. Shifting ones focus from finding and working towards a cure for a disease, to seeking therapies for symptom relief from the disease process itself, is not always an easy transition for patients or doctors. As patients face their own terminality, their focus shifts to a quality of life, as opposed to quantity.

Palliative care should be incorporated as a routine and universal service provided by physicians; it’s holistic approach to the healthcare system embodies the psychological, spiritual, and physical needs of a patient. When defined this way, palliative care becomes applicable across the cancer and terminal disease spectrum. In fact, a recently updated guideline from the American Society of Clinical Oncology, strongly recommends that all patients with advanced cancer receive palliative care early in the disease course, concurrent with active treatment (Yael, 2017).

However, palliative care referrals continue to happen too late into the treatment plan. Patients are often near the end of life when referrals are made. Patients should not have to wait until near the end of life for supportive care for symptom management. According to Bruera (2010), One of the key barriers to early referral is the misunderstanding that palliative care is only provided at the end of life once patients have exhausted all cancer treatment options. Rather, they can take advantage of the expertise of both the oncology and the palliative care teams in optimizing quantity and quality of life under a simultaneous care model (Hui, D. 2010). This is particularly important in the new era of targeted therapy, which has seen an explosion of novel therapeutic options that are less toxic than traditional chemotherapy, making it feasible for patients to receive cancer treatments closer to the end of life (Bruera, 2010).

In a survey studied by the American Cancer Society, the objective was to determine the perception of the impact of using the name palliative compared with supportive care [abstract]. The conclusion of the study shows the name palliative care was in fact more distressing to patients and did not invoke a sense of hope to patients and families. It was viewed as synonymous with hospice, which then leads to end of life. Patients would be more likely to respond more positive to the term supportive care, especially those early in their treatment plans (p.220). Some of the participants of this study viewed palliative care as reserved for patients with terminal cancer, that is used in the last hours or days of life. The provisions of palliative care that have been changed from focusing on end of life care, to a more comprehensive model integrated throughout a person's illness experience, would come into play at a person’s initial time of diagnosis. Therefore, it is more imperative for healthcare providers to incorporate education into their practices, as well as promote changing the perception of palliative care is only for dying patients who are no longer candidates for life-prolonging therapy (Fadul, 2009).

Discussions of what patients view as a quality of life should be incorporated into an initial treatment plan, with careful consideration to not pursue overaggressive treatments. If the idea of palliative care were introduced sooner to patient diagnosis, patients could potentially learn not to become attached to an expected medical outcome and have better symptom management control. Most patients living with advanced cancer

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have an average of seven or more uncontrolled symptoms (Walsh, 2000). Palliative and hospice providers help families reframe their curative mindset, to providing hope and supportive therapies for everyday living. Hope is an important psychological resource, that can be used as a coping mechanism and life-affirming treatment that can protect against despair in end of life situations.

For patients with advanced cancer, when is the appropriate time to refer to a palliative care consultation? Some of the consultation triggers for hospital-based palliative care include: frequent hospital admissions, admissions for difficult-to-control physical or psychological symptoms, complex care requirements, decline in function, or failure to thrive. In addition to these symptoms, according to Perrin and Kazanowski (2015), acknowledges the barriers late consultations can bring. An important key to overcome these barriers are critical care nurses; in hospital settings, they need to be the champions for palliative care on their prospective units. Nurses can recognize the signs of fatigue, untreated pain, which can lead to delirium, among other signs and symptoms that chronic illness brings (p.48).

Nurses can be great at facilitating communication with patients about difficult life topics; they can help bring down the barriers in difficult situations and can act as a go-between for the patient and doctor. Advocating on behalf of patients to ensure their wishes are followed needs more empathy from doctors that may help curb verbal battles at the bedside. If the idea of palliative care were introduced sooner, patients could potentially learn to not become attached to an expected medical outcome. It could take some of the heat off the doctors for potentially providing a false sense of hope and helping the family to not focus on prognosis or cure. Encouraging and supporting respect of a patient’s wishes is something we can do right now to improve end of life care.

On the other hand, it is difficult to address a patient after a diagnosis of a malignancy; some doctors opt for telling the patients families over the patient themselves to avoid an emotional outburst. The question should not be “should we tell…?” but doctors should switch to, “how to I tell my patient…?” Open communication between a doctor and patient as well as the family is key. As discomfiting as end of life discussions are, having proper planning in place helps healthcare providers have a sort of guide in place to handle medical care and builds relationships and rapport by listening to families and patients describe what is important to them. It acknowledges and preserves the dignity of a patient and can arguably be emotionally easier on families and medical professionals alike.

The answer of when and how to introduce palliative care is not always clear and can lead to prolonged unmanaged symptoms and increased admissions in the hospital setting, which can then lead to unwanted and unneeded testing. One of the pressing realities in end of life care, is that despite more Medicare beneficiaries dying in palliative care or home settings since 2000, the frequency of hospitalizations into acute and critical care units and the frequency of transitions across multiple care sites during the end of life increased, reflecting persisting emphasis on administering aggressive, curative care, only marked by brief hospice stays immediately preceding death (Teno, 2013).

When it comes to end of life care or life preserving measures, the duration of the care being received can rack up overwhelming costs. Families will usually spend thousands of dollars with little to no insurance coverage, with a terminal illness diagnosis, which after treatments, may result in the expected terminal outcome originally given by doctors.

The skyrocketing costs of healthcare weigh heavily on these individuals who are faced with a terminal illness. In the medical industry, insurance has become a big player in how things are currently run in institutions across the county. It can be viewed that insurance, especially Medicaid and Medicare, only care about increasing revenue and decreasing patient care. For example, debt.org reports that the cost of routine end of life care for patients residing in a hospital can range from $6,000 to over $10,000 per day, and stay at home care for terminal patients can cost between $150 to $650 per day (Fay, 2016). Studies have shown that health care expenditures began to decline 24 to 48 hours after the palliative care consultation occurred, which usually has been facilitated by a palliative care team. (Greer, 2013).

As the cost of healthcare rises, the number of sick people grows with it. In 2007, almost 12 million Americans with a diagnosis of cancer at some point in their history were alive. This number, which represents almost 4% of the US population, has dramatically increased from the 3 million cancer survivors alive in 1971 (Arif, 2011). Most of these people are capable of living in their normal home care setting, but require more attention to their growing healthcare needs. With chronic illness on the rise, community-based palliative care could address the multi-dimensional needs and symptoms that occur with widespread illness. Providers of community-based palliative care must be prepared to address a substantial concurrent array of symptoms using evidence-based pharmacologic and nonpharmacologic strategies.

The question then becomes how would palliative care and oncology services pair together to serve these growing community needs? To provide the best care to patients, a proper balancing system must be established for coordination of care. Community oncologists balance time within outpatient visits between the discussion of technical medical issues, such as test results and anticancer treatment options, with more broad components of health-related quality of life, such as ability to do daily activities, emotional functioning, and symptoms of pain and fatigue. Often, as disease progresses, both symptoms and family or caregiver distress increase. The goals of care usually change over time, and the issues that the patient, family, caregivers, and the oncology practice are confronted with shift as well (Muir, 2010).

If palliative care services were integrated with a private based oncology practice, it could allow for the medical oncologist to focus on the evaluation of staging and treating a patient while understanding how their course of treatment is working for their disease, and the palliative care can focus on symptom management and goals of care concurrent with treatment. If these services are offered in the same setting, it could drastically improve quality patient outcomes, with the greater care given in all aspects of treatment.

Many other practical issues must be addressed to provide adequate care for the growing number of people experiencing cancer as a chronic illness in the community. For example, new reimbursement mechanisms must be effective and efficient to
ensure proper coding and billing are done correctly. The current Medicare benefit funds hospice services, but did not always include palliative care. In a recent study by the Fairfax North Virginia Hematology Oncology group along with Capital Palliative Care Consultants, together, they believed palliative care could provide a clinical benefit to patients and families, as well as changing the quality of care provided by oncologists. The economic factors had to be addressed as well as provisions to ensure each entity would not be competing for funds. Proper medical coding was established for “disease coding” for the oncologist, and “symptom management” coding when the patient was treated for such symptoms as dyspnea or pain. The study also followed the amount of time saved by the palliative care team picking up the workload the oncologist would normally have to deal with. The oncologist time is now available to see more patients, assess therapeutic regimens, determine if a patient could fit into certain disease specific studies, attend to patient specific needs regarding treatment, or take on new patients that would normally have not been able to be seen.

With chronic illness growing in numbers, and patients living through sometimes years of chemotherapy and outliving their prognosis, a change needs to happen in our current system for an increase in supportive care. Through better education early on, specialists can work together to ensure the burden of care is minimized to patients and their families.

REFERENCES


ACMD – Aquatic Condition Monitoring Drone

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Abstract- In the modern times pollution is a common issue faced by the people. One of the most troublesome form of pollution is the water pollution. Since Sri Lanka is a country that relies a lot on agriculture, the farms and field mainly use the water from the lakes and other water reservoirs. Therefore it has become necessary to protect those. This project is intended to produce a Water Drone which will help to monitor for water pollution such as chemical dumping and disposing garbage in water bodies. This project will also help to monitor the fish population to ensure that their habitat is not threatened. The Drone will be equipped with GPS for tracking as well as remote controller for manual control.


1. INTRODUCTION

Lakes and other water reservoirs which harbor aquatics plants and animals needs to be protected from any possible threats. Covering Large water masses with technologies require much resource to work with. Which includes high maintenance and labor cost. Therefore a drone with capabilities of moving around a large water body was decided to be made, which would be much more cost efficient than implementing a large scale system throughout the water body.

From the days of yore Sri Lanka was known for its agriculture, one of the main reasons for the British to capture Sri Lanka was for the moist land it had along with the rain fall. Agriculture was something which was carried out generation by generation and still is continued, one of the main resource for agriculture is water, and one of the main ways of getting water was from rain, but then rain doesn’t pour frequently in these lands and an alternative way of supplying water for agriculture was needed, and that’s when the importance of lake was found. Whenever water was needed during a drought, water from the lake was diverted and used for agriculture.

As days passed industries, hotels and residents started growing and kept on increasing which made the waste to be diverted into lake to keep the land clean, and little did they know polluting lakes will lead to destruction of aquatic beings which leads to the breakage of the food chain, decrease of oxygen emitted by the water plants and destroying the natural beauty. As an example in Sri Lanka is the Beira Lake which is situated at the heart of Colombo which was used during the Portuguese era, but now several industries have been established around this lake which has made it resemble a green color and gives out a bad odor due to the pollution made by the industries surrounding it. This gives out great discomfort for people travelling or living in that area.

As a cost efficient way onitor the lakes, this drone was made with sensor technology to monitor the water resources. Along with the hardware unit with a pH sensor which reads the pH wherever the drone is. An algorithm had to be developed to map the whole lake and get the difference using sonar technology. A hardware unit to capture the location of the drone and let the user know where the drone is and a hardware unit to capture videos of what is below the drone and transmit it to the user. The main idea was to build the drone at a low cost so it would be easily affordable.

Therefore this project was implemented to monitor lakes and detect water pollution. The system was tested in Lake Gregory, Nuwareliya, Sri Lanka.

2. LITERATURE REVIEW

The literature review is done based on several components related to our proposed Aquatic Condition Monitoring Drone. So that we could identify and differentiate our product among the other related products in the market. The study is based on the following topics which is Sonar Technology, GPS technology, pH Sensor, Live streaming camera, Arduino Boards technology and also about similar existing systems.

An approach for deriving a terrain model from sensor data is presented for autonomous underwater vehicles using a side scan sonar system. The project [1] propose us in using a geometric reflection model and information about shadows and highlights to derive as estimated bottom contour. It also discusses some general aspects of the type of data and filtering techniques to improve it as well as several techniques of surface reconstruction and their limitations are presented.

Using an autonomous Underwater Vehicle equipped with various sensors such as DVL, IMU, Sonar this project [2] presents a novel integrated approach of creating a 3D surface map of seabed terrain. Acoustic sensors mounted on AUV helps overcome the unfavorable underwater conditions like low visibility. Down-facing multi-beam sonar sensors are used to capture the terrain data. The Long Baseline (LBL) localization system and PID controllers are used to drive the AUV to the set-points given by the navigation controller. The collected data is then used offline to construct a 3-D map of seabed using alpha shapes.

There is a nationwide issue of fishermen cross the country border. Using technologies like Global Positioning System
Fiber pH sensor based on long period gratings [15] different mobile telecommunications. This system using Arm11 as the embedded video surveillance system based on 3rd generation the safe region. In the system the boundary is detected using GPS in real time and the retrieval was followed by vital information being sent to the PIC for taking corresponding actions.

In order to improve the mobility of the traditional video surveillance system, this paper [11] puts forward a design of embedded video surveillance system based on 3rd generation mobile telecommunications. This system using Arm11 as the core processor which has high performance data processing and it uses embedded Linux as the operating system. Here the research group used CMOS camera to capture video and used 3G wireless network to transfer video data instead of traditional wired network. C++ is chosen as the development language for both server side and client side application and ARM11 is composed of the main controller module. 3G module is used that is produced by HUAWEI which can transfer video data over a wireless network and this system realize video capture, H.264 compression, and some other functions.

This paper [4] introduces a camera surveillance system in wireless communications. The system contains three major modules, PTU (pan-tilt unit) camera control for surveillance video capture, cross-layer control for data compression and transmission, and error concealment for video quality enhancement. The architecture of the wireless video surveillance system is transmitter is responsible for video capture and data transmission and camera is controlled by both the commands from a remote control unit and the local tracking result. The captured video is recorded by the local tracker and is sent to the data processing center and video is processed at the data Centre for compression and transmission over the wireless network. The remote control unit performs error concealment on received data and provides necessary feedback to the transmitter.

A wireless passive sensor for remote in vivo milk pH measurement is proposed in this project (A wireless passive pH sensor for real-time in vivo milk quality monitoring) [14] sensor consists of iridium oxide and a silver chloride electrode. The sensor is attached to the side wall of a container or packet and the frequency given out from the container is captured, the pH is measured using the voltage difference across the electrodes. An impedance analyzer and an interrogator coil are also used to get the resonant frequency from a distance. This doesn’t go in contact with the milk which doesn’t affect the milk in any ways.

A fiber pH sensor pH sensor based on an air-gap long period fiber grating in a multi-modes fiber is proposed in the project (Fiber pH sensor based on long period gratings) [15] different sensitivity levels are given for acid solutions and alkaline solutions. Whenever there is a change in index the wavelength shifts due to the core and cladding layers. This simple system can be used in long-term monitoring of pH values in drinking water or testing solutions.

3. METHODOLOGY

Prototyping Methodology was selected as the methodology in order to develop the “Aquatic Condition Monitoring Drone”. Designing and Implementation Phases were done concurrently and iteratively until the system met all functional and nonfunctional requirements. The initial prototype was built with minimum features and only the base function of each component was programmed. There upon each stage of the prototype the components were integrated and complete list of features were added one by one.

A. Planning

Planning phase was starting at the beginning of the project the system to be built, scope of the system and possible risk that may arise were discussed and identified. A feasibility analysis was done to make sure the project was feasible.

B. Requirement Gathering and Analysis

Analysis phase focused on gathering information and analyzing the difficulties faced by the authorities in maintaining the lakes and other water reservoirs. The data sources used for analysis was categorized as primary and secondary data sources. As primary data source an interview was held with the irrigation department authorities in charge of lake and reservoir maintenance. The gathered data from primary source was more helpful to accurately determine the requirements for the system. The Secondary data source was the past research journal and internet articles on the topic which helped us confirm the requirements and understand the possible risks involved in the development of the project.

C. Design

The primary objective of design phase is to create a design that satisfies the requirements. Initially the overall design was based on the High level diagram (Figure 1). From there a blueprint was drafted for the drone upon which the initial prototype was built. The sonar, camera, pH sensor and GPS tracker are the components attached to the drone, they will read the transmit data through the drone Wi-Fi module, which will be received by the System.
The System will then use the data obtained from the sonar sensors to generate a contour map allowing users to better understand the lake. The Camera will allow the user to live monitor the lake when needed with an ability to detect anomalies with water through object identifier. The equipped pH sensor will continuously transmit the pH data in order to monitor the toxicity of water in the lake and alert the user if it reaches a threshold set by the user. The interface will display the current location of the drone and allow the user the control the drone manually if needed as well as display the information processed using the data to the user allowing him/her to make necessary decisions.

D. Implementation

Implementation is the fourth stage of SDLC where the project team transformed the design into a working system. Visual Studio was the IDE used to develop the System and many libraries were used to achieve desired functions as well as improve the performance of the System and ease of application development.

Since the data needed for processing has to be stored for processing of map and comparison of pH values, a database was created. MYSQL database was used for this and PHP was used to communicate with the database.

The Sonar and pH sensor will transmit the data which will be stored in the database, the system will then retrieve the collected data to create the contour map using the depth data taken from sonar and the longitude and latitude data transmitted through GPS Module to create a contour map of the desired lake. pH values stored in the database will allow for comparing of values in the lake to assess the situation of the lake. The camera will use an IP address to directly transmit the data to the system in order to avoid delays along with GPS to monitor the location of the drone.

4. RESULT AND DISCUSSION

The Aquatic Condition Monitoring Drone desktop application is created using C# language. Using this application, User can control the drone and get information from it. This application allows the user to control the drone. Figure 2 shows the implementation of this functionality.

The location of the drone can be identified using GPS location page and also the movement of the drone also can be tracked using the desktop application. Figure 3 shows the implementation of this functionality.

Desktop application allows the user to get live feed of the lake from the camera attached to the drone and to detect the floating objects using the color. Figure 4 shows the implementation of this functionality.

pH value of the water can be checked using the pH value page. Figure 5 shows the implementation of this functionality.
Desktop application allows to generate a map of the lake to identify the depth. Figure 6 shows the implementation of this functionality.

The “Aquatic Condition Monitoring Drone” was built with the overall objective of maintaining the local lakes which is preventing them from getting polluted. While building the drone the team had to experience some technical issues the following are those issues along with how the team managed to overcome those issues.

The most important issue was the Wi-Fi module which was planned to be used for this drone, while building the drone the proper module could not be found to build the drone therefore in order to overcome this issue a Bluetooth module was used, and another issue with the Wi-Fi module was an online database where the data has to be sent to the online database via a channel and retrieved from the database which doesn’t give data real time.

The Assumptions made when developing the drone are as follows

- User has to have a basic knowledge of using a computer and the standalone application.
- The User is nearby within the Bluetooth range.

5. CONCLUSION AND FUTURE WORKS

Rapidly increasing population, urbanization and industrialization have been the major reasons for lake pollution. The Aquatic Condition Monitoring Drone gives the best solution by not letting the lake get polluted and identifying the pollution problem early on and fixing it. The Drone moves around the lake and every given interval the drone retrieves the co-ordinates of where the drone is, the pH value and the distance to collision, when moving around if collision is detected within 5cm the drone automatically reroutes to another direction. All the retrieved data are sent to the database and retrieved to a standalone system where the user can keep track of and watch each and every part of the lake. Based on the statistical analysis it can be concluded as the GPS and the sonar sensors are really important in navigating the drone around the lake, finally the project achieved to fulfill all the objectives of this system and wish this project would be a real benefit to the society and enrich living. The research team wishes that this study will be helpful for the researchers who are interested in related topics. This project will give better ideas and more knowledge to implement similar kind of projects or hi-technical projects with more advance and costly tools.

Following are the limitations which were found out by the research team about the “Aquatic Condition Monitoring Drone”

- **Wi-Fi Module**
  Initial plan was to use a Wi-Fi module for the drone, while building the drone the proper module could not be found to build the drone therefore in order to overcome this issue a Bluetooth module was used, and another issue with the Wi-Fi module was an online database where the data has to be sent to the online database via a channel and retrieved from the database which doesn’t give data real time.

- **Underwater Camera**
  As the cost for the underwater camera was high we could not afford an underwater camera but all the functionalities needed for the underwater camera had been implemented on a phone camera.

- **Sonar Mapping**
  A 3D map of the lake could not be generated.

Accordingly Aquatic Condition Monitoring Drone System has shown 80% of accuracy level and moderate rate of reliability level. The level of reliability has been achieved by testing different kind of water to ensure proper pH value monitoring. Monitoring of overall water monitoring process and retrieving to the desktop in real time makes Aquatic Condition Monitoring Drone system highly reliable. This real time process has been achieved through real time Bluetooth transmission. Cost effective GPS module and desktop application provides a reliable interface to the user. Rechargeable battery and battery life of the Aquatic Condition Monitoring Drone are some other reliable factors. The drone will detect collisionusing the ultra-sonic sensor which is attached to the drone. This is also a reliable factor. Accuracy level of Aquatic Condition Monitoring Drone System has been calculated based on the accuracy of some major components. Accuracy of pH sensor, Accuracy of ultrasonic sensors, Accuracy of GPS module, Accuracy of Bluetooth module and live video streaming are major accuracy factors considered when calculating accuracy level of Easy Clean System. The GPS module used in the Aquatic Condition Monitoring Drone is cheaper module which is the reason for decreasing accuracy.
ACKNOWLEDGEMENT
The project team of "Aquatic Condition Monitoring" would like to declare our honest sense of gratitude to our institution – Sri Lanka Institute of Information Technology (SLIIT). We are acutely beholden to whose help, stimulating suggestions, knowledge, experience, and courage helped us in all the times of study and analysis of the project in the pre and post research period. Also very special thanks to Mrs. Gayana Fernando for their endless support given at times of difficulty as well as to our seniors and the lecture panel. The completion of this undertaking could not have been possible without the participation and assistance of so many people whose names may not all be enumerated.

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A Smart Travel Companion Application with Location Base Scheduling


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In urban life style traveling inside and outside of the city takes a major role. Because cities have, high density of population and high density of vehicles, and this will lead to the problem of city traffic and scheduling. This problem will cause big interruptions to working class citizens and undergraduates like being late to work, missing appointments, and missing lectures. To solve this, past few year’s companies like Google introduced navigation systems with predicted traffic. Still people does not often use these resources to improve their lifestyle. With the help of the google Maps, “ROADIE” is focused on filling the gap between the user and the information through an intelligent voice assistant by learning and analyzing users’ habits and introducing the integration of Navigation with Location base scheduling. Users can schedule appointments considering traffic conditions and receive feedback through text or voice base about the reachability of the destination. Users can plan their day according to the travel schedule and increase the productivity. In addition, users can contribute by posting traffic updates that system will analyze and send to the community to optimize existing predictions. The research team believes that the proposed application will contribute to solve the scheduling and traffic problems that faced by urban working class citizen.

Keywords: City; out-door Navigation; companion; Android; urban citizen; intelligent

I. INTRODUCTION

In the busy urban lifestyle, traveling is a main activity. People use different mode of travel to reach their destination. There are many problems related with day today traveling. In a busy city area, too many vehicles create traffic. When traveling by public transportation most often people might get stuck in the traffic or end up taking the wrong bus, and arrive at lecture/work place late or when using the private transportation people might use the wrong route without knowing traffic conditions and waste time. Through there are many narrative navigation systems and route traffic displaying applications there have not been any companion infrastructure based navigation system that learns form user habits and interact with the user to present navigation data in an understandable manner in the simplest form.

The usage of android devices are increasing, According to the recent research reports, there are above five billion mobile users in the world currently and approximately one billion among them are smart phone users. [1]

“Roadie” collects data/information from Weather from google weather API, Google maps location database, user/admin created routes and compute/mine them with users’ (Roadie user) travel data collected from different users, using data mining techniques and shortest path calculation algorithms to predict and suggest the best route for the user based on users preferences, habits and travel system.
II. LITERATURE REVIEW

As congestion, problems in day today travelling become a greater concern to urban citizens. Solutions, which alleviate them, were needed to improve the performance of the transportation system.

In an article written by Paul Borokhov, they present a system which enables users of smartphones to obtain directions generated using an algorithm which provides an optional routing policy for reliable on time arrival that is directions which seek to maximize the probability of arriving to the destination within a given time budget, rather than to minimize the travel time based on posted speed limits [2].

Article, published by student Kari Torkkola and some other students of Intelligent System Labs in USA, says that “Traffic Based on Route Prediction”, Traffic advisories can be delivered to assist travels in avoiding congested areas and reaching their destination in a timely manner. They collected Location and route data from fourteen participants, representing 6 undergraduate students, 5 office employees and 3 independents. Each participants was provided with a commercially available mobile phone. Each participant used the phone and the GPS receiver for a two to three month period. Context data logging software is “context phone”, public domain software from University of Helsinki, Finland. The logged context variables consist of the following:

- GPS data from Bluetooth GPS receiver
- Current GSM cell ID
- Bluetooth devices around the phone
- Phone profile
- Active phone application
- Phone idle/active time
- Battery status and charger status

- Incoming/outgoing calls
- SMS or multimedia messages
- User interaction with the Phonebook and recent call log
- Media captured with the device (e.g. photo, video)

[3], In this paper, they present “Moode”, a practical mobile application based on a novel hybrid model of factor graph model combined with a deep neural network (DNN), main technical contributions of Moodee are:

1) Design a convolutional neural network (CNN) with cross auto encoders (CAE) to generate user-level content at tributes from tweet-level content attributes.

2) Define a partially-labeled factor graph (PFG) to combine social interaction attributes with user-level content attributes for stress detection [4].

In a research paper called “The Research of Travelling Companion Algorithm Based on Fuzzy Clustering Analysis”, the algorithm research of Travelling Companion is based on the fuzzy clustering analysis. The result of the empirical research with indicates that the algorithm research of travelling companion is faithfully and reasonably designed and has guiding significance to solve relevant problems in the future [6].

Fleisher describes development and deployment of GPS (Global Positioning System)/GSM (Global system for mobile communications) based Vehicle Tracking and Alert System. This system allows inter-city transport companions to track their vehicles in real-time and provides security from armed robbery and accident occurrences [7].

Cell tower triangulation similar to GPS tracking in many ways. Multiple towers were used to track the phones’ location by measuring the time delay that a signal takes to return back to the towers from the phone. This delay is then calculated into distance and gives a fairly accurate location of the phone. Detecting which antenna of the tower of signal bounced off of can further refine the location. This gives a more specific location when used congruently with multiple towers calculated by multiple dishes on each tower [8].

In one research paper which has been published by a student in university of Electronic Science Technology of China Chengdu it is mentioned that BLSPM algorithm is more efficient and time saving
in finding the shortest path a given destination with road traffic data.

Following points are considered by the algorithm when giving the solution to the user,

- Traffic Status (Free Flow, Heavy, Congested, Impossible)
- Travel Times (Elaborated, Free flow and Normally Expected)
- Traffic Values (Measured values e.g. Flow, Speed, Congestion)
- Weather Value (Precipitation, Wind, Temperature, Population, Road Surface, Condition and Visibility)
- Obstruction (Animal Presence, Vehicle Obstruction, Infrastructure damage)
- Driving Condition Type (Impossible, Hazardous, Passable with care, Normal) [5]

In the research paper published by student of an engineering college of Jordan they have developed a website for tracking, navigation and finding a shortest path for a destination and tracking the user position for the city of Amman. Their tracking function operation can be summarized as follows.

1. Auto-refresh which means updating the location of the car every interval chosen by the user.

2. Interval to receive location update info, which means the update time used to receive location of car (0.5 sec), means receive location info by (SMS or GPRS) every 0.5 sec.

Their tracking system is based on the dynamic layer (GeoEvent Function). A GeoEvent is a moving object. Example includes vehicles, aircraft and satellites systems. If the user wishes to track and display on the map. Then the GeoEvent in the Animation Layer may be refreshed without reloading the map image. The user can utilize the animation Layer and GeoEvent objects to track and display the location of a vehicle in real time. [11]

For our data collection, they used CellOScope – a smartphone data-collection system. The CellOScope application tracks the user’s geographical locations using the GPS coordinates. In case the GPS coordinate are unavailable, it uses the location coordinates provide by the cellular operator. CellOScope has two components: a) an Android based smartphone app which was installed on participants’ smartphones manually and was also made available on google play for download and b) a data collection server. CellOScope data collection involves three important components of the user’s smartphone data. [9]

III. METHODOLOGY

The system is using the prototype methodology of Software Development Life Cycle (SDLC). The software prototyping was refers to building software application prototypes which display the functionality of the product under development but may not actually hold the exact logic of the original software.

Initializing of the project was done by this planning phase. The goal of planning was to examine the feasibility of the project. In addition, decisions were made concerning who is the project is carryout, the system has two main components. Android application and server.

The project team analyzed hardware and software requirements in order to start the project and the related research papers about the topic. The team’s work plan was done firstly the interfaces designing and then implementation of the android application. While working on the mobile application plan was also to start the developing of web server, then checking compatibilities between the devices and the server and testing.

There are four members in the team. Requiring and gathering, Designing, Implementation and Testing of the developed system share among the members. All the four members contributed in the implementation of the android application and the web server.

When the team analyzing existing map/navigation and scheduling systems we realize that yet there are information and data everywhere no company or system attempted fill the gap between the user and the information. We did not needed to re-invent the wheel technology was already there, so the team focus on how to present these data to the user. We used Houndify API to calibrate the voice assistant. Assistant will update user about traffic conditions and upcoming schedules/appointments according to the users’ situation through voice or text base. To do that User habit analyzing component will track users usual traveling routes, sleeping and waking patterns, device monitoring data and users likes and dislikes. Also application will prompt questionnaires to user to gather information. When researching through previous work done in the field team realized that Maps/Navigation and Location base scheduling should be an integrated system. Placing appointments on a map based on locations users can get a clear idea about the reachability or
Achievability of appointments using the information presented from the system by analyzing the time difference and traffic conditions between locations. By tracking users’ movement and speed on the route application will re calculate the achievability or reachability of the destination. Also users can contribute to traffic data base using the tweet traffic function.

These data provided by the users’ will be analyze and cross reference with the google traffic data and through confirming data by prompting questions to other users on the same route or near the location. Focus of the research team was to utilize only the hardware and software resources available in the users ‘device. And as for technologies team mostly used Google API s for maps and geo location data gathering.

IV. RESULTS AND DISCUSSION

“Roadie” has been successfully developed and it’s able to predict traffic using google API, able to save places, ask questions based on geo locations, give feedback using a voice assistance and the application is successfully able to prove the need of integrating Navigation/Maps with Scheduling. Also users can contribute to the system using a tweet traffic feature. A walk through of the main interfaces of the system is shown below. Prior to Registering to the application user needs to answer to some questions predefined, or user can skip the process to start the main interface.

In the main interface of the android application will navigate to other main interfaces such as,

- Traffic
- Follow me
- Scheduling
- Shortest path
- My places
- My trip
- Tweet Traffic

Users can save places and get alerts and suggestions when the location is getting close. This suggestions and alerts will receive through text notifications or Voice assistant depending on user’s situation.

Application will backup weeks’ worth users travel data to learn user’s habits, usual traveling places and routes and travel modes.
And using these data application will ask questions randomly from user to store more data regarding users' preferences and dislikes.

When placing an appointment user can set a location of the appointment. Application will check the other appointments placed before with the location and calculate the distance between two destinations. Or it will calculate the distance from the user’s current location. And system will alert user through text and voice base whether he/she will be able to reach the destination on time.

Users can contribute to the traffic database using Tweet traffic feature. Using hashtags user can insert traffic updates to the system. System will then verify the content and push the traffic updates to users on the same route.

“Roadie” was developed to help urban busy travelling citizens to make their daily activities easy by integrating Maps/navigation with Location based scheduling. That was the main target of the research team. Team wanted the application to be as hands-Off possible, because of this team integrated the system with an assistant. During the development of “Roadie” the team had to face some technical issues. Those were like, using GSM 2G network to locate the user modern cell towers rejected to allow access to their location manually. When there is no active data connection confidence...
of locating the user or recognizing the users activity (travel mode, running or walking etc.) is approximately 70 percent.

V. CONCLUSION

Data analytics lead in to take better decisions in order to prepare a solution for a real world problem. With the data gathered and the obtained results through analysis process, there are some notes to take prior to develop the entire system. Results showed that main occupants are working people and students. Most of those occupants are having smart mobile phones and it was a positive sign as far as the research is concerned. Without having a smartphone, it is useless in undertaking the developed solution. Majority of the respondents are travelling by bus, car and motor bicycle. Approximately 50% of those occupants are travelling by their own vehicles like cars and motor bicycles. The developed application is better suited for those who are travelling by their own vehicles and do not aware of routes and traffic jams. According to the analysis, 53% of respondents are using travel guidance application but they are not fully satisfied with it. Understanding their major requirement and compare the current solutions with the developed solution is advantageous prior to develop the application. Most of the respondents are from Colombo and others are around Colombo where different kinds of routes have been utilized. Consideration of almost every route in the map is very important in these circumstances. Higher percentage of respondents are using scheduling applications and they are not necessarily satisfied with it. Some of them have missed on their early meetings as well as lectures due to bad scheduling. Scheduling should be a part of the requirement for the application due to results of the analysis. Best part of the respondent are lacking location awareness and better interaction of users through the developed solution is highly beneficial for users. Majority of respondents are depending on Google Maps and they are having considerable amount of satisfaction with it. Studying and understanding of the process of Google Maps can be effective in developing the application. Higher percentage of respondents have understanding on intelligence applications, but they are not using them in effective manner. Speech Recognition component play a major role in the application. It is necessary to get traffic updates to avoid certain routes and majority of respondents are not getting updates on traffic in daily basis. Functionality to give daily updates on traffic is beneficial for users in many ways.

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Fodder Resources in Temperate Fruit Valley of Western Himalaya, India.

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** Department of Drinking water & Sanitation (SWAJAL)

Abstract- In developing nations agriculture is the bone of economy, which is directly related to livestock farming. Fodder resources are key factor in the hilly area where the economy of local people is much more dependent on their livestock. More than 65% of fodder requirements of animals met out from pasturelands and forests in hilly regions. A sound understanding of utilizations and availability of resources and the impact of herbivores on grassland landscapes is essential for long-term sustainable pastoral production, implying of management practices and for both on-and off-reserve biodiversity conservation.

Chhachpur Valley in Himachal Pradesh is rich in natural resources and people of the area have got the advantage of the good climatic conditions of this valley. Peoples of the area are economically prosperous. Horticulture and livestock farming are the important occupations of the villagers. In this paper fodder resources of Chhachpur valley has been assessed with special reference to animals’ dietary preference to browsing in various seasons.

A total of 240 species from different life forms were listed as fodder species in study area, out of which 122 (50.83%) forbs, 40 (16.66%) grasses, 7 (2.91%) sedges, 15 (6.25%) climbers, 43 (7.91%) shrubs and 13 (5.41%) trees. During the winter season in hills availability of fodder is very less about one fourth of all the resources available mostly grasses and few trees or shrubs.

Index Terms- Fodder resources, Ice-cream species, Livestock, Palatability indices

INTRODUCTION

Livestock is an integral part of environment and economy especially in the rural part of the Himalaya. A large livestock population cannot be maintained on the fodder produced on arable land alone; therefore, they have to largely depend on the forest resources. A sound understanding of the impact of herbivores on grassland landscapes is essential for long-term sustainable pastoral production, implying of management practices and for both on-and off-reserve biodiversity conservation. One aspect of that understanding concerns plant palatability.

Palatability, an intrinsic biological characteristic of plants Vallentine (1990), is an important factor in the selection and, in the consideration of which plants are actually eaten; Vesk and Westoby (2001) and Fletcher and Russell (2003) make it clear that palatability is relative, not absolute. Palatability varies with the driving factors like nutrition value, life span, animal preferences, habit of feeding, part used, availability of fodder resources, growing season etc. It is always site specific and depends on the choice of ungulates and availability of fodder species. In our observation there are many species, which are browsed or eaten in one region by cattle but ignored in other region. Investigate these aspects, it becomes imperative to ascertain benchmark of animal preferences the ice-cream species, the species that are browsed, consumed frequently or rarely, eaten in scarcity or never consumed. Hussain and Mustafa (1995) conducted ecological studies on pasture plants. Noor (1978) compared the grazed and ungrazed vegetation of sub-alpine pasture. Awasthi et al., (2003) give food plants and feeding habits of Himalayan ungulates. Manjrekar (1997) conducted a detail study on the feeding ecology of Himalaya region, ibex (Capra ibex sibirica) in the trans-Himalaya region. Food habits of bharal (Pseudois nayaur) and domestic livestock formed a part of another study carried out by Mishra (2001) in the trans-Himalayan region. There is a very few studies and concise information on plant palatability. For example, the standard and comprehensive reference “Arid Shrub land Plants of Western Australia” (Mitchell and Wilcox 1994), provides only general palatability information (along with ‘Indicator Value’ and ‘Forage Value’) for many of the described plants, using terms such as "palatable", "non-palatable", “unknown” or “not relished by stock”. In a similar vein, Vesk and Westoby (2001) in their Australia-wide literature review of plant responses to grazing, developed a 5-class ranking of species’ palatability to domestic grazers, relying solely on key-words and phrases from the literature. Clearly then, only very generalized palatability
information is available for most species—but in reality, does this level of information provide an adequate contribution to the development of a sound understanding of plant utilization, the use of plants as indicators of grazing pressure and the broader subject of rangeland ecological health. Availability of Fodder resources are key factor in the hilly area where the economy of local people much more dependent on their livestock. More than 65 % of fodder requirements of animals met out from pasturelands and forests in hilly regions.

Present study was carried out in Chhachpur Valley of district Shimla, H.P. in western Himalayan region. An analysis of livestock population shows that the cattle population has declined in last two decades drastically, however, the buffalo or stall fed jersey’s (breed of cow) population increased significantly due to shift in landuse especially for horticultural practices. Crop grown fields or grasslands are now converted into the orchards. Although villagers have reduced the cattle population but still high pressure on resources exists due to migratory cattle population of gujjars and bakarwals. Favourable climatic conditions and geographical feature of the valley had made it rich in natural resources viz., forests, grasslands, water etc. Singh (2007) had given an enumeration of plants of Chhachpur Valley. This study deals with the fodder resources and animal preference to palatability which will give the better understanding of management of fodder resources in future.

MATERIALS AND METHODS

Study Area:
The Chhachpur Valley lies in the Jubbal forest division of district Shimla, Himachal Pradesh in Western Himalaya. It falls between 30° 57' 00” to 31° 25' 20” N latitude and 77° 29' 40” to 78° 18' 42” E longitude. The valley is one of the major apple producing areas of the state. Altitude varies widely from about between 1250m (Kuddu) to 3000m (Chhachpur, Panju) and falls in the lesser Himalayan Ranges. This wide range of altitude and favourable climatic condition make the valley rich in natural resources.

METHODOLOGY

Palatability Assessment

Palatability and non-palatably of the plant species were categorized through personal observation and with the help of information collected from local peoples. Enumerated plant species were examined for the animal preference or rejection to browsing and the species, those are harvested in winter when the fodder resources are very limited, were also listed, plant species, which are otherwise undesirable but only grazed half heartily during scarcity of fodder or droughts, are taken as “non-palatable” and not considered in the list. Putting these facts in mind a palatability indices (PI) i.e. numerals (1, 2, 3 & 4) were made on the basis of best preference of animals for plant during grazing and stall-feeding or their rejection to plant component.

- Species grazed by most of the animals every time has given PI (1).
- Species grazed certain span of life or in vegetative or during new sprouting has given PI (2)
- Species which browsed rarely or in very young stage of sprouting has given PI (3)
- Species, which are undesirable grazed in scarcity of fodder resources, has considered “non-palatable” PI (4) is not counted in list.

After this categorization animals have also special preference or choice for a particular species in other word ‘ice-cream’ species, on this basis rating of their choice for species had categorized as Very High (VH), High (H), Medium (M), Low (L) and Very Low (VL).

RESULTS AND DISCUSSION

Natural resources are the bone of the economy of the rural area of a country. Livestock is an integral part of environment and economy of the rural areas dependent on these resources. Managements of any forest and grasslands depend on the availability of fodder resources and pressure exerted on them. In this paper an attempt has been made to assess the fodder resources of Chhachpur Valley.

The results of study revealed that valley is rich in fodder resources. A total of 240 species from different life forms as palatable species has been reported, out of which 122 (50.83%) are forbs, 40 (16.66%) grasses, 7 (2.91%) sedges, 15 (6.25%) climbers, 43 (17.91%) shrubs and 13 (5.41%) trees (Table 1). Awasthi (2003) reported 140 wild palatable species for different ungulates of Himalaya.
Among the available resources animals have different choice for browsing, from total palatable species about 43.33% (94 & 12 Species) have less and very less preference for browsing, 25 % (57 species) have moderate and remaining 31.16% have high & very high (33 & 44 species) preference for browsing (Table 1). Name of the ice-cream species has given in Table 2. This shows that only one third of the total available resources come in better nutritive fodder as ice-cream species. This can be varying with site, availability of resources and grazing habit of the animals.

Seasonal variation shows remarkable changes in the availability of fodder species in the area. Summer months are abundant with fodder resources. 103 species restricted to summer months, 31 spring & summer, 31 summer to autumn, 11 rainy and 8 for winter. There are only 41 species present in all the seasons mostly grasses (Table-2), and most of the fodder requirements meet from these species during the scarcity of fodder resources during winter grasses are browsed in their dead stage or as dried for hay, Brown Oak (*Quercus semicarpifolia* and *Q. floribunda*) formed important diet component during winter at upper reaches where most of the forbs under snow and dried up, this similar observation given by Miashra and Johnsigh (1996).

In Appendix I-V, Palatable plant species from different life forms with their palatable indices (PI), part used, seasons, dietary preference, frequency and animals feed has been reported.

**CONCLUSION**

Better understanding of palatability will help in the management of fodder resources. Non-scientific and unmanaged traditional grazing system deteriorating these rangeland, in grazed area undesirable or non-palatable plant species were received mostly, ice-cream highly palatable species mainly recorded in managed area i.e. agro-ecosystem and control burning and protection or moderately grazed area.

**APPENDIX**

**Table 1**: Animals preference to browsing of various life forms of plant species in Chhachpur Valley.

<table>
<thead>
<tr>
<th>Preference for browsing by animals</th>
<th>Forbs</th>
<th>Grasses</th>
<th>Sedges</th>
<th>Climbers</th>
<th>Shrubs</th>
<th>Trees</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High (VH)</td>
<td>17</td>
<td>13</td>
<td>0</td>
<td>04</td>
<td>06</td>
<td>04</td>
<td>44</td>
</tr>
<tr>
<td>High (H)</td>
<td>11</td>
<td>11</td>
<td>0</td>
<td>05</td>
<td>04</td>
<td>02</td>
<td>33</td>
</tr>
<tr>
<td>Moderate (M)</td>
<td>23</td>
<td>09</td>
<td>01</td>
<td>06</td>
<td>15</td>
<td>03</td>
<td>57</td>
</tr>
<tr>
<td>Less (L)</td>
<td>67</td>
<td>07</td>
<td>02</td>
<td>0</td>
<td>15</td>
<td>03</td>
<td>94</td>
</tr>
<tr>
<td>Very Less (VL)</td>
<td>04</td>
<td>0</td>
<td>04</td>
<td>0</td>
<td>03</td>
<td>01</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
<td>40</td>
<td>7</td>
<td>15</td>
<td>43</td>
<td>13</td>
<td>240</td>
</tr>
</tbody>
</table>
### Table 2: Palatable resources of high dietary preference (Ice-cream species) among animals in various Seasons.

<table>
<thead>
<tr>
<th>Seasonal availability/browsing period</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
<th>Rainy</th>
<th>Autumn</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forbs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brassica campestris</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Arabidopsis thaliana</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardamine flexuosa</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cardamine impatiens</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cerastium cerastoides</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cerastium glomeratum</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gypsophila cerstiodes</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stellaria latifolia</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stellaria media</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stellaria monosperma</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lathyrus aphaca</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lotus corniculatus</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Trifolium corniculatus</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Anagallis arvensis</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vicia hirsute</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vigna vexillata</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Galinsoga parviflora</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Grasses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capillipedium parviflorum</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Heteropogon contortus</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Chrysopogon serratulus</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Themeda anthera</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Chrysopogon gryllus</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cymbopogon jwarancusa</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cynodon dactylon</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
### Table 3: Seasonal fodder resources of Chhachpur Valley.

<table>
<thead>
<tr>
<th>Seasonal availability/blooming period</th>
<th>Forbs</th>
<th>Grasses</th>
<th>Sedges</th>
<th>Climbers</th>
<th>Shrubs</th>
<th>Tree lopped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>06</td>
<td>05</td>
</tr>
<tr>
<td>Winter - Spring</td>
<td>07</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>01</td>
<td>-</td>
</tr>
<tr>
<td>Spring - Summer</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>02</td>
<td>04</td>
<td>-</td>
</tr>
<tr>
<td>Summer</td>
<td>64</td>
<td>02</td>
<td>02</td>
<td>10</td>
<td>21</td>
<td>04</td>
</tr>
<tr>
<td>Summer-Rainy</td>
<td>06</td>
<td>-</td>
<td>05</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Summer-Autumn</td>
<td>15</td>
<td>06</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Present in all seasons</td>
<td>05</td>
<td>32</td>
<td>-</td>
<td>03</td>
<td>01</td>
<td>-</td>
</tr>
</tbody>
</table>
Appendix I: Palatable Forb of Chhachpur Valley in relation to animal use and preference (Cattle, sheep and Goat)

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Habit</th>
<th>Part Used</th>
<th>Palatability Indices</th>
<th>Seasons</th>
<th>Preference for Browsing by animal</th>
<th>Harvesting time for storage of hay making</th>
<th>Frequency</th>
<th>Animal feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brassica campestris</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Arabidopsis thaliana</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Cardamine flexsosa</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Cardamine impatiens</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Cerastium cerastoides</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Cerastium glomeratum</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Gypsophila cerastioides</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Stellaria latifolia</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Stellaria media</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Stellaria monosperma</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Rare</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Lathyrus aphaca</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Rare</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Lotus corniculatus</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Rare</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Trifolium pratense</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Rare</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Anagallis arvensis</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Vicia hirsute</td>
<td>Forb</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Wnt., Spr.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Vigna vexillata</td>
<td>Forb</td>
<td>Wh., Pt.</td>
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<td>Frqt.</td>
<td>Cattle, &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Urtica ardens</em></td>
<td>Forb</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Thrht. Yr. L</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Urtica dioica</em></td>
<td>Forb</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Thrht. Yr. L</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Anemone vitifolia</em></td>
<td>Forb</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Spr., Sum. VL</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ranunculus laetus</em></td>
<td>Forb</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Spr., Sum. VL</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Elsholtzia pilosa</em></td>
<td>Forb</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.-Atm. VL</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Juncus glaucus</em></td>
<td>Forb</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Thrht. Yr. VL</td>
<td>Rare</td>
<td>Cattle</td>
<td></td>
<td></td>
</tr>
</tbody>
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**Appendix II:** Palatable Grasses and sedges of Chhachpur Valley
<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Habit</th>
<th>Part Used</th>
<th>Palatability indices</th>
<th>Seasons</th>
<th>Preference for Browsing by animal</th>
<th>Harvesting time for storage of hay making</th>
<th>Frequency</th>
<th>Animal feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cymbopogon jwarancusa</td>
<td>Grass</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Thrht. Yr.</td>
<td>VH</td>
<td>Sept.-Oct.</td>
<td>Abd.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Cydonodactylon</td>
<td>Grass</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Thrht. Yr.</td>
<td>VH</td>
<td>-</td>
<td>Abd.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Avena fatua</td>
<td>Grass</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Sum.</td>
<td>VH</td>
<td>-</td>
<td>Abd.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Agrostis pilosula</td>
<td>Grass</td>
<td>Wh., Pt.</td>
<td>2</td>
<td>Thrht. Yr.</td>
<td>H</td>
<td>-</td>
<td>Abd., Hgr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Aplula mutica</td>
<td>Grass</td>
<td>Wh., Pt.</td>
<td>2</td>
<td>Thrht. Yr.</td>
<td>H</td>
<td>-</td>
<td>Abd., Hgr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Echinochloa columnum</td>
<td>Grass</td>
<td>Yng Tilr</td>
<td>2</td>
<td>Sum.</td>
<td>M</td>
<td>-</td>
<td>Abd.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Bromus asper</td>
<td>Grass</td>
<td>Wh., Pt.</td>
<td>2</td>
<td>Thrht. Yr.</td>
<td>M</td>
<td>-</td>
<td>Abd., Lwr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
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</table>
### Appendix III: Palatable Climbers of Chhachpur Valley

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<thead>
<tr>
<th>Plant Species</th>
<th>Habit</th>
<th>Part Used</th>
<th>Palatability indices</th>
<th>Seasons</th>
<th>Preference for Browsing by animal</th>
<th>Frequency</th>
<th>Animal feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhynchosia himalensis</td>
<td>Climber</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Sum.</td>
<td>VH</td>
<td>Frqt., Lwr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Vicia sativa</td>
<td>Climber</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Vicia tetrasperma</td>
<td>Climber</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
</tbody>
</table>
### Appendix IV: Palatable Shrubs of Chhachpur Valley

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Habit</th>
<th>Part Used</th>
<th>Palatability indices</th>
<th>Seasons</th>
<th>Preference for Browsing by animal</th>
<th>Frequency</th>
<th>Animal feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berberis chitria</td>
<td>Shrub</td>
<td>Lvs. Twigs</td>
<td>1</td>
<td>Winter.</td>
<td>VH</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
</tr>
<tr>
<td>Berberis lycium</td>
<td>Shrub</td>
<td>Lvs. Twigs</td>
<td>1</td>
<td>Winter.</td>
<td>VH</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
</tr>
<tr>
<td>Desmodium floribundum</td>
<td>Shrub</td>
<td>Lvs. Twigs</td>
<td>1</td>
<td>Sum., Atm.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Desmodium racemosum</td>
<td>Shrub</td>
<td>Lvs. Twigs</td>
<td>1</td>
<td>Sum., Atm.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Indigofera gangetica</td>
<td>Shrub</td>
<td>Lvs. Twigs</td>
<td>1</td>
<td>Sum., Atm.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Indigofera heterantha</td>
<td>Shrub</td>
<td>Lvs. Twigs</td>
<td>1</td>
<td>Sum., Atm.</td>
<td>VH</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Reimwardia indica</td>
<td>Shrub</td>
<td>Wh., Pt.</td>
<td>1</td>
<td>Spr., Sum.</td>
<td>H</td>
<td>Frqt., Lwr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Debregeasia velutina</td>
<td>Shrub</td>
<td>Lvs. Twigs</td>
<td>1</td>
<td>Winter.</td>
<td>H</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
</tr>
<tr>
<td>Zanthoxylum armatum</td>
<td>Shrub</td>
<td>Lvs., twigs</td>
<td>2</td>
<td>Winter.</td>
<td>H</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
</tr>
<tr>
<td>Cotoneaster rotundifolia</td>
<td>Shrub</td>
<td>Lvs.</td>
<td>2</td>
<td>Thrht. Yr.</td>
<td>H</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
</tr>
<tr>
<td>Indigofera dosua</td>
<td>Shrub</td>
<td>Lvs. Twigs</td>
<td>2</td>
<td>Sum.-Atm.</td>
<td>M</td>
<td>Frqt., Lwr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Rosa brunonii</td>
<td>Shrub</td>
<td>Lvs.</td>
<td>2</td>
<td>Spr., Sum.</td>
<td>M</td>
<td>Frqt., Hgr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
</tr>
<tr>
<td>Rubus ellipticus</td>
<td>Shrub</td>
<td>Lvs.</td>
<td>2</td>
<td>Winter.</td>
<td>M</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
</tr>
<tr>
<td>Rubus lasiocarpus</td>
<td>Shrub</td>
<td>Lvs.</td>
<td>2</td>
<td>Sum.-Atm.</td>
<td>M</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
</tr>
<tr>
<td>Rubus macilentus</td>
<td>Shrub</td>
<td>Lvs.</td>
<td>2</td>
<td>Winter.</td>
<td>M</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
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</table>
### Appendix V: Palatable Tree Species lopped by local people to feed their animals in Chhachpur Valley

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Habit</th>
<th>Part Used</th>
<th>Palatability indices</th>
<th>Seasons</th>
<th>Preference for Browsing by animal</th>
<th>Lopping seasons</th>
<th>Frequency</th>
<th>Animal feed</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Spiraea canescens</em></td>
<td>Shrub</td>
<td>Lvs., Twigs</td>
<td>2</td>
<td>Sum.</td>
<td>M</td>
<td>Frqt., Hgr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Spiraea sorbifolia</em></td>
<td>Shrub</td>
<td>Lvs., Twigs</td>
<td>2</td>
<td>Sum.</td>
<td>M</td>
<td>Frqt., Hgr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Lespedeza Gerardiana</em></td>
<td>Shrub</td>
<td>Lvs., Twigs</td>
<td>2</td>
<td>Sum.-Atm.</td>
<td>M</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td>* Cotoneaster baccarum*</td>
<td>Shrub</td>
<td>Lvs.</td>
<td>2</td>
<td>Winter-Spr.</td>
<td>M</td>
<td>Frqt., Hgr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Inula cuspidata</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>2</td>
<td>Sum.</td>
<td>M</td>
<td>Frqt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Lonicera quinquilocularis</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>M</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Viburnum moha</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>M</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Viburnum nervosum</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>M</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Roslea calycina</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>M</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Sarcococa saligna</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Rare</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Berberis aristata</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt., Hgr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Berberis asiatica</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt., Hgr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
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<tr>
<td><em>Hypericum oblongifolium</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Lespedeza juncea</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt., Lwr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Lespedeza sericea</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt., Lwr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
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<tr>
<td><em>Deutzia staminea</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Sum.-Atm.</td>
<td>L</td>
<td>Frqt., Hgr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
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<tr>
<td><em>Cyathula capitata</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Cyathula tomentosa</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Lamium album</em></td>
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<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Calamintha umbrosa</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Urena lobata</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Rare</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
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<tr>
<td><em>Potentilla fruticosa</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Rare</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Jasminum humile</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Spr., Sum.</td>
<td>L</td>
<td>Frqt., Hgr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Cynanchum vincetoxicum</em></td>
<td>Shrub</td>
<td>Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>L</td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Elsholtzia cristata</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>VL</td>
<td>Frqt., Hgr Alt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Coriaria nepalensis</em></td>
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<td>Lvs.</td>
<td>3</td>
<td>Sum.</td>
<td>VL</td>
<td>Frqt., Hgr Alt.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
</tr>
<tr>
<td><em>Buddleja asiatica</em></td>
<td>Shrub</td>
<td>Yng Lvs.</td>
<td>3</td>
<td>Spr., Sum.</td>
<td>VL</td>
<td>Frqt., Lwr Alt.</td>
<td>Goats &amp; Sheep</td>
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</tr>
<tr>
<td>Plant Name</td>
<td>Type</td>
<td>Part(s)</td>
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<td>L. Frqt.</td>
<td>Herbivores</td>
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<td>--------</td>
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<td>---------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machilus gamblei</td>
<td>Tree</td>
<td>Lvs., Twig</td>
<td>2</td>
<td></td>
<td></td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pyrus pashia</td>
<td>Tree</td>
<td>Lvs.</td>
<td>3</td>
<td></td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symlocos paniculata</td>
<td>Tree</td>
<td>Lvs.</td>
<td>3</td>
<td></td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ficus palmate</td>
<td>Tree</td>
<td>Lvs.</td>
<td>3</td>
<td></td>
<td>L. Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alnus nitida</td>
<td>Tree</td>
<td>Lvs.</td>
<td>3</td>
<td></td>
<td>Frqt.</td>
<td>Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morus serrata</td>
<td>Tree</td>
<td>Lvs., Twig</td>
<td>1</td>
<td></td>
<td>LH Sum.</td>
<td>Cattle, Goats &amp; Sheep</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Cattle: Buffalos, Cows and Oxen; Wh., Pt.: Whole Plant; Lvs.: Leaves; Lvs., Yng St.: Leaves, Young shoot or stem; Yng Lvs.: Young Leaves; Yng TIlr.: Young Tillers; VH: Very High; H: High; M: Medium; L: Low; VL: Very Low; V. Frqt.: Very Frequent; Frqt.: Frequent; Frqt., Hgr Alt.: Frequent Higher Altitude; Frqt., Lwr Alt.: Frequent Lower Altitude; L. Frqt.: Less Frequent; VR: Very Rare; Wnt., Spr.: Winter, Spring; Sum.: Summer; Thrht. Yr.: Throughout Year; Wnt.: Winter; Atm.: Autumn; Abd: Abundant

**REFERENCES**


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Preliminary Study of Optimization Model of Local Government Infrastructure Asset Management to Improving the Sustainable Development Performance

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Abstract- Infrastructure development is an important aspect in the process of accelerating national development. The availability of adequate infrastructure is needed in support of various economic, industry, and social activities in the community. The main weakness of both central and local government in the implementation of infrastructure development is the management of infrastructure assets. Good asset management will certainly be the right solution to optimize the functioning and sustainability of existing infrastructure assets. This research analyzes an optimization asset management model that can be applied by local government in improving the performance of sustainable development. The analysis used in this preliminary study is limited to the determination stage of factors and research variables, where the approach used is literature review approach with comparative analysis literature method. In its application, a number of literature were collected for comparisons of literary opinions as a basis for determining the variables and research factors. The result of the research shows that there are 6 factors of infrastructure asset management that influence to improve the performance of sustainable development such as planning, procure, operational and maintenance, monitoring and evaluation, renewal/rehabilitation and improvement, and asset disposal, which is then called life cycle infrastructure asset management. In addition, 56 research variables were also identified based on these factors. The approach that can be used in measuring the performance of sustainable development is to determine performance indicators as a reference comparison of development results that have been or are being implemented with strategic development goals. In addition, there is also a need to evaluate the performance of development that can be done by using Multivariate Regression Analysis, Data Development Analysis, or Iterative Generalized Least Square (IGLS) method.

Index Term- Infrastructure Asset Management, Model Optimization, and Sustainable Development.

I. BACKGROUND OF RESEARCH PROBLEMS

Infrastructure system becomes the main supporter of social system function and economic system in society life. Infrastructure is a physical system needed to meet basic human needs in the social and economic sphere. The meaning of basic human needs can be in the form of water supply, electric power, waste disposal, transportation and similar services to facilitate social and economic goals.

Infrastructure development is an important aspect in the process of accelerating national development. The availability of adequate infrastructure is needed in support of various economic activities, industry, and social activities in the community. Infrastructure enables an area to work properly, so that the progress of a region can be seen from the successful development of its sustainable infrastructure.

The main weakness of both central and local government in the implementation of infrastructure development is the management of infrastructure assets. Generally, the government seems able to buy, but less able to maintain, so many infrastructure assets are damaged and not maintained. In this case, good asset management can be a solution to optimize the functioning and sustainability of existing infrastructure assets, without having to rebuild new infrastructure that would later be neglected as well because of weaknesses in the management of these infrastructure assets.

The management of infrastructure assets leads to a systematic process that monitors, maintains, upgrades, operates, and keeps valuable things to an entity or group in relation to the functioning of the asset. Infrastructure asset management can be defined as a combination of management, finance, economics, engineering, and other practices applied to physical assets of infrastructure with the aim of improving services in the most efficient and efficient way. In the public sector, physical assets and infrastructure can be in the form of production and generation of electricity, water and sewage.
treatment services, distribution networks, transportation systems, buildings, and so on. The amount of investment embedded in the asset leads to the need for maximal management of the asset.

Among the physical asset classes in some infrastructure domains, such as roads and sidewalks, railroads, bridges, and distribution pipelines are about its existence as part of a network, as well as its continuous linearity. It is necessary to review because the failure or loss of infrastructure performance in a small segment of an infrastructure system can affect the whole system, if the asset is not monitored and the risk is not properly managed.

In general, regional infrastructure assets are an important resource for local governments as a key source of local revenue. Therefore, it is important for local governments to be able to optimize the functioning and sustainability of the region's wealth assets, so that an asset management model optimization that can be implemented by the local government in improving the performance of sustainable development.

The Asian Development Bank (2009) defines sustainable infrastructure development as a new infrastructure design and re-planning, rehabilitation and reuse and optimization of existing infrastructure including maximizing renewable energy utilization and minimizing environmental impacts, providing for local communities including the poor, controlling infrastructure expenditures and corruption, and finding the appropriate role for the government and the private sector in meeting the financing needs and management of infrastructure activities. Sustainable infrastructure development will pay attention to environmental, economic and social aspects.

This study is a preliminary study that examines the factors and variables of local government infrastructure asset management in improving the performance of sustainable development through literature review approach with comparative analysis method. This research will be continued by analyzing the ways or methods that can be done to measure the performance of sustainable development.

II. RESEARCH PROBLEMS

Based on the above background, the subject matter in this study can be formulated, namely:

1. What are local government infrastructure asset management factors in improving the performance of sustainable development?
2. What are the variables of local government infrastructure asset management in improving the performance of sustainable development?
3. How to measure the performance of sustainable development?

III. LITERATURE REVIEW

3.1 Infrastructure Asset Management

Asset management is a new theory in the science of property that arises from the fact that a region especially Indonesia that has a wealth of resources, both natural resources, human and infrastructure. The following will explain the definition of asset management.

Management is a series of processes consisting of planning, organizing, actuating, controlling and budgeting (Nawawi, 2003). The definition of an asset is a thing or something that has economic value, commercial value or exchange value owned by a business entity, agency or individual. There are two types of assets: tangible and intangible assets (Siregar, 2004).

Intangible assets are non-financial assets that are identifiable and have no physical form and are held for use in the production of goods or services or used for other purposes including intellectual property rights, while tangible assets with a useful life better than twelve months for use in government activities or utilized by the general public. Tangible assets (tangible) include land, equipment and machinery, buildings and buildings, roads, irrigation, and networks.

The notion of asset management is clarified by Hastings (2010) arguing that asset management is a series of activities related to identifying what assets need, identifying funding needs, acquiring assets, providing logistical support and maintenance systems for assets, removing or renewing assets so that effectively and efficiently meet the objectives.

Asset management is the science and art to guide wealth management that includes the process of planning asset needs, obtaining, inventorying, legal auditing, appraising, operating, maintaining, renewing or eliminating to transfer assets effectively and efficiently (Sugiama, 2013).

Based on the above opinion, it can be seen that the management of infrastructure assets is a process or activity related to the management of infrastructure assets with the aim of streamlining and streamlining the functioning and sustainability of assets, either in the form of tangible or intangible assets.
3.2 Local Infrastructure Assets

Infrastructure assets are assets that serve the public interest, the cost of spending on infrastructure assets is determined by the continuity of the use of the assets concerned, such as roads, bridges, and so on (Hariyono, 2007).

Local infrastructure assets are derived from two sources, namely from APBD and from outside the APBD. In short, assets sourced from APBD implementation are the output/outcome of the realization of capital expenditure in one budget year, while assets sourced from outside APBD implementation is the acquisition of assets not due to the realization of local budgets, both capital expenditure budget and personnel expenditure and goods expenditure and services. These assets are usually obtained from World Bank, Corporate Social Responsibility (CSR), and other assistance.

3.3 Optimization of Regional Infrastructure Assets

Asset optimization is a work process in asset management that aims to optimize the physical, location, value, volume, legal, and economic potential of the asset. In this stage of optimization, state-owned assets are identified and grouped based on the potential of the asset. Assets that have potential that can be grouped based on the leading sectors that become the foundation in the national economic development strategy, both short, medium, and long term. Optimization of asset management must maximize asset availability, maximize asset utilization and minimize cost of ownership (Siregar, 2004).

The objectives of optimizing local infrastructure assets in general include identifying and inventoring all local assets (including form, size, physical, legal) as well as knowing the market value of each asset reflecting its economic benefits, the utilization of assets in accordance with its intended use, and create an information and administration system so that the achievement of efficiency and effectiveness in asset management.

3.4 Sustainable Development Performance

Bruntland in the World Commission on Environmental Development (WCED) in 1987 mentions the notion of sustainable development is development that seeks to meet the needs of today without reducing the ability of future generations to meet their needs.

The performance of sustainable development is the result of work that has strong links with strategic development goals that contribute to social and economic value. The performance control process generally consists of three basic steps, namely setting performance standards in the form of budgeted schedules and costs, measuring performance against standards by comparing actual performance with performance standards, and performing corrective actions in case of deviation standard set (Dipohusodo, 1996).

3.5 Relevant Research Results

Several selected research results as the basis of reference support in this study are shown in table 1 below:

<table>
<thead>
<tr>
<th>Research Topic</th>
<th>Relevant Essentials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying Rehabilitation Options for Optimum Improvement in Municipal Asset Condition Zafar Khan, Osama Moselhi, Tarek Zayed – 2014</td>
<td>This study analyzes the most appropriate municipal asset rehabilitation techniques. Methodologies for addressing proposed asset management issues are model identification that illustrates the level of asset services, models for measuring the condition of assets based on performance, and fuzzy-logic models mapping the level of service to the assessment of asset conditions.</td>
</tr>
<tr>
<td>Asset Management Assessment Model for State Departments of Transportation Steven R. Cooksey, David Hyung Seok Jeong, Myung Jin Chae – 2011</td>
<td>This study develops a model for measuring the level of asset management implementation for benchmarking purposes. Models are developed through identification of indicators that demonstrate successful practices for an ideal AM system. The method used is Analytical Hierarchy Process (AHP).</td>
</tr>
<tr>
<td>Asset Management for Urban Wastewater Pipeline Networks Rita Ugarelli, Venkatesh, Vittorio Di Federico, Sveinung Saegrov – 2010</td>
<td>This study discusses the requirements and constraints of asset management implementation in the Oslo Vann og Avløpsetaten pipeline study case in the Norwegian Capital. The results show that a very effective information management system is the backbone of asset management.</td>
</tr>
<tr>
<td>Asset Management Perspective on the Duration of Public-Private Partnership Contracts: Cost Control Trade-off Marc van Buiten, Andreas Hartmann – 2014</td>
<td>This study adopts an asset management perspective on the issue of contract duration in public-private partnership (PPP) contracts with the aim of deepening the effect of network level assets of the most important contract parameters such as contract duration.</td>
</tr>
<tr>
<td>Life Cycle Asset Management Methodologies for Buildings Michael N. Grussing – 2013</td>
<td>This study identifies various approaches in building life cycle asset management, reviewing the benefits and challenges of current practice conditions, and proposing a framework for achieving better information facilities for decision-making facilities that can be acted upon.</td>
</tr>
<tr>
<td>Managing Ancillary Transportation Assets: The State of the Practice Margaret-Avis Akofio-Sowah, Richard Boadi, Adjo Amekudzi, Michael Meyer – 2013</td>
<td>This study analyzes the state of the management practices of additional traffic signs and barriers to assess the need for successful implementation of the program by highlighting data collection and cost strategies, data analysis tools, and data usage in making decisions.</td>
</tr>
<tr>
<td>Data Integration of Pavement Markings: A Case in Transportation Asset Management William E.S, William Rasdorf, Joseph E. Hummer, Hugh A. Devine – 2009</td>
<td>This study discusses integrated transportation asset management system combined with computerized software system. This system includes algorithms, which implements data structures and predictive models to estimate asset conditions at any point of time or space on the road system.</td>
</tr>
<tr>
<td>Event-Based Approach to Optimize the Timing of Water</td>
<td>This research analyzes the recommendation of asset management optimization to the municipality in</td>
</tr>
<tr>
<td>Title</td>
<td>Abstract</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Main Rehabilitation with Asset Management Strategies</td>
<td>planning the rehabilitation of water resources more rationally, with the aim of developing an event-based approach in optimizing water resource rehabilitation time.</td>
</tr>
<tr>
<td>Importance of Workplace Relationships and Attitudes towards Organization of Change in Engineering Asset-Management Organizations</td>
<td>This study analyzes the impact of workplace relationships (organizational support and perceived leader leadership) on organizational change attitudes, affective commitment, and psychological well-being for Australian asset managers, engineers and technicians working in the management of physical assets.</td>
</tr>
<tr>
<td>Building a Proactive, Engagement Culture in Asset Management Organizations</td>
<td>The research develops a pathway model to examine the perceived impact of organizational support from a member-member exchange organization culture within an asset management organization in Australia. The model is analyzed by the smallest partial squares modeling method.</td>
</tr>
</tbody>
</table>

IV. RESEARCH METHODOLOGY

4.1 Optimization of Research Framework Models

To understand more clearly this research, the optimization of the research framework model is done by grouping the material into several parts with the order as shown in Figure 1 below:

![Figure 1 Research Framework](image)

4.2 Research Process

The study was conducted using an explorative study approach consisting of literature study, questionnaire survey, and expert interview. In summary, the research process undertaken can be observed in Figure 2 below:

![Figure 2 Research Process](image)
This study is a preliminary study of optimization research model of asset management is limited to the determination phase of factors and research variables. Research begins with the selection of problems followed by a preliminary study with the intent to seek information required by the researcher to make the problem clear. The next stage is to formulate the problem so that research can be done best, and clearly must start from where. After formulating the problem, the study proceeds to formulate a basic assumption or something that is believed to be true by the researcher who will serve as the research reference, choose the type of approach to be used, and determine the factors and variables based on the source of research data.

4.3 Research Instruments
The research instrument is a tool used by researchers to obtain data. In this study, the instrument to be used is a questionnaire. Questionnaires are designed based on information obtained in the previous research literature. The distribution of questionnaires was conducted to local government agencies involved in the management of infrastructure assets in Bengkulu and Jakarta Provinces. Distribution of questionnaires will be done at the next stage of research is the stage of data collection.

4.4 Data Collection Techniques
Techniques or methods of data collection is a way done by researchers to obtain the necessary data in a study. Data is a collection of facts obtained from a measurement. A good decision-making is the result of drawing conclusions based on accurate data or facts. In general, the data in this study is divided into two data sources namely primary data sources and secondary data.

4.4.1 Primary Data
The primary data collection in this research will be conducted by questionnaire survey of research respondents involved in infrastructure asset management in Bengkulu and Jakarta Provinces.

4.4.2 Secondary Data
Secondary data collection conducted by researchers in a way not directly to the object of research, but through documents related to the object of research. Secondary data collection will be done through official website of Public Works Department of Indonesia, Central Bureau of Statistics, and other official elements involved in infrastructure asset management in Bengkulu and Jakarta Provinces.

4.4.3 Measuring Instruments
Measuring tool that will be used in this research is questionnaire with Likert scale. Likert scale is used to measure attitude, opinion, influence and perception of a person or group of people about social phenomenon. In the Likert scale procedure, a number of questions are constructed with the respondent's answer being in one continuum with a given weight.

4.5 Research Sites
This research will be conducted at two research sites, namely Bengkulu and Jakarta Provinces by reviewing the management of infrastructure assets in both locations.

4.6 Research Respondents
Respondents in this study are local government agencies as well as other administrative elements involved in the management of infrastructure assets in Bengkulu and Jakarta Provinces.

4.7 Research Analysis Methods
The analysis used in this preliminary study is limited to the determination stage of research variables, where the approach used is literature review approach with comparative analysis literature method. In its application, a number of literature will be collected for comparisons of literary opinions as a basis for determining factors and research variables.

V. ANALYSIS
5.1 First Research Problems Analysis
The first research problem focuses on the influential infrastructure asset management factors in improving the performance of sustainable development. The research factor is the object of observation that plays a role in the event and the phenomena to be studied. The most influential indicator of asset management factors influencing life cycle infrastructure asset management is life cycle infrastructure asset management.

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Within the scope of an area, asset management is regulated in PP. 6 of 2006 on Management of Regional Property, which is then followed up with Permendagri No. 17 of 2007 on Guidelines for Management of Regional Property. The scope of asset management involves planning of needs and budgeting, procurement, use, utilization, security and maintenance, valuation, deletion, alienation, administration and coaching, supervision and control.

In opinion of Hariyono (2007), the life cycle of an asset has three phases which include acquisition, operation, and disposal. Then an advanced process is the planning phase, which is an advanced process, in which the output of each phase is used as input for planning. An asset has a life cycle in order to differentiate responsibilities from each phase of its handling. In particular, the responsibility for the procurement decision of an asset in an organization differs from the responsibility for the operation and maintenance of the asset as well as with the responsibility for the removal of an asset.

Understanding of life cycle asset management is further explained by Campbell et al. (2011) stating that the life cycle of an asset is a strategy, plan, evaluate / design, procure, operate, maintain, modify, (dispose).

In opinion of Sugiama (2013), the life cycle of asset management includes asset asset planning, asset acquisition, asset inventory, asset audit, asset valuation, asset operation and maintenance, asset renewal / asset replacement, asset removal, asset transfer.

In infrastructure, life cycle asset management is also described in the 2002 International Infrastructure Management Manual (IIMM) which summarizes all practices related to management strategies as part of the asset life cycle, namely requirements definition, asset planning, asset creation, operations and maintenance, asset monitoring, renewal / rehabilitation, and disposal.

Table 2 below shows the literature compare analysis of the determination of research factors based on life cycle asset management indicators.

<table>
<thead>
<tr>
<th>Literary Opinion</th>
<th>Life Cycle Asset Management</th>
</tr>
</thead>
</table>

Based on the above opinion, infrastructure asset management factors in terms of life cycle asset management indicators are planning, procure, operational and maintenance, monitoring and evaluation, renewal / rehabilitation and improvement, and the disposal of assets shown in Figure 3 below:

**Figure 3 Life Cycle Infrastructure Asset Management**

5.2 Analysis of Second Research Problems

The second research problem is about the variables that affect the management of infrastructure assets in improving the performance of sustainable development. The research variables are the small parts of the research factors related to

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the research focus to be studied. Determination of variables in this study was done by analyzing the opinions of literature as shown in table 3 below:
<table>
<thead>
<tr>
<th>Numbr.</th>
<th>Research Factors</th>
<th>Research Variables</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Planning</td>
<td></td>
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<tr>
<td></td>
<td>X1</td>
<td>Resource Allocation</td>
<td>Cooksey et al. (2011)</td>
</tr>
<tr>
<td></td>
<td>X2</td>
<td>Decision based on condition data</td>
<td>Cooksey et al. (2011)</td>
</tr>
<tr>
<td></td>
<td>X3</td>
<td>Planning needs and budgeting</td>
<td>Grussing (2013)</td>
</tr>
<tr>
<td></td>
<td>X4</td>
<td>Asset Mapping</td>
<td>Khan et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X5</td>
<td>Risk estimation,</td>
<td>Ugarelli (2010)</td>
</tr>
<tr>
<td></td>
<td>X6</td>
<td>Identification of assets</td>
<td>Hastings (2010)</td>
</tr>
<tr>
<td></td>
<td>X7</td>
<td>Asset tracking</td>
<td>Hastings (2010)</td>
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<tr>
<td></td>
<td>X8</td>
<td>Feasibility study</td>
<td>Hastings (2010)</td>
</tr>
<tr>
<td></td>
<td>X9</td>
<td>Identify potential asset</td>
<td>Hastings (2010)</td>
</tr>
<tr>
<td></td>
<td>X10</td>
<td>Market and financial analysis</td>
<td>Roshani &amp; Fillon (2014)</td>
</tr>
<tr>
<td>2.</td>
<td>Create Procure</td>
<td></td>
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<tr>
<td></td>
<td>X11</td>
<td>Identify the asset needs</td>
<td>Grussing (2013)</td>
</tr>
<tr>
<td></td>
<td>X12</td>
<td>Efficiency of asset needs procurement</td>
<td>Khan et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X13</td>
<td>Utilization of asset</td>
<td>Buiten et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X14</td>
<td>Analysis of asset potential</td>
<td>Sowah et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X15</td>
<td>Developing and refining policies</td>
<td>Hastings (2010)</td>
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<tr>
<td></td>
<td>X16</td>
<td>Determining the infrastructure delivery method</td>
<td>Hastings (2010)</td>
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<tr>
<td></td>
<td>X17</td>
<td>Asset provided by others</td>
<td>Hastings (2010)</td>
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<tr>
<td></td>
<td>X18</td>
<td>Project managing the asset procurement process</td>
<td>Hastings (2010)</td>
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<tr>
<td></td>
<td>X19</td>
<td>Commissioning and handover of assets</td>
<td>Hastings (2010)</td>
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<tr>
<td></td>
<td>X20</td>
<td>Evaluating the project (post-completion review)</td>
<td>Hastings (2010)</td>
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<tr>
<td>3.</td>
<td>Operation and Maintenance</td>
<td></td>
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<td></td>
<td>X21</td>
<td>Level of asset service improvement</td>
<td>Hastings (2010)</td>
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<tr>
<td></td>
<td>X22</td>
<td>Asset grouping</td>
<td>Hastings (2010)</td>
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<td></td>
<td>X23</td>
<td>Improvement organizationl culture AM</td>
<td>Hastings (2010)</td>
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<td></td>
<td>X24</td>
<td>Increased asset productivity</td>
<td>William et al. (2009)</td>
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<tr>
<td></td>
<td>X25</td>
<td>Asset integrated control</td>
<td>Brunetto et al. (2014)</td>
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<tr>
<td></td>
<td>X26</td>
<td>Computerized inventory technology</td>
<td>Sowah et al. (2014)</td>
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<td></td>
<td>X27</td>
<td>Human resource development in AM</td>
<td>Sowah et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X28</td>
<td>The design of an asset optimization program</td>
<td>Buiten et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X29</td>
<td>Cost, quality, and time control</td>
<td>Buiten et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X30</td>
<td>Physical Approach and Legality</td>
<td>Khan et al. (2014)</td>
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<tr>
<td></td>
<td>X31</td>
<td>Asset condition assessment</td>
<td>Grussing (2013)</td>
</tr>
<tr>
<td></td>
<td>X32</td>
<td>AM information system</td>
<td>Roshani &amp; Fillon (2014)</td>
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<tr>
<td>4.</td>
<td>Monitoring and Evaluation</td>
<td></td>
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<tr>
<td></td>
<td>X33</td>
<td>Codification/labeling assets</td>
<td>Buiten et al. (2014)</td>
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<tr>
<td></td>
<td>X34</td>
<td>Asset assessment</td>
<td>Cooksey et al. (2011)</td>
</tr>
<tr>
<td></td>
<td>X35</td>
<td>Quality information and analysis</td>
<td>Cooksey et al. (2011)</td>
</tr>
<tr>
<td></td>
<td>X36</td>
<td>Asset inventory</td>
<td>Cooksey et al. (2011)</td>
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<tr>
<td></td>
<td>X37</td>
<td>Common referencing system</td>
<td>Cooksey et al. (2011)</td>
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<td></td>
<td>X38</td>
<td>Up-to-date data</td>
<td>Cooksey et al. (2011)</td>
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<tr>
<td></td>
<td>X39</td>
<td>Data management and analysis</td>
<td>Cooksey et al. (2011)</td>
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<td></td>
<td>X40</td>
<td>Policy goals and objective</td>
<td>Cooksey et al. (2011)</td>
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<td></td>
<td>X41</td>
<td>Performance measure and targets</td>
<td>Cooksey et al. (2011)</td>
</tr>
<tr>
<td></td>
<td>X42</td>
<td>Evaluation of asset performance</td>
<td>William et al. (2009)</td>
</tr>
<tr>
<td></td>
<td>X43</td>
<td>Evaluation of asset manager liability</td>
<td>Brunetto et al. (2014)</td>
</tr>
<tr>
<td>5.</td>
<td>Renewal/Rehabilitation &amp; Improvement</td>
<td></td>
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<tr>
<td></td>
<td>X44</td>
<td>Identifying rehabilitation options</td>
<td>Khan et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X45</td>
<td>Level of service</td>
<td>Khan et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X46</td>
<td>Performance indicators</td>
<td>Khan et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X47</td>
<td>Asset inspection &amp; condition assessment</td>
<td>Khan et al. (2014)</td>
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<tr>
<td></td>
<td>X48</td>
<td>Condition assessment methods &amp; protocol</td>
<td>Khan et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X49</td>
<td>Rehabilitation strategies</td>
<td>Khan et al. (2014)</td>
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<tr>
<td></td>
<td>X50</td>
<td>Policy development</td>
<td>Khan et al. (2014)</td>
</tr>
<tr>
<td></td>
<td>X51</td>
<td>Corrective repairs, major overhauls, &amp; renovations</td>
<td>Grussing (2014)</td>
</tr>
<tr>
<td>6.</td>
<td>Disposal</td>
<td></td>
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<tr>
<td></td>
<td>X52</td>
<td>Review of inventory results</td>
<td>Cooksey et al. (2011)</td>
</tr>
<tr>
<td></td>
<td>X53</td>
<td>Highest and best use asset potential</td>
<td>Ugarelli (2010)</td>
</tr>
<tr>
<td></td>
<td>X54</td>
<td>Disposition of asset arrangements</td>
<td>William et al. (2009)</td>
</tr>
<tr>
<td></td>
<td>X55</td>
<td>Transfer of Asset</td>
<td>Roshani &amp; Fillon (2014)</td>
</tr>
<tr>
<td></td>
<td>X56</td>
<td>Asset deletion</td>
<td>Roshani &amp; Fillon (2014)</td>
</tr>
</tbody>
</table>
5.3 Analysis of Third Research Problems

The third research issue is about the methods or ways that can be used to measure the performance of sustainable development. Measurement of development performance is an attempt to compare the objectives to be achieved at a certain time period with the progress of achievement that is being observed at a time on a material planning shown by a form of indicators and performance evaluation in the context of development.

United Nations (2007) mentions 8 criteria for determining indicators in the context of sustainable development, that is, especially within the national scope; relevant to assessing the progress of sustainable development; limited in number, but still open-ended and tailored to future needs; broad in scope and all aspects of sustainable development; easy to understand, clear and unambiguous; conceptual sound; to the extent possible representing international consensus; within the scope of the national government's ability to develop; and depending on known cost and quality cost data.

According to the opinion of Mayston in the book Evaluation Guidance and Indicators of Development Performance, Bappenas (2009), the way of general performance evaluation usually used Multivariate Regression Analysis or Data Development Analysis method. These two ways are usually used for educational evaluation because of the many complexities in the educational variables, but good for continuous audit performance. In addition, Iterative Generalized Least Square (IGLS) methods are also widely practiced, although not too common.

VI. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based on the analysis of research and discussion that has been done, there are at least 6 factors of infrastructure asset management indicated to have an effect on improving the performance of sustainable development, ie planning, procure, operation and maintenance, monitoring and evaluation, renewal / rehabilitation and improvement, and asset disposal. These factors are then called life cycle infrastructure asset management.

There are 56 research variables based on life cycle of infrastructure asset management consisting of 10 variables for planning factor, 10 variables for procure factor, 12 variables for operational and maintenance factor, 11 variables for monitoring and evaluation factor, 8 variables for renewal / rehabilitation and improvement factors, and 5 variables for assets disposal.

The approach that can be used in measuring the performance of sustainable development is to determine the performance indicators as a reference comparison of development results that have been or are being implemented with strategic development goals. In addition, there is also a need to evaluate the performance of development that can be done by using Multivariate Regression Analysis, Data Development Analysis, or Iterative Generalized Least Square (IGLS) method.

6.2 Recommendations

This research is expected to contribute to various stakeholders in the implementation of infrastructure asset management, both government, private, community, and other stakeholders, to better understand and consider factors and variables in life cycle infrastructure asset management and methods that can be recommended in the process of improving the performance of sustainable development.

Further research is needed by considering the factors of community involvement in infrastructure asset management through the approach of sense of ownership and demand responsive approach, so that people are treated not only as objects of development, but rather as subjects or actors in their own development process.

References

Knowledge, Attitudes and Behavior regarding Antibiotics Use and Misuse among Adults in the Community of Lahore, Pakistan

Umaira Zaheer¹, Mayasara Iqbal² and Fatima Amin³
Institute of Pharmacy, Lahore College for Women University

Abstract- Objective The aim of this retrospective study was to assess knowledge, behavior and attitude towards antibiotics use among adult population of Lahore Pakistan.

Study Design Descriptive / retrospective study.

Plan and Duration of Study 3rd July to 31st August, 2017.

Materials and Methods This study represents a cross sectional survey using an interviewer administered questionnaire. Data collected from a random sample of adult people, recruited at different settings, regarding their knowledge about the effectiveness of, resistance toward, and self-medications with antibiotics against bacterial, viral and parasitic diseases.

Results Only 40% people used antibiotics within last 2 months. 84% people had taken antibiotics from medical store or Pharmacy. Only 44% people thought that antibiotics are used for bacterial infections. 77% are not agreed to use unfinished antibiotics in future. Only 42% people answered 7 or less to be an appropriate duration of antibiotic use. Only 36% adults knew that antibiotics can cause ADR. 71% people never use left-over antibiotics without physician consultation. 68% adults are agreed to visit the doctor immediately if they experience any ADR from taking antibiotics. 60% adults think that symptoms of illness reduced during antibiotic use while 23% adults think that resistance developed during antibiotic use.

Index Words Antibiotics, adverse drug reaction, self-medication, resistance

I-Introduction

Antibiotics are viewed as most usually sold medication class in the developing countries. The irrational and abuse of antibiotics result not just in the resistant bacterial strains yet in addition in adverse responses and monetary weight on national wellbeing framework. This nonsensical utilize emerges from the financial elements, wellbeing arrangements concerning therapeutic protection, absence of doctors' concerns about long term resistance and impact as opposed to treating current manifestations, pharmaceutical promoting and the sale of antibiotics without prescription in a few nations.

In Pakistan, patients visit a drug store to buy a pharmaceutical item much like they would at a market. Likewise, as most other developing nations, having a valid prescription isn't generally implemented for getting prescription only medications (POM) [1].

The greater part of antibiotics (80%) is prescribed in essential care. Outpatient antibiotic utilization is higher in elderly patients than in the all-inclusive community and most antibiotics are recommended in elderly patients for respiratory tract infections (RTI) , skin and delicate tissue infections and urinary tract infections (UTI). Adverse drug events (ADEs) are additionally connected with antibiotic use and all the more much of the time in frail elderly with co-morbidity and co-medication. Furthermore, elderly patients have altered pharmacokinetics, for example, diminished absorption and decreased elimination, which alters antibiotic blood levels, along these influencing the risk of ADEs.

Despite the fact that the antibiotics have wide variety of uses yet at the same time their abuse can prompt resistance towards extensive range of pathogens and bacteria. There might be a few elements prompting the abuse or overuse of antibiotics. These components which prompt abuse of antibiotics might be at the patient level or at the level of specialists. These elements can be named as social elements, behavioral elements, financial status of patients and level of education both at the level of medical experts and patients particularly in our community. Recently, it is thinking that antibiotics period may arrive at an end due to expanded resistance of pathogens towards antibiotics and because of less production of new agents [2]. Resistance to first-line medications to treat infections caused by Staphylococcus aureus—a typical reason for serious infections in health facilities and the community—is across the board. Individuals with MRSA (meticillin-resistant Staphylococcus aureus) are evaluated to be 64% more prone to die than individuals with a non-resistant type of the infection [3].

Self-medication with antibiotics is a typical practice, which may likewise prompt the development of antimicrobial resistance (AMR) — a noteworthy health concern around the world. Pharmacists have to play a noteworthy part in judicious utilization of antibiotic medications. In 2008, FIP published an updated articulation on AMR entitled, FIP Statement of policy - control of antimicrobial medicines resistance (AMR) (18), whereby FIP takes liability for the expert authority through a range of activities [4].
II-Material and Methods

The retrospective study was conducted almost for the period of 2 months. Data was collected from a random sample of adult people, recruited at different settings, regarding their knowledge about the effectiveness of, resistance toward, and self-medications with antibiotics against bacterial, and viral diseases. The data was collected from 115 adults of both sexes. Adult males and females were included in this study.

III-Results

According to the survey, only 40% people used antibiotics within last 2 months (Fig.1). Only 23% adults had taken prescribed (from a doctor or a nurse) antibiotics (Table: 1). 84% people had taken antibiotics from medical store or pharmacy (Fig. 2). Only 44% people thought that antibiotics are used for bacterial infections (Fig. 3), 77% are not agreed to use unfinished antibiotics in future (Table: 2).

Only 42% people answered 7 or less to be an appropriate duration of antibiotic use (Fig. 4) (Table: 2) Only 36% adults knew that antibiotics can cause ADR (Table: 2). 77% people take antibiotics after meal while 2% take with meal (Table: 3), 68% people never use antibiotics on relative advice (Table: 3).71% people never use left-over antibiotics without physician consultation. While 6% people use left-over antibiotics without physician consultation (Table: 3). 68% adults are agreed to visit the doctor immediately if they experience any ADR from taking antibiotics (Table: 3).60% adults think that symptoms of illness reduced during antibiotic use while 23% adults think that resistance developed during antibiotic use (Fig. 5)(Table: 3).

Table 1. Demographic characteristics

<table>
<thead>
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<th>Number</th>
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</tr>
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<tbody>
<tr>
<td>Gender</td>
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<td></td>
</tr>
<tr>
<td>Males</td>
<td>30</td>
<td>26</td>
</tr>
<tr>
<td>Females</td>
<td>85</td>
<td>74</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males 15-49 years</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Females 16-48 years</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Co morbid diseases</td>
<td>40</td>
<td>35</td>
</tr>
<tr>
<td>Medication use within last 2 months</td>
<td>40</td>
<td>35</td>
</tr>
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### Table 2. Knowledge and Beliefs about Antibiotics

<table>
<thead>
<tr>
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<th>Number</th>
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</tr>
</thead>
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<tr>
<td>Antibiotic is use for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacterial infection</td>
<td>51</td>
<td>44</td>
</tr>
<tr>
<td>Viral infection</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Common cold, cough and nasal congestion</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Analgesic</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Fever</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Stomach ache</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will antibiotic always be effective in the treatment of same infection in future</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>36</td>
<td>31</td>
</tr>
<tr>
<td>No</td>
<td>79</td>
<td>69</td>
</tr>
<tr>
<td>Can unfinished antibiotics be kept to use in the future</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>No</td>
<td>89</td>
<td>77</td>
</tr>
<tr>
<td>Appropriate duration of antibiotic use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3days</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>4-6days</td>
<td>46</td>
<td>40</td>
</tr>
<tr>
<td>&gt;7days</td>
<td>48</td>
<td>42</td>
</tr>
<tr>
<td>Appropriate period of antibiotic use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Period indicated by physician or pharmacist</td>
<td>54</td>
<td>47</td>
</tr>
<tr>
<td>Period indicated in drug leaflet</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>Period indicated by family members or friends</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Until disappearance of symptoms</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Until relief of symptoms</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Not answered</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Are antibiotics safe medications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>54</td>
<td>47</td>
</tr>
<tr>
<td>No</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>I don’t know</td>
<td>47</td>
<td>41</td>
</tr>
<tr>
<td>Can antibiotics cause adverse drug reactions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>42</td>
<td>36</td>
</tr>
<tr>
<td>No</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>I don’t know</td>
<td>52</td>
<td>46</td>
</tr>
</tbody>
</table>

### Table 3. Attitude and Behavior towards Antibiotic Use

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>When would people take antibiotics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before meal</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>With meal</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>After meal</td>
<td>89</td>
<td>77</td>
</tr>
<tr>
<td>Before or after (no preference)</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>How would people take antibiotics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With water</td>
<td>104</td>
<td>90</td>
</tr>
<tr>
<td>With tea</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>With juice</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Any other</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>In general, how do people store oral antibiotic/ tablets and capsules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In a medicine cabinet</td>
<td>70</td>
<td>61</td>
</tr>
<tr>
<td>On kitchen shelf</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>In the refrigerator</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>People keep antibiotics at home for emergency for children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>No</td>
<td>83</td>
<td>72</td>
</tr>
<tr>
<td>People use siblings’ (brothers and Sisters) antibiotics when you are ill?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Sometimes</td>
<td>44</td>
<td>38</td>
</tr>
<tr>
<td>Never</td>
<td>68</td>
<td>59</td>
</tr>
<tr>
<td>People use antibiotics on relative advice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Sometime</td>
<td>33</td>
<td>29</td>
</tr>
<tr>
<td>Never</td>
<td>79</td>
<td>68</td>
</tr>
<tr>
<td>People use left-over antibiotics without physician consultation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Sometime</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Never</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>If people experienced adverse effects from taking antibiotics, what would they do</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop taking the antibiotics</td>
<td>23</td>
<td>20</td>
</tr>
<tr>
<td>Visit the doctor immediately</td>
<td>78</td>
<td>68</td>
</tr>
<tr>
<td>Not be concerned</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>People told about outcomes occurred/showed during antibiotic use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptoms elevated</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Symptoms reduced</td>
<td>69</td>
<td>60</td>
</tr>
<tr>
<td>Resistance developed</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>Any other</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

### III-Discussion

Misconceptions about antibiotic use among community members potentially lead to inappropriate use of antibiotics.
in the community. This population-based study was aimed at examining common knowledge, attitudes and behavior survey conducted in Yogyakarta City of Indonesia, Italy, Jordan and Lithuania [1][2][3].

In this study, data was collected from Private and Government Educational Institutes and from residents of Lahore by means of questionnaire regarding knowledge, attitudes and behavior regarding antibiotics use and misuse. 115 adults were interviewed. They were all of different ages. They were including both from unmarried and married population.

According to the survey, 78% adults have no co morbid diseases while 14% have co morbid disease. 35% adults used medicines within last two months. Only 40% people used antibiotics within last two months. Only 23% adults had taken prescribe (from a doctor or a nurse) antibiotics while 63% had taken antibiotics without prescription. One of the previously conducted studies in Italy reveals the use of antibiotics as one-third of the respondents self-classified them as users of self-medication since they had taken an antibiotic without the prescription of a physician [6].

84% people had taken antibiotics directly from medical store or pharmacy while 3% used previously save antibiotics and the previous studies conducted in Italy showed the same fact as the majority of the self-medication users said that they already have antibiotics at home and or they buy them directly at the pharmacy without a prescription [6].

Only 44% people thought that antibiotics are used for bacterial infections while 10% thought that antibiotics are used for viral infections and 35% thought that antibiotics are used for common cold, cough and nasal congestion. It is almost same findings as that of a previous study conducted in Jordan. This previous study reveals that out of the total respondents, 32.9% agreed correctly that antibiotics are effective only against bacteria, whereas, 6.9% of respondents incorrectly agreed that antibiotics are effective against viruses. Half of the respondents are agreed that antibiotics work on common cold, cough and nasal congestion [1].

77% are agreed not to use unfinished antibiotics in future. The previous study conducted in Jordan has same finding as almost only one third of the respondents thought that unfinished antibiotics can be used in future [1].

Only 42% people answered 7 or less to be an appropriate duration of antibiotic use while 18% adults answered 3 days or less to be an appropriate duration of antibiotic use. This finding is same as that of previously conducted study in Lithuania which reveals the considerably low percentage of the respondents (15.1%) indicated 3 days or less to be an appropriate duration of antibiotic use [7].

According to our study, 47% adults used antibiotics for a period indicated by Physician or Pharmacist while 17% adults used antibiotics for the period indicated in drug leaflet and 17% used till the relief of symptoms. 36% adults are agreed that antibiotics can cause ADR while most of the people did not know about adverse drug reactions. Therefore, it is necessary that physicians should inform patients about antibiotic use in adult people in the community of Lahore, Pakistan like a cross sectional population-based the adverse effects of self, abuse and overuse of medication. Physicians should also prescribe the exact dosage according to the patient’s age and weight requirement and instruct them to complete full antibiotic course.

In our study, only 2% adults would take antibiotics with meal while 77% adults would take antibiotics after meal and 90% of the respondents would take antibiotics with water. It is same finding stated in the previous study conducted in Jordan that majority (94.0%) reported taking antibiotic with water [1]. Half of the respondents, 59% answered that they never use sibling antibiotics when they were ill.

Almost one third of the respondents, 28% answered that they keep antibiotics at home for emergency for children. Most of the people 71% answered that they never use left-over antibiotics without physician consultation. Only 6% people used left-over antibiotics without physician consultation. 68% people answered that they did not use antibiotics on relative advice while 29% adults answered that they sometime use antibiotics on relative advice. These findings regarding attitude and behavior towards antibiotic use are almost same as the findings in the previous study conducted in Jordon. According to this previous study, almost one third of respondents kept antibiotics at home for emergency use for children younger than 12 years of age, and almost half of respondents indicated that they did use left-over antibiotics (antibiotics remaining from uncompleted previously prescribed courses) without physician consultation. Fifty-two percent used antibiotics based on a relative advice [1].

More than half of the adults, 68% answered that they visit the doctor immediately if they experience any ADR from taking antibiotics and half of the respondents, 60% thoughts that symptoms of illness reduced during antibiotic use while 23% adults thought that resistance developed during antibiotic use.

The present survey has generated information about knowledge, attitudes, and behaviors regarding antibiotics issues in the adult population. This study has highlighted lack of proper knowledge of antibiotic use and its misuse among community. The results of this study are helpful in planning effective antibiotic awareness programs and guiding patients. Effective public education initiative should not only dissemnate information, but also provide practical and appropriate means to change their behavior. Improvement of knowledge and awareness can improve health practices.

IV-Conclulsion

Irrational antibiotics use is a major reason for the spread of antibiotic resistance. This survey indicates the irrational antibiotic use among the adult public. We tried to evaluate the current knowledge, attitude and behavior regarding antibiotic use and reasons for resistance development among adult population. We believe that this study is useful in describing people’s knowledge and beliefs regarding antibiotic use among adult community. These findings may be useful to help develop intervention to decrease misconceptions regarding antibiotic use and to increase people’s awareness regarding the risks of inappropriate use of antibiotics in the community. It is concluded that there is a need not only to educate patients about antibiotics, but also to educate physicians to prescribe antibiotics according to guidelines.

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www.ijsrp.org


4. The role of pharmacist in encouraging prudent use of antibiotics and averting antimicrobial resistance: a review of policy and experience, Health Technologies and Pharmaceuticals Program, World Health Organization (Europe), WHO Regional Office for Europe UN City, Marmorvej 51 DK-2100 Copenhagen Ø, Denmark DOR: 16.04.2017


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Comparison of Efficacy of Oral Drug Therapy with Interferon in Hepatitis C

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Institute of Pharmacy, Lahore College for Women University Lahore.

ABSTRACT - AIMS AND OBJECTIVE: To observe the treatment of hepatitis C and to compare the oral drug therapy with interferon.

Methods: An cross sectional study was conducted in outpatient departments of different hospitals of Pakistan including (Jinnah hospital Lahore, Services hospital Lahore, Sheikh zayed hospital Lahore, Mayo hospital and Victoria Hospital Bahawalpur). Data of 100 patients within 20 years-70years of age, diagnosed with hepatitis C, was collected using convenient sampling technique during face to face interviews with patients. Then data was compiled, analyzed and presented in tabular form.

Results: Results showed that 83% patients were given oral therapy 8% of patient were given interferon and 10% were given both as combination therapy. The most common and current medicines used for hepatitis C are 61% Ribavirin 67% sofosbuvir 17% ledipesavir. Some side effects were seen like 8% depression 5% itching in body 6% dizziness and 31% body pain. 99% of patients were following drug regimen properly.

Conclusion: it is concluded that the efficacy of oral (sofosbuvir + ribavirin) therapy is greater as compared to the inject able (interferon + ribavirin) therapy because oral therapy does not relapse and disease eliminates in shorter time 3 months than long therapy inject able (6 months).

INDEX TERMS: Hepatitis C, efficacy, oral drug therapy, interferon, combination therapy, liver disease, medications.

Introduction
Liver disease can be inherited (genetic) or caused by a variety of factors that damage the liver, such as viruses and alcohol use. Approximately 25,000,000 Americans have a liver related disorder, including 3.9 million people with hepatitis C [1]. Hepatitis C virus (HCV) is mostly transmitted through exposure to infective blood. There is no vaccine for HCV [2].

The WHO reports that approximately 3% of the world population or 170 million persons are affected with hepatitis C virus (HCV) with between 3 and 4 million new infections each year. [3] Egypt has an unusually high prevalence of hepatitis C with 20% of Egyptian blood donors positive for HCV antibody [4]. The estimated prevalence of HCV sero positivity in the United States general population is 1.6% or 4.1 million persons. [5].

HCV is treated with a glycoprotein commonly known as interferon (INF) alpha and it is considered the backbone of [6]. Afterwards interferon plus ribavirin become a gold standard (3 MIU thrice weekly along with ribavirin 800 to1200 mg per day). [7]. currently the regular treatment of HCV is pegelated interferon (PEG-INF) in combination with ribavirin. [8].

Current HCV therapy for genotypes 2a to 2b, 3a to 3d, 5a, 6a and mixed genotypes infected patients is 3 subcutaneous injections of 3 monitor unit of recombinant interferon alpha and ribavirin (10 mg/ day/ kg body weight) in one week for 6 months. Individuals infected from HCV genotype 1a to 1c, 4 and mixture of 1 and 4 HCV genotypes should receive three 3 MU subcutaneous injections of recombinant IFN alpha and ribavirin that are given orally in a week for total 48 weeks [9].

According to the Centre for Disease Control and Prevention, the rate of spontaneous viral clearance is relatively low (15–25 %); thus, in order for a chronically infected person to clear the virus from their body anti-viral pharmacotherapy is generally required [10] [11].

Younossi and colleagues compared interferon-based and all oral therapy in which it was concluded that all-oral therapy was more cost effective compared to interferon-based therapy. [12]
Materials And Methods:

An cross sectional study was conducted during June 2017-August 2017 in outpatient departments of different hospitals including Jinnah hospital Lahore, Services hospital Lahore, Shiekhayed hospital Lahore, Mayo hospital and Victoria Hospital Bahawalpur. Data of 100 male and female patients within age limit of 20 years-70 years who were diagnosed with hepatitis C, was collected. Pregnant women with hepatitis C were excluded for this study. For data collection purpose an extensive form was designed covering the following aspects: patients demographic information, symptoms of hepatitis C, side effects, prevention, management and treatment. Form was filled during face to face interview with patients then data was compiled, analyzed and presented in tabular form. Extensive calculations and statistical functions were applied to analyze the results and led to graphical representation of results.

Results:

Data was collected from 100 individuals. The results shows that 46% males and 56% females were suffering from hepatitis C (figure 1). The age limit of patients that 62% were in (20 – 40 yrs) and 28% (40-60yrs) and 12% (60-80yrs) (figure 2).

Family history shows that 13% suffer from hepatitis C 4% suffered from hepatitis A and 6% suffered from hepatitis B (figure 3). The major chief complaints shown were 5% polyuria, 56% stomached 23% fatigue and 25% vomiting (figure 4). the most important factor was type of hepatitis that whether it is chronic or acute and which type is more common hence 62% patients suffered from acute hepatitis and 38% suffered from chronic hepatitis (figure 5).

Different type of therapy was given to patients 83% oral therapy 6% interferon therapy and 10% combination therapy was given (figure 7) and most common medicines used for the treatment of hepatitis are 61% Ribavirin 68% sofosbuvir 17% ledipesavir 11% simeprevir and 8% other medicines were given (figure 8). but some medicines had side effects which were seen very commonly in patients the side effects were 8% depression 5% itching 6% fatigue and 31% pain in body were seen (figure 6).

(Figure: 1 age distribution)
(Figure 2: Age groups)

Age %

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-40 Years</td>
<td>62%</td>
</tr>
<tr>
<td>40-60 Years</td>
<td>28%</td>
</tr>
<tr>
<td>60-80 Years</td>
<td>12%</td>
</tr>
</tbody>
</table>

(Figure 3: Family history)

Series 1

- Hep A: 0%
- Hep B: 2%
- Hep C: 14%
Figure 4: Chief complaints

- Polyuria
- Stomached
- Fatigue
- Vomiting

Series 1

Figure 5: Type of hepatitis

- Acute Hep
- Chronic

Series 1
(Figure 6: side effects of medicine)

(Figure 7: Type of therapy given to patients)
Table 1: Age distribution

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-40 Years</td>
<td>62%</td>
<td>62%</td>
</tr>
<tr>
<td>40-60 years</td>
<td>28%</td>
<td>28%</td>
</tr>
<tr>
<td>60-80 years</td>
<td>12%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Table 2: Age limits

<table>
<thead>
<tr>
<th>Age Limit</th>
<th>f</th>
<th>F</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-40 Years</td>
<td>62</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>40-60 years</td>
<td>28</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>60-80 years</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 3: Family history

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Percentages</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyuria</td>
<td>5%</td>
<td>5</td>
</tr>
<tr>
<td>Stomach</td>
<td>56%</td>
<td>56</td>
</tr>
<tr>
<td>Fatigue</td>
<td>23%</td>
<td>23</td>
</tr>
<tr>
<td>Vomiting</td>
<td>25%</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 4: Chief complaints

<table>
<thead>
<tr>
<th>Hepatitis Type</th>
<th>Chronic Hep</th>
<th>Acute Hep</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>38%</td>
<td>62%</td>
</tr>
<tr>
<td>Frequency</td>
<td>38</td>
<td>62</td>
</tr>
</tbody>
</table>

Table 5: Type of hepatitis

(Figure 8: Current medication used for hepatitis C)
Depression  |  Itching in body  |  Fatigue  |  Body pain  
%  |  8%  |  5%  |  6%  |  31%  
n  |  8  |  5  |  6  |  31  

Table 6: Side effects of medicines

| oral  | interferon  | both  |
%  |  83%  |  6%  |  10%  
n  |  83  |  6  |  10  

Table 7: Type of drug therapy

<table>
<thead>
<tr>
<th>Medicines</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribavirin</td>
<td>61%</td>
<td>61</td>
</tr>
<tr>
<td>sofosbuvir</td>
<td>67%</td>
<td>67</td>
</tr>
<tr>
<td>ledipesavir</td>
<td>17%</td>
<td>17</td>
</tr>
<tr>
<td>simeprevir</td>
<td>11%</td>
<td>11</td>
</tr>
<tr>
<td>others</td>
<td>8%</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 8: Type of medicines

Discussion:

The hepatitis C virus is a blood borne virus and the most common modes of infection are through exposure to small quantities of blood. This may happen through injection drug use, unsafe injection practices, unsafe health care, and the transfusion of unscreened blood and blood products.

HCV screening has several potential benefits. By detecting HCV infection early, antiviral treatment can be offered earlier in the course of the disease which is more effective than starting at a later stage. [13] Further, early detection together with counselling and lifestyle modifications may reduce the risk of transmission of HCV infection to other people. The optimal approach to screen for HCV is to test the individuals having risk factors for exposure to the virus. [14]

Most of the patients diagnosed with Hepatitis C were female. It has been shown in a study that there exist strong evidence in favour of a higher HCV clearance rate in females compared with males [15].

According to survey 83% patients were given oral therapy 8% of patient were given interferon and 10% were given both as combination therapy. Oral therapy was found to be more cost effective. A study conducted by Younossi showed that all-oral therapy was more cost effective compared to interferon-based therapy [16]. Another study conducted by Hagan and colleagues showed that oral therapy, as compared to an interferon-based regimen, was cost-effective for genotypes 2 and 3 disease. [17] The most common and current medicines used for hepatitis C are 61% Ribavirin 67% sofosbuvir 17% ledipesavir 11% simeprevir and 8% other medicines like omeprazole (risek) flagyl ant etc. Some side effects were seen like 8% depression 5% itching in body 6% dizziness and 31% body pain was seen. 99% of patients were following drug regimen properly.

Conclusion:

Hepatitis C is the general term inflammation of liver and transmitted through exposure to infective blood. This may happen to transfusion of HCV contaminated blood and blood products. From research it was concluded that both oral and interferon therapies were given and in some places and their combination therapy was also given. According to research oral therapy (ribavirin + sofosbuvir) is more effective, common and show better results because oral therapy has more patient compliance, less side effects, easily affordable and eliminates...
diseases in shorter period within 3 months as compared to interferon are injectables so they are painful, expensive take more time (6 months) and have many side effects like depression, body pain and itching in body.

Acknowledgments:
Apart from efforts, the success of my projects depends largely on the encouragement and guidelines of many others. I take this opportunity to express my gratitude to hospital management and staff for their support and cooperation in collecting data.

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A Review on Solid Waste Management & its Recycling

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Abstract This research was performed to understand waste generation rate & its consecutive management approach using qualitative technique in the Nashik city area.

Waste is a continually growing problem at global & regional as well as at local levels. Solid waste arises from human activities that are normally discarded as useless or unwanted as a result of rapid increase in production & consumption, urban society rejects & generates solid material regularly which leads to considerable increase in the volume of waste generated from several sources. The simplest way to reduce waste & needs to be treated as a resources that can be reused or recycled this will help to conserve resources, reduce pollution, save energy, & help the earth cope with human demands. In future there could be drastic reduction in waste, if more manufactures design & produce more durable goods that are made easily taken apart, repaired, reused or recycled

Index Terms- Solid Waste Management, Reduce, Reuse, recycling.

I. INTRODUCTION

In the early days of civilization human have used the earth’s resources & disposed of wastes. In ancient time waste disposal was not a big problem because population is small & land available is abundant. Now a day’s waste disposal is a big problem due to people congregate in larger communities that’s why population is increased & land available is less. Due to this the waste is throwing on the unpaved streets which causes pollution. In the growing cities population growth & its fundamental demand’s attribute to environmental pollution. Now a day’s increasing pollution & solid waste generation is concerning issue. This gives negative impact on environment. Solid waste management system has developed now a days to make healthier environment.

The Nashik district city is located in the northwest of Maharashtra State in India. The population of Nashik city in 2016 was 2.16 million with a total area of 259 km² which is increases continuously.

II. RESEARCH METHODS

Study Area:
The study was conducted at the Nashik city of Maharashtra. It is the most industrialized city in Maharashtra after Mumbai and Pune. There are around 71 acres of land with the Corporation at the outskirts of the city near the highway.

In 2000, the Ministry of Environment and Forest, GoI, (MoEF) notified the Municipal Solid Waste (Management and Handling) Rules (MSW (M&H) Rules) for all Indian cities.

The study was conducted from September 2017 to October 2017. The qualitative & quantitative data were collected by feedback assessment test. A complete questionnaire was contained demographic information, waste generation & management approach, information about solid waste collection & management approach. Near around 350 tons of waste are composed from the city each day.

Qualitative Research Technique:
A qualitative research was performed on solid waste generation & management approach to make clean & healthy environment in study area.

A total number of 150 questionnaires were distributed to waste picker, waste collecting, & recycling shops in four different study areas of Nashik city like East Nashik, West Nashik, Panchavati, Cidco, Satpur & Nashik road. These shops collects every solid waste items like organic waste, plastic, paper, glass, metal etc. By observing the questionnaire it is observed that the among solid waste the percentage of organic waste is more than the other solid waste material. The solid waste collected per day in study area is observed.
Table 1: Division wise waste collection per day (2017)

<table>
<thead>
<tr>
<th>SW / DAY</th>
<th>EAST NASHIK</th>
<th>WEST NASHIK</th>
<th>PANCHAVATI</th>
<th>CIDCO</th>
<th>SATPUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic waste</td>
<td>55%</td>
<td>58%</td>
<td>60%</td>
<td>55%</td>
<td>59%</td>
</tr>
<tr>
<td>Paper</td>
<td>28%</td>
<td>30%</td>
<td>28%</td>
<td>26%</td>
<td>25%</td>
</tr>
<tr>
<td>Plastic</td>
<td>7%</td>
<td>8%</td>
<td>7%</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>Glass</td>
<td>6%</td>
<td>3%</td>
<td>3%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
<td>1%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Below figure shows the Graphical representation of solid waste of various divisions of Nashik city per day.

**Solid waste Management:**

**By Reduce, Reuse & Recycle in Nashik City:**
The all solid waste material like Glass paper, metal, organic solid, construction debris are collected by Ghatagadi workers. Around 350 tones of waste are collected from the city every day. The municipal solid waste management treatment plant is situated at Pathardi, Nashik. There are around 71 acres of land with the corporation at the outskirt of the city. The corporation land can be used to expand operations when required to treat the most amount of waste & produce energy from it. The solid waste collected by Ghatagadi workers is transported to corporation area at Pathardi to reduce, recycle the waste. The solid waste is sorted first & then recycled by different process like Bio-methanization, inert processing, Windrow processing, Refuse Derived Fuel (RDF) Plant. The rejected, non-recyclable solid waste is passed to sanitary landfills.

**Some other ideas to Reduce, Recycle & Reuse solid waste:**

**Organic solid waste:** Organic solid waste is split down naturally when exposed to micro-organisms heat, and oxygen. Recycling organic waste into a nutrient-rich, workable material is called composting. The material produced through composting can further be added to soil to enhance the fertility of the soil. By recycling the organic waste it helps to decrease the pollution and creates healthy environment.

**Paper:** Instead of using tissue papers that are made from trees, it is better to use handkerchiefs, we can reuse a piece of cloth by washing it again and again. We can also save paper that has print on only one side. This paper can be reused in different ways- for writing notes, drawing or coloring paper for children, useful for many unprofessional written purposes. If we avoid toilet paper rolls, that can be useful for many other purposes, like school or home art projects. They can also be used for starting seeds. Another paper saving fact is about tissue wrapping paper- Once it is used for wrapping any gift, it can be reused for wrapping another gift.

**Plastic:** Reprocessing and reuse of waste plastics have various advantages. 1. Reprocessing and reuse of waste plastics cause to a depletion of the use of natural materials and of the use of energy, hence also a depletion of carbon dioxide excretions. Monetarily, in some cases, plastics reprocessing may be profit making. 2. Depleting your dependence on pre-packing goods give up beverages that come in plastic bottle. Reuse plastic berry containers to store leftovers. 3. Carry with you old plastic bags to the any store instead of asking for new ones. we can reuse empty containers of foods as seeding pots for plants. 4. We can also reused plastic bottles of water for hanging garden. It is said that “Prevention is always better than a cure”. Therefore, waste prevention is always better than the waste generation. It not only keeps the environment healthy but also keeps the oceans clean.

**Glass:** The process of glass recycling involves the collection & sorting of glass by its colors. It is useful for the manufacturing of new glass containers. The raw glass material which cannot be recycled but crushed can be sent to landfills, it reduces the volume of waste. The colored pieces of glass can be used on the wall compound of house or any type of building. Doing this will provide good looking of the wall as well as protection from the outsider.

III. CONCLUSION
This study was conducted to evaluate solid waste generation & recycling approach in Nashik city Corporation area of Maharashtra. We need clean & green Smart city, for which to improve the waste pickup system in our city as well. Nashik is the one of the city in Maharashtra which has taken lead towards scientific management towards municipal solid waste in abundance of MSW rules 2000. The Nashik Municipal Corporation (NMC) has a challenge ahead to ensure proper collection & segregation of waste.

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Nashik was among the 20 cities in the country which were nominated for the award instituted by the first Smart Cities Council. Therefore, it is necessary to manage solid waste and recycle, reduce, & reuse the solid waste to make the city clean & make the environment healthy.

ACKNOWLEDGMENT
I am thankful to all who guided me for completion of this research paper.

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Isolation and Identification of Soil Fungi from Kadegaon Tehsil, Sangli District, Maharashtra, India.

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ABSTRACT:-

The investigation was conducted to find out the fungal diversity in soil sample collected from Kadegaon tehsil, Dist- Sangli. During investigation 18 isolates of fungi obtained from the soil samples. Among the 18 isolates 16 were identified with standard key & microbial expert. From the fungal isolates the most of the species belonging to genera Aspergillus

KEY WORDS:-

Soil fungi,
Microbial pathogen,
Isolation,

I. INTRODUCTION:-

The soil serves as a reservoir for many microbial communities of plant and herbs which can be producing, CO2 nitrogen cycle. The microorganisms play a major role in soil ecosystem. (Stefanis et al. 2013) soil is an oligotrophic medium for the growth of fungi because the fungal growths are extremely limited for most of the time & readily available are present for short periods in a limited zone. For most of the time fungi are either dormant, or they metabolize and grow very slowly utilizing a range of organic molecules. The fungi distribute organic matter away from the roots. Genetic studies have shown that fungi are more closely related to animals than to plants. Fungi have 80% or more of the same genes as humans. Ratna kumar et al. 2015; Dick 2009 & Krick 2004. Fungi are not only beautiful but play a significant role in the daily life of human beings besides their utilization in industry, agriculture, medicine, food industry, textiles, bioremediation, natural cycling, as biofertilizers and many other ways. Fungal biotechnology has become an integral part of human welfare (Karthikeyan et al, 2014. Fungus protects plants by supplying a protective health to supply both water & phosphorus to the plant roots during droughts (Magdoff and VanEs, 2009) The present studies were identified fungal community from soil samples collected from Kadegaon tehsil

II. MATERIAL AND METHODS:-

A. COLLECTION SITES:-

Soil samples were collected near plant roots. Soil samples (Approximately 5g) were collected with clean dry and sterile polythene bags along with sterile spatula. The collected brought to the laboratory and preserved for further studies. The soil samples were collected from the month of August 2017 in Kadegaon tehsil

B. PREPARATION OF SOIL SAMPLE AND MICROBIAL CULTURE:-

In systematic screening process for isolation of fungus soil samples collected at different locations inside the Kadegaon tehsil. Samples were collected near roots were most of the microbial activity is concentrated. From the collected soil samples (soil dilution method; Waksman, 1927) diluted with 1 gm soil in 10 ml of sterile distilled water. 1ml suspension was added to sterile petriplates in triplicates containing sterile Potato Dextrose Agar the plates were incubated at 28 Degree C For 5-7 days. A greater number of species was isolated most of the fungus sporulate heavily. Pure culture done using test tube containing fresh agar slants of PDA medium. The test tubes are stored in refrigerator. When inoculums were transferred into petriplates containing nutrient media cells are not separated from each other. Therefore,
there develop mixed colonies. Hence isolation of pure culture from mixed colonies is rather difficult therefore spread plate technique is employed for pure culture.

C. IDENTIFICATION OF FUNGI:-

The isolated were identified to the genus level and to the species when possible on the basis of macro morphological (the colonies were examined for slow or for rapid growth, topography (Flat, heaped, regularly or irregularly folded), texture (east like, powdery, granular, velvety or cottony), surface pigmentation and reverse pigmentation and micro morphological (Hyphae, macro conidia, chlamydospores and other special fungal structure) characteristics using suitable media, slide culture and the most updated keys for identification. The identified fungi confirmed with microbial expert. And also with the help of standard book Illustration of Fungi by classification system.

III. RESULTS AND DISCUSSION:-

The study aimed that the isolation of soil fungi from Kadegaon tehsil grown in vitro during the period of August 2017. Isolated fungi was identified by some key with help of standard books. During investigation 18 isolates obtained from the soil samples. 16 were identified with standard key and microbial expert. From the fungal isolates the most of the species belonging the genera Aspergillus were dominant.

Soil is a multi-layered surface complex of mineral and organic constituents present in solid liquid and gaseous states. The mineral portion of soil results from the actions of Weathering and erosion on rock (Dannis, 2012). Broad soil type and, slit or clay is defined as largest to smallest of particle size. These particles pack loosely, and pour spaces, and plant roots are particular habitats for microorganisms, often in bio films. Soil also contains plants, animal carcasses and manmade materials.

A gram of garden soil can contain around 1 million fungi such as yeasts, and moulds fungi have no chlorophyll and are not able to photosynthesis. They can no use atmospheric carbon dioxide as a source of carbon; they are chemo heterotrophic meaning that, like animals. They require a chemical source of energy rather than being able to use light as an energy source as well as organic substrates to gate carbon for growth and development. Many fungi are parasitic, often causing disease to their living host plant although some have beneficial with plants. Where ever adequate moisture, temperature and organic substrates are available fungi are present. Diversity of most groups of fungi tends to increase in tropical regions, but detailed studies are only in their infancy (Issac et al, 1993) from the mycelia the fungi is able to throw its fruiting, the visible part above the soils (e.g. Mushrooms, toad stools, puffballs), which may contain millions of spores.

Present study carried out for an effort to understand the soil fungal diversity in Kadegaon tehsil. The environmental, moisture, organic carbon an nitrogen play an important role in distribution of mycoflora. The soil moisture has a direct effect on the population of fungi positively hence, at higher moisture the tolerance and colonization is badly affected. (Adams et al, 1999) Several reviews exist of recent, successful techniques for isolating fungi from nature (Labeda, 1992). (Seifert, 1992) includes basic techniques for isolating specific taxonomic groups and from specific habitat and (Bacon 1992) in discussing the endophytic fungi of grasses, includes techniques that cloud be apply to other substrates. As above Bills and (Polishook 1994) have demonstrated the value of particle filtration for the isolation of diverse fungi.
### TABLE: THE COLONY MORPHOLOGY OF DIFFERENT SPECIES ISOLATED FROM DIFFERENT LOCATION IN KADEGAON TEHSIL.

<table>
<thead>
<tr>
<th>Area</th>
<th>Sr. No</th>
<th>Size</th>
<th>Colour</th>
<th>Nature of Hyphae</th>
<th>Conidia Shape</th>
<th>Name Of the species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sagreshwar Abhayarnya area soil</td>
<td>1</td>
<td>Medium</td>
<td>Black</td>
<td>Non-Septate</td>
<td>Rough,Irregular</td>
<td>Aspergillus niger</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Small</td>
<td>Gray-Green</td>
<td>Non-Septate</td>
<td>Irregular</td>
<td>Aspergillus fumigates</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Medium</td>
<td>Blue-Green</td>
<td>Non-Septate</td>
<td>Oval</td>
<td>Penicillium Crysogenum</td>
</tr>
<tr>
<td>Dongrai – Kadegaon area soil sample</td>
<td>4</td>
<td>Medium</td>
<td>Black</td>
<td>Non-Septate</td>
<td>Rough,Irregular</td>
<td>Aspergillus niger</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Large</td>
<td>Green</td>
<td>Non-Septate</td>
<td>Globose</td>
<td>Aspergillus Clavatus</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Medium</td>
<td>Blue-Green</td>
<td>Non-Septate</td>
<td>Oval</td>
<td>Penicillium Crysogenum</td>
</tr>
<tr>
<td>Amrapur area soil sample</td>
<td>7</td>
<td>Small</td>
<td>Black</td>
<td>Non-Septate</td>
<td>Oval</td>
<td>Rhizopus Stolonifer</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Medium</td>
<td>Black</td>
<td>Non-Septate</td>
<td>Rough,Irregular</td>
<td>Aspergillus niger</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Medium</td>
<td>Brown</td>
<td>Non-Septate</td>
<td>Globose</td>
<td>Rhizopus Oryzae</td>
</tr>
<tr>
<td>Sugar factory-wangi area soil sample</td>
<td>10</td>
<td>Medium</td>
<td>Black</td>
<td>Non-Septate</td>
<td>Irregular</td>
<td>Aspergillus Sydowii</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Medium</td>
<td>Black</td>
<td>Non-Septate</td>
<td>Rough,Irregular</td>
<td>Aspergillus Niger</td>
</tr>
<tr>
<td>Chauranginath-Sonsal area soil sample</td>
<td>12</td>
<td>Medium</td>
<td>Blue-Green</td>
<td>Non-Septate</td>
<td>Oval</td>
<td>Penicillium Crysogenum</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Medium</td>
<td>White</td>
<td>Non-Septate</td>
<td>Ellipsoidal</td>
<td>Mucor spp</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Small</td>
<td>Black</td>
<td>Non-Septate</td>
<td>Oval</td>
<td>Rhizopus Stolonifer</td>
</tr>
<tr>
<td>Nerli area soil sample</td>
<td>15</td>
<td>Medium</td>
<td>Black</td>
<td>Non-Septate</td>
<td>Rough,Irregular</td>
<td>Aspergillus niger</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Small</td>
<td>Gray-Green</td>
<td>Non-Septate</td>
<td>Irregular</td>
<td>Aspergillus Fumigates</td>
</tr>
</tbody>
</table>
ACKNOWLEDGMENT:-

We, the authors sincere thanks to Dr. Mrs. M.M. Ghatge, Dr. Mr. R.R. Jadhav, and Dr. Mr. V.S. Salunkhe and also thankful to our M.B.S.K College kadegaon for helping to do the research work.

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PHOTO PLATES:-

Aspergillus niger
Aspergillus fumigates

Penicillium crysogenum
Aspergillus clavatus

Aspergillus sydowii
Rhizopus stolonifer

Mucor spp
Rhizopus oryzae
EMOTIONAL INTELLIGENCE AMONG UNDERGRADUATE NURSING STUDENTS

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Abstract:

Background & Objective: The nursing profession is an occupation with a high level of emotional labor. So, it is important to identify the level of emotional intelligence among nursing students for an effective nursing leadership and quality nursing care. Thus, this study aimed to assess the factors associated with emotional intelligence of undergraduate nursing students. Materials & Methods: A descriptive cross-sectional study with 223 undergraduate nursing students was carried out in Sanjeevani College of Medical Sciences, Butwal, Rupandehi, Nepal. Census method using pre-tested self-prepared self-administered questionnaire was used for the data collection. Collected data were analyzed using descriptive and inferential statistics. Results: The mean & median age of the students was 21.78 & 22 years respectively. About 45% of the students had previous work experience and only 12% had received some type of health related training. Approximately 17% were married and about 93% of the students had mixed diet. One third (33.63%) consumed junk foods more than 3 times a day and about 88% of the students performed light exercise on regular basis. The study found that about 46% of the students had normal & about 15% had high level of emotional intelligence. Diet, father’s educational status, age of the students, work experience, Program (PBBN & BSN) and religion were the factors influencing emotional intelligence of the undergraduate nursing students (p-value 0.002, 0.043, 0.025, 0.008, 0.006, 0.011) respectively. Conclusion: The study concluded that nearly half (52%) of the nursing students had normal level of emotional intelligence. Diet, father’s educational status, age of the students, work experience, Program (PBBN & BSN) and religion were the factors influencing emotional intelligence in the study. Thus, these factors should be considered for emotional management among nursing students.

Key words: Nursing, Emotional, Intelligence, Undergraduate.
1. Introduction

Emotional intelligence (EI) has been associated with positive outcomes for nursing students. Higher EI is associated with personal wellbeing and stress management, higher academic performance, stronger nursing leadership and practice performance, and greater patient safety\(^1\). Today, nursing education which educates the future members of the nursing profession aims to gain them high self-esteem, self-confidence and self-compassion, independence, assertiveness and ability to establish good human relations\(^2\).

Developing emotional intelligence should be a useful adjunct to improve academic and clinical performance and to reduce the risk of emotional distress during clinical placement experiences. We call for more consistency in the use of emotional intelligence tests as a means to create an empirical evidence base in the field of nurse education\(^3\).

Nurse managers who exhibit high emotional intelligence (EI) can elicit higher nurse-retention rates, better patient satisfaction and optimal organizational outcomes, and those who are emotionally intelligent tend consistently to model the positive behavior that is expected of healthcare staff. The results of this study could be of use to help nursing students in their psychological adaptation and health based on the understanding of such students considering the characteristics of their emotional intelligence.

Objectives

- To assess the demographic profile of the nursing students.
- To identify the level of emotional intelligence of nursing students.
- To find out the association between socio-demographic profile and emotional intelligence of nursing students.

2. Materials & Methods

Design: A cross-sectional descriptive study design.

Setting: Sanjeevani College of Medical Sciences (SCMS), Butwal, Rupandehi, Nepal.

Sample Size: 223.

Sampling Technique: Census method.

Research Instrument: A self-prepared, pretested semi-structured self-administered questionnaire was used.

Data Collection Procedure: Data was collected after obtaining permission from the Institutional Review Committee and all the concerned authority of SCMS. Consent was obtained from each respondent.

Data Analysis Procedure: Collected data were analyzed using descriptive statistics (Mean, Median, Standard Deviation) and inferential statistics (Mann Whitney U Test and Kruskal Wallis Test) in SPSS version 16. P-value was calculated at 95% CI & 5% permissible error. Tests of Normality were used to check the distribution of data and so non-parametric test were used for the analysis. Level of emotional intelligence...
intelligence was categorized on the basis of lower & upper limit of total percent score of emotional intelligence at 95% confidence interval. The data consisted of socio-demographic section and emotional intelligence sections with 5 subscales: Self-awareness, Self-regulation, Motivation, Empathy & Social Skills subscale. The checklist for measuring subscales was computed as highest score & lowest score (Yes=3, Don’t know=2 & No=1). Then, the total score and total percentage score was calculated and interpreted at 95% CI and categorized as low, normal and high level of emotional intelligence.

3. Results & Findings

The findings of the study showed that the mean & median age of the students was 21.78 & 22 years respectively. Majority (98%) of the fathers & approx. 96% of the mothers were literate. About 45% of the students had previous work experience and only 12% had received some type of health related training. Approximately 17% were married and about 93% of the students had mixed diet. One third (33.63%) consumed junk foods more than 3 times a day and about 88% of the students performed light exercise on regular basis. Majority (82.95%) of the students belonged to nuclear family and majority (93.27%) followed Hindu religion. About 77% of the students were from Rupandehi district of Nepal. Other district indicates Baglung, Dang, Synagja, Kaski, Arghakhanchi, Tanahun, Gulmi and Kathmandu.

### Table 1: Socio-demographic Characteristics of the Nursing Students (N=223)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td>B. Sc. Nursing</td>
<td>118</td>
<td>52.91</td>
</tr>
<tr>
<td></td>
<td>PBBN</td>
<td>105</td>
<td>47.08</td>
</tr>
<tr>
<td>Work Experience (PBBN)</td>
<td>1-2 years</td>
<td>87</td>
<td>39.01</td>
</tr>
<tr>
<td></td>
<td>2-3 years</td>
<td>12</td>
<td>5.38</td>
</tr>
<tr>
<td></td>
<td>3-4 years</td>
<td>2</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>4-5 years</td>
<td>4</td>
<td>1.79</td>
</tr>
<tr>
<td>Training received</td>
<td>Yes</td>
<td>27</td>
<td>12.11</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>196</td>
<td>87.89</td>
</tr>
<tr>
<td>Father's Educational Status</td>
<td>Illiterate</td>
<td>3</td>
<td>1.34</td>
</tr>
<tr>
<td></td>
<td>Literate</td>
<td>220</td>
<td>98.65</td>
</tr>
<tr>
<td>Mother's Educational Status</td>
<td>Illiterate</td>
<td>10</td>
<td>4.48</td>
</tr>
<tr>
<td></td>
<td>Literate</td>
<td>213</td>
<td>95.51</td>
</tr>
<tr>
<td>Dietary Pattern</td>
<td>Vegetarian diet</td>
<td>15</td>
<td>6.72</td>
</tr>
<tr>
<td></td>
<td>Mixed (veg &amp; non-veg) diet</td>
<td>208</td>
<td>93.27</td>
</tr>
<tr>
<td>Performing light exercise on regular basis (2-4 hours per day)</td>
<td>Yes</td>
<td>197</td>
<td>88.34</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>26</td>
<td>11.66</td>
</tr>
<tr>
<td>Age of the Respondents (in years)</td>
<td>15-20</td>
<td>63</td>
<td>28.81</td>
</tr>
<tr>
<td></td>
<td>20-25</td>
<td>151</td>
<td>67.64</td>
</tr>
<tr>
<td></td>
<td>25-30</td>
<td>9</td>
<td>4.14</td>
</tr>
<tr>
<td>Mean age ± S.D (21.78 ± 2.154) years</td>
<td>22 (20-23)</td>
<td>95.40</td>
<td></td>
</tr>
<tr>
<td>Median age (IQR)</td>
<td>22 (20-23)</td>
<td>95.40</td>
<td></td>
</tr>
<tr>
<td>Type of the Family</td>
<td>Nuclear</td>
<td>185</td>
<td>82.95</td>
</tr>
<tr>
<td></td>
<td>Joint</td>
<td>38</td>
<td>17.04</td>
</tr>
<tr>
<td>Religion</td>
<td>Hindu</td>
<td>208</td>
<td>93.27</td>
</tr>
<tr>
<td></td>
<td>Buddhist</td>
<td>13</td>
<td>5.83</td>
</tr>
<tr>
<td></td>
<td>Christian</td>
<td>2</td>
<td>0.89</td>
</tr>
<tr>
<td>Address</td>
<td>Rupandehi</td>
<td>173</td>
<td>77.57</td>
</tr>
<tr>
<td></td>
<td>Palpa</td>
<td>17</td>
<td>7.63</td>
</tr>
<tr>
<td></td>
<td>Nawalparasi</td>
<td>15</td>
<td>6.73</td>
</tr>
<tr>
<td></td>
<td>Kapilvastu</td>
<td>5</td>
<td>2.24</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>13</td>
<td>5.83</td>
</tr>
</tbody>
</table>

Key:
PBBN: Post Basic Bachelor in Nursing BSN: Bachelor of Science in Nursing

Regarding association between subscales of emotional intelligence, father’s educational status, age of the students, type of diet, work experience and program were significantly associated with self-awareness subscales (p-value=0.043, 0.025, 0.018, 0.008 & 0.006 respectively). This signifies that undergraduate nursing students whose father’s were literate,
belonging to age group (25-30) years, having mixed diet, having work experience and belonging to PBBN were more self-aware as illustrated by their total percentage rank score. The study findings illustrated that type of diet was significantly associated with self-regulation subscale of emotional intelligence (p-value=0.022) whereas father’s educational status, age of the students, age of the students, work experience and program were not statistically significant (p-value=0.770, 0.379, 0.726 and 0.803 respectively). This identifies that undergraduate nursing students having mixed diet were more self-regulated in the study.

The subscale motivation was significantly associated with religion (p-value=0.011). Father’s educational status, age of the students, type of diet, work experience, religion, program were not significantly associated with motivation subscale (p-value= 0.436, 0.702, 0.911, 0.743 & 0.967 respectively). This signifies that nursing students following Buddhism were more motivated than the others in the study.

Regarding subscale empathy, age of the students was significantly associated with empathy (p-value=0.011) whereas father’s educational status, type of diet, work experience, religion, program were not statistically associated with empathy (p-value=0.351, 0.095, 0.142, 0.416 and 0.275 respectively). This concludes that undergraduate nursing students belonging to age group (20-25) years were more empathetic than the others.

Type of diet, work experience and program were statistically significant with sub scale social skills (p-value=0.013, 0.012 & 0.025 respectively) whereas father’s educational status, age of the students and religion were not statistically significant with social skills of the students (p=value=0.933, 0.060 & 0.393 respectively). This illustrates that undergraduate nursing students having mixed diet, having no work experience and PBBN program were more social than the others in the study.

The study found that about 46% of the students had normal & about 15% had high level of emotional intelligence as depicted by the Table2.

Table 2: Level of Emotional Intelligence (N=223)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Emotional Intelligence</td>
<td>Low</td>
<td>86</td>
<td>38.56</td>
</tr>
<tr>
<td>(Taking cut off points at 95% CI)</td>
<td>Normal</td>
<td>103</td>
<td>46.18</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>34</td>
<td>15.24</td>
</tr>
</tbody>
</table>

Regarding association of selected socio-demographic variables and emotional intelligence, diet was found to be statistically associated with emotional intelligence of the nursing students (p-value=0.002) whereas program, type of family, religion, father and mother educational status, work experience, training received and age of the students were not statistically significant with the overall emotional intelligence score (p-value=0.164,
0.508, 0.128, 0.993, 0.194, 0.111, 0.629 & 0.060 respectively). This illustrates that undergraduate nursing students having mixed diet were emotionally intelligent as depicted by Table 3.

**Table 3: Association between Selected Socio-demographic Variables & Emotional Intelligence (N=223)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Category</th>
<th>f</th>
<th>EI Mean Rank</th>
<th>EI Sum of Rank</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program*</td>
<td>PBBN</td>
<td>10</td>
<td>118.35</td>
<td>12427.00</td>
<td>0.164</td>
</tr>
<tr>
<td></td>
<td>BSN</td>
<td>11</td>
<td>106.35</td>
<td>12549.00</td>
<td></td>
</tr>
<tr>
<td>Type of Diet*</td>
<td>Vegetarian</td>
<td>15</td>
<td>161.83</td>
<td>2427.50</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>Mixed</td>
<td>20</td>
<td>108.41</td>
<td>22548.50</td>
<td></td>
</tr>
<tr>
<td>Type of Family*</td>
<td>Nuclear</td>
<td>18</td>
<td>113.29</td>
<td>20959.00</td>
<td>0.508</td>
</tr>
<tr>
<td></td>
<td>Joint</td>
<td>38</td>
<td>105.71</td>
<td>4017.00</td>
<td></td>
</tr>
<tr>
<td>Religion**</td>
<td>Hindu</td>
<td>20</td>
<td>109.85</td>
<td></td>
<td>0.128</td>
</tr>
<tr>
<td></td>
<td>Buddhist</td>
<td>13</td>
<td>136.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Christian</td>
<td>2</td>
<td>176.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father’s Educational Status*</td>
<td>Illiterate</td>
<td>3</td>
<td>111.67</td>
<td>335.00</td>
<td>0.993</td>
</tr>
<tr>
<td></td>
<td>Literate</td>
<td>22</td>
<td>112.00</td>
<td>24641.00</td>
<td></td>
</tr>
<tr>
<td>Mother’s Educational Status**</td>
<td>Illiterate</td>
<td>10</td>
<td>137.85</td>
<td>1378.50</td>
<td>0.194</td>
</tr>
<tr>
<td></td>
<td>Literate</td>
<td>21</td>
<td>110.79</td>
<td>23597.50</td>
<td></td>
</tr>
<tr>
<td>Work Experience</td>
<td>Yes</td>
<td>10</td>
<td>119.48</td>
<td>12186.50</td>
<td>0.111</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12</td>
<td>105.70</td>
<td>12789.50</td>
<td></td>
</tr>
<tr>
<td>Training received*</td>
<td>Yes</td>
<td>27</td>
<td>117.61</td>
<td>3175.50</td>
<td>0.629</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>19</td>
<td>111.23</td>
<td>21800.50</td>
<td></td>
</tr>
<tr>
<td>Age of the Students (in years)**</td>
<td>15-20</td>
<td>63</td>
<td>95.83</td>
<td></td>
<td>0.060</td>
</tr>
<tr>
<td></td>
<td>20-25</td>
<td>15</td>
<td>118.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25-30</td>
<td>9</td>
<td>112.94</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean age ± S.D. (21.78 ± 2.154) years
Median age (IQR) (22 (20-23) years)

Key: * Mann-Whitney U test  **Kruskal Wallis test
PBBN: Post Basic Bachelor in Nursing
BSN: Bachelor of Science in Nursing
EI: Emotional Intelligence

Above all of the findings conclude that diet, father’s educational status, age of the students, work experience, Program (PBBN & BSN) and religion were the factors influencing emotional intelligence of the undergraduate nursing students.

4. Discussion

This is a descriptive study, which was intended to assess the emotional intelligence of undergraduate nursing students. A total of 223 undergraduate nursing students were included in the study.

Regarding association between subscales of emotional intelligence, father’s educational status, age of the students, type of diet, work experience and program were significantly associated with self-awareness subscales (p-value=0.043, 0.025, 0.018, 0.008 & 0.006 respectively). This signifies that undergraduate nursing students whose father’s were literate, belonging to age group (25-30) years, having mixed diet, having work experience and belonging to PBBN were more self-aware as illustrated by their total percentage rank score which is similar to findings of the study done by Muhammad Akbar⁴, Austyn Snowden⁵, Maryam Vahidi⁶ with respect to literate father, father’s literacy, increasing age of the students and work experience.

A study conducted by Nagia and Omar⁷ found that consumption of a healthy diet was also correlated with exercise participation. The study results indicate this sample of nursing students participated in a healthy lifestyle and

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reported high EI which is in accordance with the findings of the present study. This identifies that undergraduate nursing students having mixed diet were more self-regulated in the study.

According to the results of this study conducted by Masoumeh Bagheri Nesami et al., found that most students possess high levels of positive religious coping and EI, which is similar to the findings of the present study. Father’s educational status, age of the students, type of diet, work experience, religion, program were not significantly associated with motivation subscale (p-value= 0.436, 0.702, 0.911, 0.743 & 0.967 respectively). This signifies that nursing students following Buddhism were more motivated than the others in the study.

Regarding subscale empathy, age of the students was significantly associated with empathy (p-value=0.011) whereas father’s educational status, type of diet, work experience, religion, program were not statistically associated with empathy (p-value=0.351, 0.095, 0.142, 0.416 and 0.275 respectively). This concludes that undergraduate nursing students belonging to age group (20-25) years were more empathetic than the others.

Type of diet, work experience and program were statistically significant with sub scale social skills (p-value=0.013, 0.012 & 0.025 respectively) whereas father’s educational status, age of the students and religion were not statistically significant with social skills of the students (p-value=0.933, 0.060 & 0.393 respectively). This illustrates that undergraduate nursing students having mixed diet, having no work experience and PBBN program were more social than the others in the study.

The study found that about 46% of the students had normal & about 15% had high level of emotional intelligence.

A study conducted by Kahraman N found that there were no significant differences between emotional intelligence scores of the nurses according to demographic variables such as age, gender, marital status, having children. Higher total emotional intelligence scores were observed in those who had 10 years or longer experience, who found oneself successful in professional life, who stated that emotional intelligence, is an improvable skill and who previously received self-improvement training. Interpersonal skills were higher in those with a graduate degree and in nurses working in polyclinics and pediatric units.

Regarding association of selected socio-demographic variables and emotional intelligence, diet was found to be statistically associated with emotional intelligence of the nursing students (p-value=0.002) whereas program, type of family, religion, father and mother educational status, work experience, training received and age of the students were not statistically significant with the overall emotional intelligence score (p-value=0.164, 0.508, 0.128, 0.993, 0.194, 0.111, 0.629 & 0.060 respectively). This illustrates that undergraduate nursing students having mixed diet were emotionally intelligent.
Emotional intelligence can be developed. The process begins with self-awareness, enhanced through self-care behaviors, such as exercise and journaling. Reading popular self-help literature also can improve self-awareness. After a nurse becomes self-aware, the next phase is to develop an awareness of others. This can be learned using the same type of techniques in the self-awareness stage. The final step is the development of empathy. Through discipline and effort, an individual can learn to actively listen to others. This type of listening fosters empathy. Through the development of emotional intelligence, the nurse can improve personally and professionally, a win-win situation for all involved. For this purpose, the factors such as diet, literacy of the parents, work experience, age, religion etc... should be considered.

5. Conclusion
The study concluded that nearly half of the undergraduate nursing students had normal level of emotional intelligence. The domains of emotional intelligence as self-awareness, self-regulation, motivation, empathy and social skills were affected by the socio-demographic variables such as educational status of parents, work experience, healthy diet, religion & age of the undergraduate nursing students. Thus, these factors should be considered for enhancing emotional intelligence among undergraduate nursing students.

Limitations of the Study
This study is a pioneer study and other longitudinal studies are required to achieve the better results in Butwal, Rupandehi. The size of our sample was small and so we cannot generalize the results among all other undergraduate nursing students. This study was a cross-sectional study and done in only one nursing college having program up to baccalaureate level only. So, evaluating changes in students’ emotional intelligence grades from entering the university to graduation was not possible.

Competing Interests
The authors declare that they have no competing interests.

Acknowledgments
The authors wish to thank the nursing students and faculties of Sanjeevani College of Medical Sciences, Kalikanagar, Butwal, Rupandehi, Nepal who devoted their time to making this study a success.

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[2]. Eraydin S, Karagozoqlu S. Investigation of self-compassion, self-confidence and submissive


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Identifying the users of public health services within Greater Cairo as a part of achieving social justice

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* Architecture and Urban Planning Department, Faculty of Engineering, Port-Said University

Abstract- This study aims to identify the real users of public health services within Greater Cairo. This can help in reducing service delivery to non-beneficiaries, thus, prevent resources' abuse and promotes economic efficiency. Moreover, it makes the needy -who are deprived of the service and cannot afford private surgery and private medical treatment- feel justice. In this study, identifying the users of public health services depends on: defining the basis on which services will be provided and the factors affecting it, identifying the validity of these factors and how to measure them, constructing factors’ index and testing it.

Index Terms- Social justice, Public health services, and Greater Cairo.

I. INTRODUCTION

Social justice is one of the most important moral, legal, political and social concepts that has been defined differently by different groups and changed from time to time depending upon the prevailing conditions of an era. It can be identified as “the mutual obligations -rights and duties- flowing between the individual and society” [1]. These obligations with regard to public services are:

- Society’s duty is to ensure the right of access of different types of individuals to different services that provide protection, maintenance, care, and well-being.
- Individuals’ duty is to utilize and maintain these services.

It is notable that, in order to make a service well utilized, it is important to define service’s users at first, then make these users properly accessed to the service. Based on this, the literature suggests that there are five-justice conceptions that may be used to allocate public service units. These conceptions include [2]:

Equality

Equality seeks the equal distribution of services. William and Kenneth recognized several dimensions of services’ equal distribution; the most prominent are: 1) units of analysis: for services that are supplied directly to households/ neighborhoods/ districts, etc. This means that households in one neighborhood/ neighborhoods in one district/ districts in one city receive services equal to those in other neighborhoods/ districts/ cities, 2) range of permissible variation: for services that have a defined catchment area. This means that those reside beyond the maximum distance are said to be victims of unequal service distribution. The most observed shortcomings of this concept is that it neglects the differences among different analysis units. In other words, it requires that everyone starts from the same place and needs the same things.

Need

Services distribution based on need assumes that some people have a greater need for specific services than do other people. According to William and Kenneth, need refers to characteristics of people (i.e. income level) or conditions in society (i.e. buildings materials). They explained that low-income persons are considered as having a greater need for public services than the high-income ones because they have less potential for obtaining those services with private resources. Similarly, houses built with flammable materials and are close together are considered as having a higher need for fire protection services than those built with bricks; as the probability of fire occurrence, fire spread and loss of life is greater.

Demand

William and Kenneth argued that demands that people make for services should influence services distribution. These demands can be measured by two methods: 1) directly, through requests/ complaints transmitted by phone, letters, etc. 2) indirectly, through calculating usage rates; since the more the users are, the need to establish a new service increases. It is worth mentioning that many researchers criticized using the previous methods in measuring demands. Some argued that some groups and individuals –especially the rich– are more likely than others to contact government officials about service related problems, others argued that many –especially the low-income– may decide not to use a service at all because of its remoteness; thus, services’ budget in both cases will mostly be oriented to the wealthier areas.

Preference

People may feel like requesting or complaining without doing so because of lack of money, fear for their safety, etc.; therefore, consulting them about the services they prefer is necessary. Distribution of services based on preferences has many problems. The most important are consumer tastes may vary widely and their preferences for particular services may be erratic and subject to change. Moreover, the cost of responding to such variances and changes is very high.

Willingness-to-pay

Willingness-to-pay is related to ability-to-pay; therefore, income levels influence who gets what. This means that the subsequent pattern of service distribution will be skewed in the direction of wealthier areas. As this study is concerned with identifying the real users of public health services within Greater Cairo, it is important to define the basis on which services will be provided. On one hand, many researchers argued that, amongst the previously mentioned conceptions, “need” is the main determinant of

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equitable health services distribution. They referred that health-seeking behavior is governed primarily by need rather than by how much it would cost. The proof of this is based on the fact that if the amount of services that meet medical needs exceeds the amount that consumers actually choose, health service units will be under-utilized. Alternatively, if consumers need more health services than would be provided, demand will exceed the available units. Thus, the distribution of service units should be proportional to “need”.

On the other hand, other researchers argued that, health services should be distributed equally among inhabitants, and should be increased to the needy. According to GOPP (2014), this agrees with the Egyptian standards. However, due to the high international costs of health services, the low level of spending on public health services, and deficiencies in the numbers and levels of nursing and technical staff, the provision of public health services was limited to the needy who cannot afford private surgery and private medical treatment. Thus, “need” will be adopted in this study.

II. FACTORS AFFECTING NEED TO PUBLIC HEALTH SERVICES

Pursuant to the foregoing, one of the main dimensions influencing the need for public services -in general- and health services -in particular- is the income level. Other dimensions include [3] [4] [5] [6] [7]:

-Individual characteristics

Gender
Women tend to have a greater need for health services than men; due to their reproductive health care needs at the younger ages and the greater incidence of chronic conditions among them at the older ages.

Age
Some age-gender groups have a greater need for health services than others. It is argued that areas with a greater percentage of older people and small children will see more demands on health services than those with more younger age groups.

Genetics
Inheritance plays a part in determining healthiness, lifespan, and the likelihood of developing certain illnesses.

-Individual lifestyle

Balanced eating, keeping active, drinking, smoking, and how we deal with life’s stresses affect health.

-Social factors

Population density
High population density corresponds to the greater number of contacts among individuals. These contacts are essential parameters in the transmission of infectious disease. Therefore, areas with high population densities are more vulnerable to disease spread.

Family size
Previous researchers focused on how family size affects a mother’s health. They argued that the more children a woman has, the fewer family resources that could be allocated to her, and the more likely that she has bad health conditions. Others found that family size and the number of siblings can affect children's health and well-being, since children in large families receive fewer financial/practical investments than do children in small families.

Educational condition
Illiterate individuals are more likely to work under hazardous conditions or be exposed to environmental toxins, therefore, they are more vulnerable to disease. Moreover, they are more often misuse medication whether because they have trouble reading and understanding the relevant information (warnings, dosage, contraindications, etc.), or their mistrust of the healthcare system and reluctance to use healthcare services, therefore, they could be exposed to more health problems.

Women work
Researchers argued that women work makes them too busy to shop for, prepare and cook healthy meals at home; which can cause obesity in children. Overweight and obese children are likely to stay obese into adulthood and more likely to develop noncommunicable diseases diabetes and cardiovascular diseases at a younger age.

-Physical factors

The characteristics and quality of housing:
Adequate housing is a broad concept that includes a range of issues, but in terms of health the key housing issues are:
- Location: far from pollutants and risks (e.g. stormwater drains).
- Stability: withstands tough conditions.
- Infrastructure: connected to water and sanitation networks.
- Design: allows the entry of sunlight and fresh air.
- Area: suitable for the number of occupants.

Table 1: The health risks of housing defects

<table>
<thead>
<tr>
<th>Housing defect</th>
<th>Health risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate heating</td>
<td>Bronchitis, pneumonia, stroke, heart disease, hypothermia</td>
</tr>
<tr>
<td>Inadequate ventilation</td>
<td>Respiratory complaints, CO poisoning</td>
</tr>
<tr>
<td>Lack of hygiene facilities</td>
<td>Infections</td>
</tr>
<tr>
<td>Structural instability</td>
<td>Injury or death</td>
</tr>
<tr>
<td>Hazardous materials</td>
<td>Respiratory diseases, cancer</td>
</tr>
<tr>
<td>Overcrowding</td>
<td>Infections, stress</td>
</tr>
<tr>
<td>Inadequate means of escape</td>
<td>Injury or death by fire</td>
</tr>
</tbody>
</table>

Accessibility to the benefits of urban life:
Increasing travel time to work, social and recreational facilities or spaces takes over time and energy that could be spent on physical activity to stimulate mental and physical health. Moreover, it can reduce the number of trips to those activities, thus, reducing social interactions. Researchers found that people with lower levels of social interactions have a higher risk of cognitive decline and risk of dementia in old age.

Access to food environment
Researchers found that higher food costs make households – especially the low-income– don’t get enough food; these higher costs can occur due to increasing the time and effort required in getting to green grocers, supermarkets, and other food stores from an urban planning perspective, making them suffer from severe undernutrition or marasmus.

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Facilitating physical activity:
Areas with wide streets, long blocks, few sidewalks and a lack of mixed land use leave children and young people with “nowhere to go” and contribute to the increase in passive indoor recreational activities; therefore, reducing physical activity. Physical inactivity has been identified as the fourth leading risk factor for global mortality. Moreover, it is estimated to be the main cause for approximately 25% -30% of cases of breast and colon cancers, diabetes and ischaemic heart disease.

Providing a safe living environment:
From a health perspective, safety is concerned with injuries and the extent to which the physical environment contributes to or prevents them. These injuries can be unintentional injuries (e.g. motor vehicles crash, buildings collapse) or intentional injuries (e.g. violence against oneself or others and homicides).

-Natural environment
A healthy natural environment contributes to public health. The aspects of natural environment that have a substantial impact on public health include:

Quality of air
Good air quality is essential for human health. Air pollutants can reduce the capacity to resist infection, and increase incidence of stroke, heart disease, and lung cancer. Therefore, the World Health Organization (WHO) offered a global guidance on thresholds and limits for key air pollutants that pose health risks; including, Suspended particles (PM10), Lead (PB), Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Sulphur Dioxide (SO2), and Ozone (O3).

Quality of water
Good water quality is substantial for the health and well-being of humans and ecosystems. Drinking contaminated water, in medical term, may cause diarrhea, bacterial dysentery, cholera and many other contagious illnesses.

Acoustic comfort
Excessive noise seriously harms human health and can cause hearing loss, high blood pressure, and sleep loss; these effects depend on acoustical characteristics of the noise (e.g., loudness, time, pattern).

Thermal comfort
Cities retain much of its heat in roads, buildings, and other structures; causing of higher temperatures. Higher temperatures can affect human health and lead to additional deaths; particularly among elderly people. It can also raise the levels of ozone and other pollutants in the air that exacerbate cardiovascular and respiratory disease.

Green areas
Green areas are the ‘lungs of the city’. They help in mitigating the effects of urbanization and provide residents with a choice of recreational opportunities; which ordinarily entail some form of physical activity, at least walking. Therefore, green areas contribute positively to health and general wellbeing.

III. IDENTIFYING THE VALIDITY OF THE FACTORS AFFECTING NEED TO PUBLIC HEALTH SERVICES
In order to identify the validity of the previous factors; regarding the Egyptian environment, a questionnaire was conducted over 1200 participants within different economic level areas. The questionnaire was divided into three parts. The first part (P1) concentrates on the factors affecting health; including: individual characteristics, socio-economic and physical factors. By answering this part, health status of the respondents can be predicted (I1). The second part of the questionnaire asks about the respondents’ health status (P2). If the respondents’ answers match the predicted health status (P2=I1), factors affecting health are considered valid and can be used to identify those in need to health services. Furthermore, respondents’ answers can be considered as an indicator of need to public sector’s health services (I2).

As for the third part, it identifies the users of public sector’s health service and asks about the reasons that push them to use it (P3). If the respondents’ answers match the indicator of need to public sector’s health service (P3=I2), factors affecting health are considered valid and can be used to identify those in need to public sector’s health service units. Figure 1 illustrates the purpose of each part of the questionnaire.

The questionnaire was conducted in a number of different areas; including: Madinet Nasr, Al-Maadi, Al-Dokki, Shubra Al-Khima, Manshyet Nasser, Al-Mataria, Al-Bsateen, and Boulaq Dakour. The respondents were classified based on the following table to include: high income respondents, upper middle income respondents, lower middle income and low-income respondents. The results of the questionnaire showed that:

-Low income respondents
Part 1: Factors affecting health
Most of low income inhabitants live in rooms (61.4%) with rate scramble exceeds than 5 persons/room (55.3%), they are not connected to water/sewage networks (67.7%) as most of these areas are informal. However, they are connected -to some extent- to green groceries (47.5%), markets (31.1%) and recreational areas (54.6%). They are surrounded by landfills (58.4%), workshops (37.2%), factories (23.2%) and high-voltage transmission lines (21.1%). So they are predicted to have a lot of health problems, especially respiratory, heart and intestinal diseases.

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Part 2: Health status
Respondents’ answers showed that 82.3% of low-income inhabitants have respiratory diseases, 73.1% suffer from intestinal diseases, 59.1% suffer from undernutrition and 55.9% have heart diseases, while only 24.2% have neurological diseases. This agrees considerably with the predicted health status. It is worth mentioning that all suffering from intestinal diseases are not connected to water networks, while most have respiratory and neurological diseases live close to factories and workshops (85.7%) and do not exceed 30 years old. Due to the high percentage of patients among the low-income inhabitants; in addition to their economic level, most of them are predicted to use public sector’s health services; especially they are of low cost.

Part 3: Health services' users
Most of the respondents prefer to use public sector’s health services, even if they are distant (88.3%). All of them agreed that this is because medical consultations and drugs are low in cost. They also agreed that; for outpatient services, they prefer GHS more than FHCs. According to them, the variety of specialties (i.e. rheumatology, renal, oncology, and allergy) is the main reason. This also was applied to educational/university hospitals and the GHS. However, they see that most service units need to be developed and equipped to function better. Moreover, new units need to be established to accommodate the increasing numbers of patients.

-Lower Middle income respondents

Part 1: Factors affecting health
All of lower middle income inhabitants live in apartments with rate scramble 2 persons/room (67.6%). All of them are connected to water/sewage networks, however, some of them are connected to green groceries (56.2%), markets (60.3%), recreational (76.2%) and commercial areas (20.6%). A few are surrounded by workshops (28.6%), and high-voltage lines (18.1%), while many live close to factories (43.5%) and streets with high traffic density (66.7%). So they are predicted to have some health problems, such as respiratory and neurological diseases.

Part 2: Health status
Respondents’ answers showed that 44.2% of mid-income inhabitants have neurological diseases, 49.5% have respiratory diseases, and 36.9% have heart diseases. This agrees with the predicted health status. It is worth mentioning that most have respiratory, neurological and heart diseases live close to factories, workshops and streets with high traffic density (79.3%) and do not exceed 30 years old. Due to the percentage of patients among the lower middle income inhabitants; in addition to their economic level, some of them are predicted to use public sector’s health services; especially those suffering from chronic disease, while the others are predicted to use private sector’s health services.

Part 3: Health services’ users
For outpatient services, 33.2% of respondents use public sector’s health services, as they are close to them, while the others (66.8%) use private health services. As for inpatient services, the percentage of users increases to reach 58.3%. They agreed that they prefer Educational hospitals more than GHS. Those use private services agreed that they do not use the public ones because of the weakness of the provided service.

-Upper Middle income respondents

Part 1: Factors affecting health
All of upper middle income inhabitants live in apartments with rate scramble 2 persons/room (76.3%). All of them are connected to water/sewage networks, however, most of them are connected to green groceries (77.2%), markets (81.3%), recreational (82.7%) and commercial areas (64.6%). A few are surrounded by workshops (6.3%), and high-voltage lines (10.1%), and live close to streets with high traffic density (32.6%). So they are predicted to have few health problems, such as respiratory and neurological diseases.

Part 2: Health status
Respondents’ answers showed that 21.5% of upper middle income inhabitants have neurological diseases, 19.2% have respiratory diseases, and 9.1% have heart diseases. This agrees with the predicted health status. Due to the low percentage of patients among the upper middle income inhabitants; in addition to their economic level, a few are predicted to use public sector’s health services, while the others are predicted to use private sector’s health services.

Part 3: Health services’ users
For outpatient services, 7.3% of respondents use public sector’s health services, while the others (92.7%) use private health services. As for inpatient services, the percentage of users increases to reach 18.2%. They agreed that they prefer university and specialized hospitals. Those use private services agreed that they do not use the public ones because their conviction that this type of services established basically to serve the low income.

-High-income respondents

Part 1: Factors affecting health
All of high-income inhabitants live in apartments and villas with rate scramble 2 persons/room (36.8%) or less (63.2%). All of them are connected to water/sewage networks (100%), green groceries (83.5%), markets (91.9%), recreational (98.2%) and commercial areas (87.8%). A few are surrounded by high-voltage lines (9.7%). Thus, only the elderly are predicted to have some health problems.

Part 2: Health status
Respondents’ answers showed that 20.1% of high-income inhabitants have heart diseases, 6.9% have neurological diseases, and 3.5% have respiratory diseases; most of them are above 60 years old (72.9%). This agrees with the predicted health status. Due to the low percentage of patients among the high-income inhabitants; in addition to their economic level, they are predicted to use private sector’s health services.

Part 3: Health services’ users
All the respondents use private health services; even if the public ones are close to them. They all agreed that this is because of their conviction that this type of services established basically to serve the poor.

Based on the previous results, it is obvious that factors affecting need to public health service are compatible with the responses of the interviewee within the study area. Therefore, they can be used to identify the users of public sector’s health service.

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IV. MEASURING THE VALID FACTORS

As need is the main determinant of equitable health services distribution (according to literature review) and the factors affecting it can be used to identify the users of service’s type (based on the questionnaire), key indicators have been identified for the previous factors to be measured. It is worth mentioning that some indicators are difficult to be measured; such as genetics and individual lifestyle. Therefore, they were excluded from the study. Table 2 shows need to public health services indicators. These indicators were calculated for each shyakha (neighborhood).

Table 2: Need to public health services indicators

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Sub-dimension</th>
<th>Indicators</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual characteristics</td>
<td>GENDER</td>
<td>No. of Females</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td>AGE</td>
<td>No. of children (-5)</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. of the elderly (+60)</td>
<td>Persons</td>
</tr>
<tr>
<td>Socio-economic factors</td>
<td>Population Density</td>
<td>No. of persons per area</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td>Family size</td>
<td></td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td>Educational condition</td>
<td>Illiteracy rate</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td>Economic condition</td>
<td>Unemployment rate</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td>Women's work</td>
<td>No. of working women</td>
<td>Persons</td>
</tr>
<tr>
<td>Built environment</td>
<td>Access to the benefits of urban life</td>
<td>No. of residents not connected to transportation network</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td>Access to adequate housing</td>
<td>No. of residents within the unplanned areas</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. of residents not connected to clean water network</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. of residents not connected to sewage network</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rate scramble</td>
<td>Persons/room</td>
</tr>
<tr>
<td></td>
<td>Providing safe living environment</td>
<td>No. of residents within the unsafe areas</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. of residents at risk of crimes</td>
<td>Persons</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. of residents at risk of traffic accidents</td>
<td></td>
</tr>
<tr>
<td>Food security and healthy nutrition</td>
<td>Access to markets and green groceries</td>
<td>Meters</td>
<td></td>
</tr>
<tr>
<td>Facilitating physical activity</td>
<td>Block width</td>
<td>Meters</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Access to recreational and commercial areas</td>
<td>Meters</td>
</tr>
<tr>
<td>Natural environment</td>
<td>Quality of Air</td>
<td>PB</td>
<td>MicroGrams/m1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM10</td>
<td>MicroGrams/m2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SO2</td>
<td>MicroGrams/m3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NO2</td>
<td>MicroGrams/m4</td>
</tr>
<tr>
<td></td>
<td>Thermal Comfort</td>
<td>Land Surface Temperature</td>
<td>° c</td>
</tr>
<tr>
<td></td>
<td>Natural Landscapes</td>
<td>Area of green spaces</td>
<td>m2</td>
</tr>
</tbody>
</table>

V. CONSTRUCTING THE NEED TO HEALTH SERVICES INDEX (NHSI)

Construction of NHSI implemented the principle component factor analysis on the different calculated indicators using “STATA” program. Varimax rotation with Kaiser Normalization was done to simplify and minimize these factors to achieve meaningful construction. The result of this analysis was a principal component with the largest amount of information common to all of the factors with a factor loading for each shyakha (neighborhood). Loadings range between -4.4 and 34.06. The total explained variance for the first component was 20.81%.
VI. TESTING THE (NHSI)

In order to test the NHSI, it is important to evaluate its performance in differentiating between the different types of cells. A 4-means cluster analysis was conducted using the index score as the clustering dimension.

For the purpose of distinction, these categories were named as:
- Low need to health services.
- Lower middle need to health services.
- Upper middle need to health services.
- High need to health services.

The average score for the low need cluster was -2.574654 with a range from -1.92466 to -4.45104, while the high need cluster had an average of 3.480551 and ranges between 1.16 and 34.07. Figure 2 shows these clusters according to the corresponding shyakha. It is obvious that high need shyakhat (neighborhoods) concentrate in Manshyet Nasser, El-Basatin, Dar El-Salam, Ain Shams, El-Zawya El-Hamra, Warraq El-Arab, Saft El-Laban, Boulaq El-Dakrour, El-Maasara, Helwan, Begam and Bahtim. As for the low need shyakhat (neighborhoods), they concentrate in Madinet Nasr, Misr El-Gadida, El-Dokki, El-Agouza, and El-Maadi. It is obvious that, all the “high need to health services” areas are characterized by high population density, high percentages of illiteracy and unemployment, lack of green areas, markets, commercial and recreational areas, in addition to, intense presence of environment pollutant sources, manifested in large numbers of workshops and factories, while the “low need to health services” areas are characterized by low population density, low percentages of illiteracy and unemployment, presence of green areas, markets, commercial and recreational areas (see Table 3. Accordingly, the NHSI is effective in identifying the real users of public health services within Greater Cairo.
Figure 2: Clusters according to the corresponding shyakha (neighborhood)

Table 3: Results of cluster analysis

<table>
<thead>
<tr>
<th>High need to Health services</th>
<th>Upper middle need to Health services</th>
<th>Lower middle need to Health services</th>
<th>Low need to Health services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>Mean</td>
<td>Max</td>
<td>Min</td>
</tr>
</tbody>
</table>

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VII. CONCLUSION

This study tried to identify the real users of public health services within Greater Cairo through defining the basis on which services are provided. The study showed that need is the main determinant in using public health services. Based on this, factors affecting this need were extracted, then, the validity of these factors was identified through a questionnaire conducted over 1200 participants within different economic level areas. Respondents answers showed that the extracted factors are compatible with the Egyptian environment. Therefore, they can be used to identify the users of public sector’s health service.

![Table](data:image/png;base64,EM...BQ==)
Accordingly, indicators have been identified for the previous factors to be measured. These factors were minimized; using the principle component factor analysis, and clustered into 4 categories; representing the levels of need to public health services. Analysis showed that all the “high need to health services” areas are characterized by high population density, high percentages of illiteracy and unemployment, lack of green areas, markets, commercial and recreational areas, in addition to, intense presence of environment pollutant sources, manifested in large numbers of workshops and factories, while the “low need to health services” areas are characterized by low population density, low percentages of illiteracy and unemployment, presence of green areas, markets, commercial and recreational areas. Thus, this method is effective in identifying the real users of public health services within Greater Cairo.

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Post Mechanical Ventilation, Through Tracheotomy Treated with Pulmonary Rehabilitation – An Evidence Based Case Study

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Abstract
Respiratory distress, an acute emergency situation requires mechanical ventilatory support and tracheotomy. Rehabilitation with residual pulmonary and neurological means needs critical analysis when adopting customized physical therapy. Aims & Objectives of this original research was to evaluate the impact of pulmonary rehabilitation on quality of life of this subject. Materials & Methodology: After gradual weaning and the subject getting discharged to home daily domiciliary physiotherapy from 10.02.2017 to 28.05.2017 and he was getting treated at the rehabilitation centre as an outpatient from 1.06.2017 till 30.09.2017 with twice a week frequency in Chennai with principles of pulmonary rehabilitation. Results of pre and post PR were analyzed on QOL SF 36 P<.01 Conclusion: periodical evaluation, feedback, functional activity based exercises, combining pulmonary and neurological therapy can facilitate due rehabilitation in a shorter time frame.

Index Terms- Pulmonary Rehabilitation, Tracheotomy, Mechanical Ventilation, Respiratory Distress, Quality of Life

I. INTRODUCTION

Since most human ARDS (Acute Respiratory Distress Syndrome) patients require mechanical ventilation, several pulmonary ventilator strategies (Amato etal 1998) based on massive alveolar collapse, cyclic lung reopening, over distension of the lungs occurring during mechanical ventilation to decrease lung injury during ventilation (Borges etal 2008)

Pulmonary insults can lead to a varying degree of respiratory compromise and failure described as ARDS (Ware and Mattey 2000) and reported with a mortality rates between 40% to 60% (Declue and Cohn 2007). A smoking history is particularly associated with respiratory complications (Berlly and Shem 2007). Cindy etal 2012 in a meta analysis evaluating the effects of exercise training on measures of physical activity using accelerometer proposed thrice a week and 6 months duration to obtain significant results and changes in behavior (Vanhelst 2012).

Tracheotomies may be performed to ensures a safe and patent air way in patients to facilitate mechanical ventilation for respiratory failure (Heffner 2008) while there are complications including death, associated with tracheostomy, its performance has become common (Kapadia etal 2000)

One tenth of the patients receiving MV undergo tracheotomies (Kollef etal 1999)

Use of mechanical ventilation, development of pneumonia, use of tracheotomy explain more hospital costs (Winslow etal 2003)

An improved exercise performance was highly evidenced with PR by ACCp/ AACVPR (Ries etal 2007)

Strength training component in PR increases muscle mass and strength (Ries etal 2005)

Aims & Objectives of this original research was to evaluate the efficacy of PR on QOL following weaning from MV and tracheostomy

Keywords: ARDS, Thacheostomy, Pulmonary Rehabilitation, Dyspnea, Vital Capacity, Anxiety

Past History H/O

Mr.XXX, Aged 55 years was on ventilatory support through tracheotomy for respiratory distress from 02.02.2017 till 08.02.2017 was known type II diabetes and CAD with EF of 55% as on 08.02.2017, he was treated with due antibiotics for rissella and pseudomonas aeruginosa. Known smoker and an alcoholics, his complaints since June 2017 were inability to walk unaided frequent falls and lowered energy levels.

BMI: 24Kg/m²

O/E

- Left hypertonicity legs > arms
- Bilateral hamstring tightness
- Spirometer VC- 1200 CC
- Balance in standing needs support
- Vastus Medialis left weak > right
- Hip Abdomen – Ext – 2/5
- Knee Ext – 2/5
- Abdominal muscles moderate
- Exaggerated lumbar lordosis
- Bilateral upper extremities 3/5
- Low exercise tolerance
- Reaction time was decreases
- Nil visible deformities / soft tissue tightness except resisted cervical spine movements

But he was treated with daily domiciliary physiotherapy from the time of discharge from hospital till May 2017 by some other physiotherapist
And he has been attending this centre and is treated by the author with weekly twice frequency during the period from June to September 2017.

### Treatment & Clinical Prognosis

<table>
<thead>
<tr>
<th>Problem Identified</th>
<th>Exercises</th>
<th>Outcome Measures</th>
</tr>
</thead>
</table>
| **June 2017**  
I. Dyspnea on exertion  
II. Motor power of LE 2/5  
III. Balance disturbance  
IV. Fatigue on mild exertion | I. Incentive Spirometer  
II. Active exercises with mild resistance in all postures  
1 set of 10 exercises with rest 15 minutes duration | Outcome measures moderate reduction in fatigue, able to walk with confidence still wobbly and fear of fall, requires monitoring |
| **July 2017**  
- 2 occasions had fallen down  
- Vital capacity was 1200 CC | Physioball based Pilates exercises started, balance training 2 set of 15 exercises 3 repetitions 20 minutes | Started attending office and regular walking for 10 minutes with monitoring |
| **August 2017**  
- Getting up and down from low level chair findings tough  
- Anxiety in open environment. | Floor level exercises with core strengthening of upper and lower extremities for 5 repetitions, 20 exercises 25 minutes | Able to drive car, social activities he has started with improved confidence, walking duration was increased 20 minutes |
| **September 2017**  
- Coming down the steps, ramps, has difficulty  
- New places, surfaces balance, with fear he gets disturbed for walking | Dynamic resistance in standing, sitting on ball manually and using Physioball with 5 repetitions: Set of 20 exercises 30 minutes duration | Vital capacity was 3600 CC, level of fatigue has come down, able to walk on different surfaces and new places |

### Hypothetical Questions from this Case Study Were:

I. Pattern of prognosis post respiratory distress, treated with mechanical ventilation and tracheotomy later?  
II. Neurological rehabilitation on balance, motor power and functional activities how effective are factors involved and therapies available with evidence?  
III. Pulmonary rehabilitation evidenced clinical modalities and duration of prognosis and factors influencing?

Table on Results of Pre and Post – Rehabilitation of the subject with paired ‘t’ test using SF 36 QOL questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>SD</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>68</td>
<td>31</td>
<td>21</td>
<td>12</td>
<td>3.08</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

A. Spirometric values improve with physiotherapy as supported by (Divisi etal 2013) but few studies found no significant improvement with spirometer (Bobbio etal 2008). Patients who are liberated from MV and have their tracheotomies tubes removed have the best survival (Engoren etal 2003). Chatila etal 2001 who evaluated 25 survivors of a ventilator rehab unit found mild moderate in pairment in quality of life

B. Inactivity leads to deconditioning, mainly caused by breathlessness, which can lead to an increased fear of exertion, avoidance of physical and social activities adding further isolation and depression accompanied by a reduced health related quality of life (Core Hay etal 2014). An RET with 2 years follow up where reduction in health care utilization with PR was recorded (Guell etal 2000). Muscular functional disorders are reversible with moderate to high intensity rehab exercises (Sala etal 1999) ie 60-80% peak work rate are sufficient to elicit adequate physiologic training effects in 30 minutes (Nici etal 2006). With endurance exercises of the leg muscles being the main focus (Bogdanis etal 2012) upper limb exercises should be incorporated to facilitate daily activities such as dressing, washing and carrying groceries (Nici etal 2006).

C. Adherence to pulmonary rehabilitation by smokers remains less than that of ex smokers (Youg etal 1999). 6 weeks pulmonary rehab had low hospital admission in a one year follow up (Griffiths etal 2000). Griffiths etal 2000 reported PR to be cost effective and resulted in financial benefits.
Meta analysis (Sin et al 2003) have recommended with PR coming COPD subjects a highly significant St Georges respiratory questionnaire. Dyspnea relief with PR in grade a evidence was recorded by gold (Vestbo et al 2013) on chronic respiratory questionnaire. 6 months PR programs have shown with more successful outcomes (Guell et al 2000 and maintenance of benefits of PR such as physical activity and life style changes are important challenge for those who have undergone a comprehensive PR program (Ries et al 2003)

II. CONCLUSION

Weaning from mechanical ventilation through tracheotomy, post rehabilitation of the subject with due physiotherapeutic means requires synchronizing both cardio respiratory and neurological exercises. Proper evaluation with analysis and feed back from the subject ensures maximized achievement of quality of life.

Limitations of this research study was being a single case study report, outcome measures were not measured wit PFT and shorter duration follow up was the main outcome of this original presentation.

Further Studies on similar subjects with pulmonary and neurological deficit with larger sample size and more physical therapy variables can be carried out.

Critical analysis of this study findings:

a. Rehabilitation of balance, was not mentioned with evidence
b. Lower extremity and core exercises were only done during first two months, here as upper extremities were exercised later period only
c. Subject was able to drive car, walk independently for 20 minutes, ascending and descending stairs and his level of confidence has improved but anxiety prevails with beginning of any physical activity, which was unanswered
d. Through vital capacity using incentive spirometer has improved to 5000cc, status of respiratory condition were not qualitatively evaluated using pulmonary function test in this subject

REFERENCES


AUTHORS

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Causes of Bullying in Boarding High Schools in Zimbabwe

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Abstract- This is part of a broad study that investigated bullying behaviours in boarding schools in Zimbabwe. This particular paper focuses on some of the possible causes of bullying behaviours in boarding schools in Zimbabwe. The study used descriptive survey design. The research participants were pupils in boarding schools in Zimbabwe and members of schools disciplinary committees. The sample of research participants consisted of twelve members of school disciplinary committee and forty children in boarding schools. Research participants from school disciplinary committees were selected using random sampling. School children were selected using stratified sampling technique and were then randomly selected. The study used questionnaires as research instruments. The study found out that bullying was prevalent in boarding schools in Zimbabwe. The main causes of bullying in boarding schools were lack of school rules and implementation of rules that deter bullying, influence of movies and films that show bullies as heroes watched by boarding school children, home background that encouraged bullying as a way of solving problems or did not discourage bullying, influence of peers who considered perpetrators of bullying behaviours as heroes and attention seeking behaviours of bullies. The study recommended that schools should have clearly down rules against bullying, bullying rules should be rigorously enforced, children should be conscientised on the ills of bullying behaviours, children should be empowered to report bullying so that they do not suffer in silence and children should watch films and movies that show helping behaviours as heroic.

Index Terms- Bullying, Disciplinary Committee, Boarder, Impact, Mission Boarding School

I. INTRODUCTION

When children are left in boarding schools it is the hope of parents that the school authorities take over the roles of parents as ‘loco parentis’. This involves making sure all children are protected from all forms of harm including bullying. When children are bullied their academic performance is compromised implying that their future is negatively affected. It is important that the causes of bullying be interrogated so that when children interact on their own they do so in a spirit of collegiality and do not impose themselves over others. The causes of bullying should be investigated and ways of going around them found for the benefit of children who are left at care institutions.

Research Question: What are the main causes of bullying in government and mission boarding high school?

II. LITERATURE REVIEW

Bullying Contextualised

Bullying has been defined in a number of ways over the years. Olweus (1993) the outstanding pioneer in the field of bullying defines bullying by saying:

“a person is bullied when he/she is exposed, repeatedly and over time, to negative actions on the part of one or more other persons”.

O’Moore and Minton’s (2004) definition of bullying is one of the most widely used definitions. They defined bullying as long standing violence, mental or physical conducted by an individual or group against an individual who is not able to defend him/herself in that actual situation. While bullying as defined by Roland (1993) is a long standing physical or psychological violence conducted by an individual or group and directed against an individual who is not able to defend him/herself in the actual situation. Thus looking at boarding school set up, the victims are more defenseless as compared to their day-school counterparts who have an upper hand in the particular setting, as the students live away from their parents. The major proportion of bullying goes unreported as victims are threatened into silence while both teachers and some parents do not take the problem seriously as they regard it as part of growing up.

In bullying the hurt that is done to the victim is both intentional and unprovoked resulting in the tainting of the victim’s self-esteem. Bullying is usually done on the basis of imbalance of power where the victim is unable to defend him/herself in the actual bullying situation.

Bullying behaviour may take a variety of forms. What has been termed direct bullying is where the victims are more or less openly attacked by the perpetrator. Direct bullying involves physical bullying, gesture bullying, extortion and e-bullying or cyber bullying. Indirect bullying is to some extent more covert, usually involving deliberate manipulation of social relationships in order to socially isolate someone, cause to be ridiculed or to make others dislike the victim. It basically involves manipulation of the environment so that others behave negatively towards the victim.

Bullying should be viewed as an unacceptable form of interpersonal behavior. Unfortunately most bullying incidences go unreported as victims feel that adults do not take the problem of bullying seriously and times blame themselves for being bullied. At times the victims are shy and not assertive enough to open up and state the situation they are in. Rigby (2001) notes that bullying can be practiced by both males and females. Researchers have uncovered fairly consistent differences in the

www.ijsrp.org
way in which males and females perpetrate bullying behaviours. Whilst verbal bullying is generally the most common experienced form of bullying for males and females alike, male perpetrators are more likely than females to use direct means, whereas female perpetrators are more likely than males to use indirect methods.

Causes of bullying in boarding schools

Bullying can be a result of a variety of factors though it is difficult to ascertain which particular factor is responsible for a particular form of bullying. These factors include genetic predisposition, early socialization, modeling, operant conditioning, disorder in functioning of the superego, environmental factors and peer pressure.

Genetic predisposition

There are several factors that are considered to contribute in various ways to likelihood of bullying behaviours. Hallam and Reeds (2005) content that physiological theories say that the bullies are genetically different from others. Some supporting evidence comes from studies of twins which show consistently high concordance rates for anti-social behavior in identical than fraternal twins and other siblings. It is argued that there are certain personality traits that appear among most bullies such as aggressiveness, impulsive behavior, low in empathy and therefore not sensitive to the plight of others. The bullies generally enjoy and get satisfaction in seeing other children in pain. However it should be noted that when raised in a positive home environment the children with these personality traits can learn empathy and compassion which puts them at lower risk for bullying.

Tatum (1993) also suggest that children with a genetic predisposition to bullying may have risk for bullying lowered through provision of boarding school environment in which relations between students are positive. The schools should cultivate a culture of empathy where emphasis is on collegiality and deriving satisfaction from helping others. Schools that recognize and reward those that practice anti-bullying behaviours reduce the possibility of the bullying behavior manifesting.

Early Socialisation

Bullying behavior can be understood in terms of early socialization. According to Haralambos and Holborn (1995) if a child was deprived of motherly love during the first seven years, he/she could develop conduct disorders during childhood and anti-social personality disorder. There is a tendency of such children to compensate their shortcomings by inflicting pain on others. In the same vein O’Moore and Minton (2004) argue that dysfunctional families can contribute to the development of bullying behaviours in children. In dysfunctional families the socialization processes are characterized by inflicting pain on others. The interactions between the family members in a dysfunctional family are based on those with power imposing themselves on those without power. More so it has been observed that children who lack adult supervision or who are abused at home are at a higher risk of bullying others in schools. Since they do not have supervision most of the time they may inadvertently get used to inflicting pain on other children. Parents who are too lax with discipline may also expose their children to risk of being bullies when they go to school. This implies that when schools are dealing with issues of bullying at boarding schools, there is need to look at the children’s social background.

Modelling

Social learning theorists attribute bullying to both modeling and operant conditioning. Davison and Neale (1990) noted that children can learn aggressive behaviours such as bullying from adults who behave in this way. Children who are from families where bullying and aggressive behaviours are practiced are more likely to practice the aggressive behaviours. According to www.bullyingstatistics.org, in a culture fascinated with winning, power and violence, some experts suggest that it is unrealistic to expect that children will not be influenced to seek power through violence in their own lives. They will be viewing it as legitimate way of meeting their ends. Research points to world wrestling federation where glorification of bullies is done in the name of entertainment. Thus children who watch world wrestling federation on television may learn both physical and verbal bullying. It is important to point out that the high rates of domestic violence means that many young people grow up expecting that violence is an acceptable way to get what one wants. Aggressive behaviours such as bullying may be seen as an effective means of achieving a goal and is likely to be reinforced. Davison and Neale (1990) thus maintain that once initiated, bullying acts are likely to be maintained.

Peer Pressure

Bullying can also be a response to peer pressure within the school. Olweus (1993) noted that bullying can be seen as group phenomena. Within the school environment the peer group will often bully another group or individual for reasons which may be real or imagined or simply to have fun. Some bullies in previous studies have admitted to acting as part of a group for half of the bullying incidences they have been involved in. It is also important to note that bullying by an individual is often conducted with support of a group where the bully is glorified and seen as a hero.

Environmental Factors

According to www.bullyingstatistics.org, the institutions like boarding schools can also contribute to bullying behaviours. If the institution in which bullying takes place does not have high standards for the way people should treat each other, then bullying may be more likely and or prevalent. In cases where the rules are lax or are not strictly enforced there is room that bullying will occur. Institutions that have strict rules and close supervision of activities that children will be doing are likely to have fewer cases of bullying than where children are left unattended for long periods of time. Thus the institution would have an influence on why children bully.

Methodology

In this study the researcher used descriptive survey design. The descriptive survey was chosen because it places emphasis on the depth of the understanding of the deeper meaning of human experiences. The design offers rich descriptive reports on the individual’s perception, attitudes, beliefs, views, feelings and interpretations of given events. The descriptive survey design is
defined by its methodical collection of standardized information from a representative sample of the population (Christensen,1994). The descriptive research design suits the context under which the present study was undertaken. The descriptive survey represents a probe into a given state of affairs that exists at a given time. It therefore means that direct contact was made with individuals whose characteristics, behaviours and issues were relevant to the investigation under study. In this case the researcher had direct contact with some of the children who were bullied or who saw bullying taking place and members of the disciplinary committee who handled bullying issues.

Sampling involves selecting people from the population to represent the entire population, (Polit 2001). In this study the sample consisted of boarding school children in forms one to six and members of schools disciplinary committees. The research used random sampling for selecting members of schools disciplinary committee. Twelve members of the disciplinary committees participated in the research. They consisted of six males and six females. According to Hallam and Reed (2005) simple random selection involves taking names completely at random, from a list by a person or a computer, so that each member of population has an equal chance of being selected. In the case of school children the research used stratified and random sampling.

Hallam and Reed (2005) maintain that in stratified random sampling, the population is put into segments called “strata” based on things like age, gender or income. Names are then selected at random from within each segment. For the purpose of this study, the researcher put the students into three segments based on level of education at the school which are junior (Form 1 and 2), ordinary level (Form 3 and 4) and senior level (Form 5 and 6). The researcher had cards numbered one to ninety per level. The cards were put in a box and shuffled and students allowed picking cards randomly. All students who picked up cards for multiples of ten per level per school were selected. As a result forty students of different ages, sex and level of education were selected.

The research used questionnaires as research instruments. Questionnaires were used because they are anonymous and do not require respondents to sit face to face with interviewer. This makes respondents to be more frank when responding to sensitive issues like bullying. Closed questions in the questionnaires provided data which could be easily quantified and analysed. Open –ended questions were there for realizing clarity on some ambiguous issues.

III. RESULTS

Table 1 Gender of student respondents (N=40)

<table>
<thead>
<tr>
<th>Gender</th>
<th>No of respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>18</td>
<td>45</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

On the gender of respondents, 45% were male and 55% were female.

Table 2 Level of education of student respondents (N=40)

<table>
<thead>
<tr>
<th>Level</th>
<th>No of respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form 1 and 2</td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>Form 3 and 4</td>
<td>15</td>
<td>38</td>
</tr>
<tr>
<td>Form 5 and 6</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

On the level of education 40% of respondents were in Form 1 and 2, 38% were in Form 3 and 4 and 22% were in Form 5 and 6.

Table 3 Causes of bullying according to students (N= 40)

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>SD</th>
<th>D</th>
<th>NS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullying is a problem</td>
<td>9</td>
<td>22</td>
<td>13</td>
<td>33</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>in boarding schools</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>The most bullied</td>
<td>19</td>
<td>48</td>
<td>11</td>
<td>27</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>students are in form</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>1 and 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Poor upbringing is</td>
<td>12</td>
<td>30</td>
<td>14</td>
<td>35</td>
<td>03</td>
<td>08</td>
</tr>
<tr>
<td>a major cause of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>bullying</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Bullying is inherited</td>
<td>6</td>
<td>15</td>
<td>9</td>
<td>22</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>Films and movies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>33</td>
</tr>
<tr>
<td>influence bullying</td>
<td>11</td>
<td>28</td>
<td>14</td>
<td>35</td>
<td>05</td>
<td>12</td>
</tr>
<tr>
<td>Bullies are attention</td>
<td>16</td>
<td>40</td>
<td>18</td>
<td>45</td>
<td>2</td>
<td>05</td>
</tr>
<tr>
<td>seekers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>01</td>
</tr>
<tr>
<td>Lack of strict school</td>
<td>25</td>
<td>62</td>
<td>14</td>
<td>35</td>
<td>01</td>
<td>03</td>
</tr>
<tr>
<td>rules cause bullying</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>00</td>
</tr>
<tr>
<td>Counselling is used</td>
<td>15</td>
<td>37</td>
<td>11</td>
<td>27</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>as intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>strategy to bullying</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>7</td>
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<td>18</td>
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<td>40</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Results of the study showed that 22% of respondents strongly agreed that bullying was a problem, 33% agreed, 20% strongly disagreed, none disagreed and 25% of the respondents were not sure if it was a problem in their school. Therefore a majority of the respondents (55%) have the belief that bullying is a problem in boarding schools.

The study found out that Form 1 and 2 students were the most bullied. 48% of respondents strongly agreed that Form 1
and 2 were the most bullied, 27% agreed, 5% strongly disagreed, 5% disagreed and 15% of respondents were not sure if the Form 1 and 2 students were the most bullied.

Thirty percent (30%) of respondents strongly agreed that poor upbringing was a major cause of bullying, 35% agreed, 8% strongly disagreed, 2% disagreed and 25% were not sure if poor upbringing was a major cause of bullying.

On the issue of bullying being inherited from parents, 15% of respondents strongly agreed that bullying was inherited from parents, 22% agreed, 18% strongly disagreed, 12% disagreed and 33% were not sure bullying was inherited from parents.

On issue of films and movies influencing bullying 28% of respondents strongly agreed that films and movies influenced bullying, 35% agreed, 12% strongly disagreed, 10% disagreed and 15% were not sure.

On whether attention seeking was a reason for bullying 40% of respondents strongly agreed that bullies were attention seekers, 45% agreed, 5% strongly disagreed, 2% disagreed and 8% were not sure.

On lack of strict school rules as a cause of bullying the study found that 62% of respondents strongly agreed that lack of strict rules caused bullying, 35% agreed, 2% strongly disagreed and no respondents disagreed or were not sure.

On the issue of counseling being used as an intervention strategy to bullying in schools, 37% of respondents strongly agreed that counseling was being used to deal with bullying, 27% agreed, 10% strongly disagreed, 8% disagreed and 18% were not sure if counselling was being used to deal with bullying issues.

Table 4.7 Gender of Respondents in Schools Disciplinary Committees (N=12)

<table>
<thead>
<tr>
<th>Gender</th>
<th>No of respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>100</td>
</tr>
</tbody>
</table>

On the gender of respondents, 50% were male and 50% were female.

Table 4.9 Period saved as a member of disciplinary committee (N=12)

<table>
<thead>
<tr>
<th>Time</th>
<th>No of respondents</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 years</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>5-10 years</td>
<td>7</td>
<td>60</td>
</tr>
<tr>
<td>11-15 years</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>16-20 years</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>More than 20 years</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>100</td>
</tr>
</tbody>
</table>

On the period spent as a member of the disciplinary committee 16% of respondents had been members for less than 5 years, 60% for 5 to 10 years, 8% for 11 to 15 years, 8% for 16-20 years and 8% for more than 20 years.

Table 4 Causes of bullying according to members of the Schools Disciplinary Committee Members (N=12)

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>SD</th>
<th>D</th>
<th>NS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullying is a problem in boarding schools</td>
<td>2</td>
<td>17</td>
<td>6</td>
<td>50</td>
<td>01</td>
<td>8</td>
</tr>
<tr>
<td>The most bullied students are in form 1 and 2</td>
<td>3</td>
<td>25</td>
<td>8</td>
<td>67</td>
<td>00</td>
<td>01</td>
</tr>
<tr>
<td>Poor upbringing is a major cause of bullying</td>
<td>2</td>
<td>17</td>
<td>5</td>
<td>42</td>
<td>33</td>
<td>1</td>
</tr>
<tr>
<td>Bullying is inherited</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Films and movies influence bullying</td>
<td>5</td>
<td>42</td>
<td>3</td>
<td>25</td>
<td>00</td>
<td>3</td>
</tr>
<tr>
<td>Bullies are attention seekers</td>
<td>5</td>
<td>42</td>
<td>5</td>
<td>42</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Lack of strict school rules cause bullying</td>
<td>9</td>
<td>76</td>
<td>1</td>
<td>8</td>
<td>00</td>
<td>1</td>
</tr>
<tr>
<td>Counselling is used as intervention strategy to bullying</td>
<td>4</td>
<td>32</td>
<td>6</td>
<td>50</td>
<td>00</td>
<td>0</td>
</tr>
</tbody>
</table>

On bullying being a problem in schools 17% of respondents strongly agreed, that bullying was a problem in schools 50% agreed, 8% strongly disagreed, 17% disagreed and 8% were not sure. Therefore the findings point to the conclusion that bullying is a serious problem affecting weaker and junior students.

On the issue of Form 1 and 2 being the most bullied 25% strongly agreed that Form 1 and 2 were the most bullied strongly disagreed, 8% disagreed and no one was not sure.

On the issue of poor upbringing being a major cause of bullying seventeen percent (17%) of respondents, strongly agreed that poor upbringing is a major cause of bullying, 42% agreed, 33% strongly disagreed, 8% disagreed and 8% were not sure.

On issue of films and movies influencing bullying, 42% of respondents strongly agreed that media influenced bullying, 25% agreed, 0% strongly disagreed, 25% disagreed and 8% were not sure. On issue of lack of strict rules on bullying being cause of bullying, 76% strongly agreed, that 8% agreed, on bullying caused bullying, 0% strongly disagreed, 8% disagreed and 8% were not sure.

On issue of bullies being attention seekers 42% of respondents agreed that bullies were attention seekers, 42%
agreed, 8% strongly disagreed, 8% disagreed and 0% were not sure. On the issue of counseling being used as an intervention strategy to bullying in schools 32% of respondents strongly agreed that counseling was used as an intervention strategy to bullying, 50% agreed, no respondents strongly disagreed nor disagreed and 16% were not sure.

IV. DISCUSSION

Lack of strict school rules on bullying
The study found out that lack of strict school rules on bullying is a major cause of bullying in schools. 84% of members of the disciplinary committees and 97% of school children strongly agreed and agreed that lack of school rules contributed to the existence of bullying at the boarding schools. When potential bullies discover that there are no strict rules against bullying they tend to engage in bullying and others also engage in bullying when they observe that bullies can get away with bullying. If those who bully others are reprimanded for unbecoming behavior and all other pupils observe the perpetrators being punished then it is likely that the bullying cases will not be repeated. The findings are in agreement with Walter (2010) who asserted that schools run by government have lax standards that lead to the occurrence of bullying and other misbehaviours and yet on the other hand church schools are known for high academic, and moral standards have a well as a disciplined student body. This would explain why bullying is more in government than mission schools.

Bullies are attention seekers
The research findings from the study also show that bullies engage in bullying behaviours as a way of seeking attention from adults in the school or fellow students. 40% of the students strongly agreed and 45% agreed that bullying was done as a way of attention seeking. Among members of the disciplinary committee 42% strongly agreed and the same percentage agreed that bullying was done for purposes of seeking attention. This could be due to the bully’s personality inadequacies or lack of recognition through academic excellence. By engaging in bullying behaviours the bully gets attention from peers and is talked about by other pupils. Thus to gain attention the perpetrators of bullying bully other students to get into the limelight and be viewed as heroes. These findings agree with a writer at www.bullyingstatistics.org who indicated that if social recognition can be attained for negative behaviours than positive ones, bullying can occur for purposes of seeking attention.

Poor upbringing as a cause of bullying
The study also found out that 30% of the students strongly agreed and 35% of the students agreed that poor upbringing can be a cause of bullying in mission and government boarding schools. Among members of the disciplinary committee 17% strongly agreed and 42% agreed that poor upbringing could be a cause of bullying in mission and boarding schools. The poor upbringing results from broken families where children are raised by a single parent, be it the father or mother or raised by older siblings in case of death of parents. Where the family is not quite intact, moral guidance may be inadequate which will then be manifested by bullying behaviours when the child gets to board school. This is also supported by Rigby (2008) in his findings which showed that bullying can be caused by social factors such as dysfunctional families where there are family or parental problems. Children who have positive relationships with their parents or family are less likely to bully others.

Bullies are influenced by films and movies that they watch
The study also found out that bullying behaviours can be caused by films and movies that they bully watch. The study results showed that 28% of the students strongly agreed while 35% agreed that films and movies influenced bullying behaviour of pupils. Among members of the disciplinary committee the results showed that 42% strongly agreed while 25% agreed the films and movies influenced the bullying behaviour of pupils. This is because the bullies would learn the bullying behaviours from the movies and films so to boarding school where they then practice what they watched in the films and movies. The findings are in agreement with Rigby (2010) who argued that physical violence in media may contribute to bullying, though this may be difficult to generalize as some can watch the films and movies but do not bully but the children will nevertheless bully other children.

Bullying as being inherited from parents
The study also found out that both disciplinary committee members and students were not sure if bullying was inherited from parents. The study found out that only 15% of the children strongly agreed and 9% agreed and 33% were not sure whether bullying was a result of inheritance. Among members of the disciplinary committee only 8% strongly agreed that bullying was inherited while also 8% agreed and 58% were not sure. The findings, however do not agree with Hallam and Reeds (2005) who argued that bullying may be genetically inherited. A trait that is genetically inherited is passed on from parents to children. All characteristics that are shown by a person are determined and passed on from generation to generation through the transmission of genetic information. This shows the members of the disciplinary committee and school children did not consider bullying to be genetically transmitted from generation but to be a function of some other factors.

V. CONCLUSIONS
The study concluded that bullying was a problem in boarding schools both mission and government schools. The students and members of disciplinary committees revealed that junior students in Form 1 and 2 were the most bullied students. The perpetrators of bullying were identified as students in Form 3 and 4.

Students and disciplinary committee members revealed that lack of strict rules on bullying was the major cause of bullying in boarding schools. The findings also indicated that poor upbringing of bullies, films and movies that bullies watch and attention seeking were also causes of bullying. In addition to these causes the members of the disciplinary committees revealed that the poor socio-economic status of students can also be a cause of bullying. However the students and members of the disciplinary committees were not sure of genetics as a cause of bullying.

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VI. RECOMMENDATIONS

In view of the findings the study makes the following recommendations:

- All schools need to have clearly laid down rules against bullying which should be signed by parents and students.
- Schools should seriously enforce rules that deter the slightest behavior that is related to bullying.
- All children enrolling at boarding school should be inducted on how to report cases of bullying.
- Conscientisation lessons on the ills of bullying need to be held regularly with attendance being compulsory for all pupils.
- Children should be shown films that depict individuals who help as heroes instead of showing bullying behaviours in a positive light.
- Parents need to be urged to create an environment that does not tolerate the existence of bullying behavior.
- Children should be made aware of positive behaviours that they can use to be recognized by society.

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AUTHORS

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Abstract- This part of a broad study that sought to investigate the psychological effects of the presence of street children in Harare Central Business District to business operators. This particular study focused on possible ways of improving the perception of Business Operators towards street children in Harare Central Business District. The study sought to identify ways that could be employed by society at large so that there is mutual coexistence between the street children and the Business Operators. The study used the qualitative approach to get business operators’ experiences with street children. The research used questionnaires as research instruments. Forty (40) questionnaires were distributed to gather data from business operators in Harare Central Business District. Twenty seven (27) business operators responded to the questionnaires. Since street children are not found all over the Harare Central Business District (CBD) but specific areas dotted around the Central Business District (CBD), the study used convenience sampling. The study found out that street children were involved in stealing from both the operators and their customers. The street children also begged from the operators and their customers. Street children were also engaged in touting which disturbed customers and in urinating and defecating publicly which was a menace to customers. At times the street children smoked marijuana and consumed alcohol in the public. The study recommended that it is imperative for the government through the Ministry of Public Service and Social Welfare to put policies that cater for social welfare of disadvantaged children. The Government and NGOs should plan and implement public awareness campaigns on the importance of the public’s contribution to assist street children have a better life. The corporate sectors should also be urged to contribute to the alleviation of the street children life style. This can be done through the promotion of corporate social responsibilities. The government should make effective legislation and ensure strict implementation of the laws for example execution of Child Protection and Adoption Act. The government should undertake measures to provide free primary level education to street children in Zimbabwe and to provide for the associated costs of education for such disadvantaged children.

Index Terms- street children, business operators, Harare Central Business District, touting and begging.

I. INTRODUCTION

The sight of street children near business enterprises is a cause of concern especially to the operators. This has an impact on the quality of clients who visit their business enterprises. It is difficult for the street children not to visit the sites of business operators as they view them as places where they are most likely to get assistance. The business operators view them as a sore as they drive away potential customers. This naturally leads the business operators to have a negative perception towards the street children. It becomes imperative for the study to be conducted so that ways can be found out for identifying ways of improving the perception of business of business operators towards street children.

Research Question
How can the perception of business operators on street children be improved?

II. LITERATURE REVIEW

Phenomenon of street children
Regardless of definition, the phenomenon of street children is not new and neither is it restricted to certain geographical areas (Connolly, 1990). The phenomenon of street children is an alarming and escalating worldwide problem. The problem of street children in Africa may not be new as related by Grier (1996). According to Le Roux (1998) the phenomenon of neglected children, an offspring of the modern urban environment represents one of humanity’s most complex and serious challenges. According to Munyacho (1992) as quoted by Kudenga and Hlatswayo (2015) noted that some children in the streets had fled from problems at their homes to come to the streets where they made their own rules. In addition Terwase (2013) pointed out that social, political, familial, religious and economic forces, all tied to poverty, have continued to push children to the streets of urban centres in Third World countries, especially Africa and particularly, Nigeria Cities.

However, according to Kudenga and Hlatywayo (2015) the problem of children living or working on the streets of our urban areas appears to be a recent phenomenon in Zimbabwe. Prior to Independence (1980) it was almost impossible for children to work in the streets as vendors, car-washers, beggars, or parking boys as Municipal by-laws were very strict and were brutally enforced. With Independence, such enforcement of the
restrictions became slack and unpredictable thereby making it possible for the problems to surface.

**Possible ways to improve perception of street children by business operators**

According to Plotnik and Kouyoumidjian (2008) perception refers to personal interpretations of the real world. Business Operators need to know that street children are defenseless victims of brutal violence, sexual exploitation and abject neglect. Also these children are target of local business owners who force them to vacate their place of living (occupied by the children illegally) for having space for the purpose of buildings. However, for Business Operators to have a change of heart and view street children as people who need help in terms of vocational schools for rehabilitation. Most importantly, street children need to be steered back to the mainstream of social life through proper education opportunities, reformation, care and rehabilitation.

**Awareness campaigns to educate Business Operators**

According to Kudenga and Hlatswayo (2015) the phenomenon of children living in the streets implies neglect on the part of parents or guardians of these children who are found in the streets. There is need for advocacy campaigns to be conducted so as to enlighten the Business Operators on the plight of street children.

As reported by the Herald (8 May 2013) business operators hire street children to off load or load goods into their trucks and pay them small wages. Business Operators take street children as cheap labour and there is need to conscientise them that hiring street children to do menial jobs is unlawful under the Child Protection and Adoption Act. According to Newsday (11/06/2015) the International Labour Organization (ILO) defines child labour as work that is mentally, physically, socially or morally harmful to children and that interferes with their schooling. The United Nations Children’s Fund (UNICEF, 2001) defines child labour as work performed by children who are under the minimum age legally specified for that kind of work which because of its detrimental nature or conditions is considered unacceptable and is prohibited (Newsday, 11/06/2015). When they employ these children in a way Business Operators are encouraging the phenomenon of street children.

In addition, the role of electronic and print media is pivotal for awareness of the Business Operators and sensitizing them. If media play proactive role, the wrong perception against street children will reduce to a considerable extent. Business Operators stigmatize street children assuming that they are all the same and classify them in the same category, yet upon closer analysis one can conclude that they are not the same. They all have different behaviors, attitudes and personalities based on their different backgrounds and the pull factors to the streets.

According to [http://progressio.org.uk/blog_01/06/16](http://progressio.org.uk/blog_01/06/16) normally people would view street children as victims or criminals because of their way of life but the thinking should be examined closely because there is hope. According to [http://progressio.org.uk/blog_01/06/16](http://progressio.org.uk/blog_01/06/16) street children are neither survivors nor criminals nor victims because they show so much resilience and unexplainable coping mechanisms in midst of harsh life conditions. Therefore, business operators have to advocate and promote their rights, there is no need to doubt the possibility that these children can own their lives again if the community is sensitive to the needs of these street children and work together with them to make a positive change.

It is the intention of this study to find possible solutions to improve perception of Business Operators towards street children.

**Addressing needs of street children**

According to Bose (1992) many scholars believe that fixing the problems of street children depend on addressing the causal factors of their situations. Scholars and agencies have suggested various strategies to help street children, many of which focus on the use Non-Governmental Organisation (Bose, 1992). Benitez (2007) suggest that the main responsibility of assistance should be given to NGOs which should be backed financially by the government. Business Operators should donate to such Non Governmental Organization that deals with street children so as to alleviate the problem of street children. Non Governmental Organization have the ability to be more flexible than the government, they are better able to meet the needs of street children in varied circumstances (Chatterjee, 1992).

The Government has enacted good laws and put in place polices for the protection of child rights for example the Child Adoption Act. Street children being children also fall within these laws such as Children’s Act 2002, Chapter 5:06 prohibit child participation in economic activities, prostitution and other hazardous employment activities. The constitution of Zimbabwe amendment (No 20) ACT 2013 states that the State must adopt policies and measures to ensure that in matters relating to children, the best interest of the children concerned are paramount. The constitution further state that the State must adopt reasonable policies and measures, within the limits of the resources available to it, to ensure that children enjoy family or parental care, or appropriate care when removed from the family environment.

The constitution of Zimbabwe states that the State must take all practical measures, within the limits of the resources available to it, to provide social security and social care to those who are in need. Government should encourage public awareness campaigns for curbing street children economic exploitation. Government efforts should be made to prosecute perpetrators of economic exploitation of street children, who employ children and engage them in child sexual exploitation to gain income also strengthen the Police force patrol on the streets. Business owners should also take heed and desist from offering money or material support to street children as this is a major factor in influencing their continued stay in the streets.

**Involving other stakeholders**

Relevant government departments and NGOs should invest on street children’s education on Health care, child labour, sexual reproductive health and HIV and AIDS matters. Street children should be informed about the importance of attending trainings which are offered by the government and other stakeholders in child protection. They should also be encouraged to attend children’s formal gatherings and meetings such as Children’s Parliament by sending their representatives.

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According to Lemba (2002) Communities and families need to be sensitized and understand their roles and responsibilities with regard to taking care of children in society, especially vulnerable children. In addition to sensitization, efforts to build the capacity of communities and families to care for children for example through business training, support for income generating activities and other developmental support need to be undertaken so that communities and families are empowered to provide the basic needs of children under their care (Lemba, 2002).

According to www.sos-zimbabwe.org (07/07/16) Zimbabwe, SOS Children’s home in Waterfalls run a programme, family strengthening programme since 2002. The programme aims at providing holistic care for children who have lost one or both parents or are living with terminally ill parents. Business Operators who wish to donate cash or in kind to assist street children can send money to such organization as SOS Children’s Home than giving handouts in the streets which promotes the phenomenon of street children.

According to http://www.streetsahead.org.zw, (8/08/16) Street Ahead Welfare Organization of Zimbabwe strives to assist underprivileged children who are living and working on the streets of Harare. One of the Street Ahead’s mission is to uphold the rights of children living and working on the streets, giving them emotional, social and practical support, meeting their needs and providing encouragement and assistance to those who wish to have the streets, working in partnerships with all relevant stakeholders and others who share the same vision (http://www.streetsahead.org.zw, 8/08/16). However, this organization closed business in 2013 because of financial constraints. It is these Organizations which Business Operators can support to revive their noble activities of looking after street children.

Encouraging street children to go to school
Street children have rights to be protected like any other child. Since they stay alone on the street with no proper guidance from the adults they need to be educated about their rights. According to the constitution of Zimbabwe amendment (No 20) Act 2013 every citizen and permanent resident of Zimbabwe has a right to basic State-funded education, including adult basic education. The Constitution of Zimbabwe further state that the State must take reasonable legislative and other measures, within the limits of the resources available to it, to achieve the progressive realization of the right to education.

According to https://www.usaid.gov (8/08/16) the Presbyterian Children’s Club (PCC) program provides free education, basic meals, psychosocial support, health care and clothing to street children with USAID funding.

Providing street children with recreation facilities
According to the constitution of Zimbabwe amendment (No 20) ACT 2013 states that the state must take all practical measures to encourage sporting and recreational activities, including the provision of sporting and recreational facilities for all people. According to https://www.theguardian, (08/08/16) Amakhosi cultural Center is a popular Bulawayo theatre house founded in 1980. Amakhosi engages in humorous and perceptive portrayals of the struggles of ordinary people for mentoring and supporting critical voices and empowering people to shape their own future, for extraordinary resilience in upholding the value of art in society, for putting the needs of the community at the heart of their activities, and for creating courage, reflection and laughter in a difficult context (https://www.theguardian, 08/08/16). Some of the street children might have hidden talent which needs tapping and development through such cultural centers like Amakhosi Theatre Centre.

According to http://www.thetimetimes (08/08/16) the likes of Kapfupi (Freddy Majalima) emerged from the streets together with his group that included Marabha and the late Bhonjisi. Today Kapfupi is a household name.

The escalating problem of street children in Zimbabwe is also blamed on inadequate recreational facilities in most townships. Business Operators can assist the government by sponsoring sports and help build recreational facilities.

III. METHODOLOGY
The researchers chose to use a qualitative research methodology. According to Burns (2000), qualitative research is an effective way of helping the researcher in obtaining information on the individual’s experiences such as the one under study which is the psychological effects of the presence of street children to business operators in Harare Central Business District. Qualitative research also helped the researchers understand the participant’s viewpoint on common challenges faced by business operators because of the presence of street children in Harare Central Business District. In addition, qualitative research uses different ways of gathering information thus providing rich data to be gathered for example in-depth interviews, questionnaires, observations and document analysis in which business operators are free to air out their views as compared to closed ended questions in which one cannot express her feelings towards the given questions (Mutch, 2000).

The research employed the descriptive research design. This design was used as the researchers felt it was the most ideal for the study. The descriptive survey research designs are defined by their methodical collection of standardised information from any representative sample of the population (Christensen, 1994). In addition, this research design suits the context under which the present study was taken as the descriptive survey represents a probe into a given state of affairs that exists at a given time. It therefore means that direct contact was made with the individuals whose characteristics, behaviours and issues were relevant to the investigation under study. In this case the researchers had direct contact with business operators who interacted with the street children. It allowed the researchers to choose from a wide variety of instruments and in this research it was the questionnaire. The researcher found the questionnaire to be relevant for the study because it can be used to measure opinions, attitudes, beliefs, feelings, perceptions as well as gather factual information about the respondent.

The researchers used convenience sampling in selecting research participants. This was due to the fact that street children by nature of how they operate are found at specific areas dotted around the Central Business District. According to Saunders, Lewis and Thornhill (2009) convenience sampling involves selecting those cases that are easiest to obtain for your sample.
Convenience sampling represents a sample drawn to suit the convenience of the researcher (Wegner, 1995). The sample selection process is continued until required sample size is reached. The research participants selected will be meeting certain specifications that are required to answer the research question. In this study the research participants included only those business operators whose operations were affected by the presence street children. The sample consisted of forty business operators. Among these twenty seven were able to return fully completed questionnaires.

### IV. RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage (%)</th>
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</thead>
<tbody>
<tr>
<td><strong>Gender of respondents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>56</td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100</td>
</tr>
<tr>
<td><strong>Age of respondents</strong></td>
<td></td>
<td></td>
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<tr>
<td>Below 25</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>25-40</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Over 40</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100</td>
</tr>
<tr>
<td><strong>Type of business</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Grocery</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>Clothing</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>Banking/Finance</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
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<td>100</td>
</tr>
<tr>
<td><strong>Duration of operation</strong></td>
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<tr>
<td>Less than 5 years</td>
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<td>26</td>
</tr>
<tr>
<td>5-10 years</td>
<td>15</td>
<td>56</td>
</tr>
<tr>
<td>More than 10 years</td>
<td>5</td>
<td>19</td>
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<tr>
<td>Total</td>
<td>27</td>
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</table>

The results showed that the bulk of the respondents were females with 56 %, the remaining portion of 44% were males. Women constitute a large number of the population according to Zimbabwe 2012 census. Thus, maybe explain why the majority of them are operating businesses, working in Harare Central Business District (CBD).

The above results showed that majority business Operators were middle aged, between 25-40 with 37% of the respondend followed by those over 40 years with 33%.

The results revealed that the bulk of the respondents were from food businesses that is restaurants, fast foods followed by grocery business with 33% and clothing with 22%. Banking or Finance and Education have 4% each.

The above results showed that majority business operators have been operating in their respective areas for the period 5-10 years. The period of 5-10 years represented 56% of the respondents.

### Ways of improving perception of street children by business operators

Business operators were of the opinion that street children disturbed their business operations by their appearance and they need to be provided with facilities to wash and taught how they affect the operations of businesses.

Excerpt 1: **Street children disturb our business operations by driving away customers.** They smell as they do not wash. They need to be provided with facilities to wash. They should beg in a dignified manner and not disturb customers doing their shopping. Some of the customers resent to come to places where there are street children.

Excerpt 2: **These street children are filthy.** They should wash their bodies and their clothes. Their sight drives away customers. They should beg in a dignified manner. Though we at times assist them by giving them some piece jobs they continue coming to beg from customers.

Excerpt 3: **The Ministry of Social Services should mount campaigns to assist the children understand how their activities affect others.** They should encourage all to combine and remove the street children from the streets and put them in homes where they are properly kept. The corporate sector should be roped in to support in improving the welfare of these children.

Excerpt 4: **These children should be removed from the streets and put in orphanages.** Corporate can then be asked to assist when they are there. When they are in the street no one makes sure they have bathed or washed their clothes. If they beg in a neat appearance they would not disturb our operations.

Excerpt 5: **If these children were at one place it would be easy for us to assist them.** There should be campaigns to assist the children to get to a central place where they will be helped. The campaigns should involve both the street children and the corporate sector.

Excerpt 6: **It does not help to just look. Everyone needs to be conscientised on the plight of these children.** We at times give them piece jobs but that not help as we need a permanent solution. The children need to be taught to be presentable.

### V. DISCUSSION

The study found that the business operators had a poor perception of the street children as they viewed them as nuisance who always disturbed their activities. The street children disturbed their customers who were their lifeline and their mere presence had an effect of driving the customers away. The street children beg from customers who will have come to buy and their sight is uncouth and they have a bad stench as they do not wash. The business operators were of the opinion that shops where street children frequented would lose business as customers preferred shops would conduct their business in a tranquil environment.

The study found that the street children need to be provided with facilities to bath and wash their clothes so that when they come to beg they were in a clean appearance. If they do not emit the stench of dirt their customers would not worry much. There is need for them to be made aware of the effect of their appearance on people they interact with. The Ministry responsible should campaign to have the children improve their appearance.
The researcher found out that most Business Operators suggested that there is need for awareness campaigns on the importance of the corporate to assist in alleviating economic situation of street children so that they improve their perception towards street children. The efforts they did of giving the street children piece jobs were not bearing the desired results as the children would return the following day asking for more. The government ministry responsible for the welfare of children has to hold campaigns that involve the street children so that they are aware of the effects of their activities on others. The campaigns should involve not only street children but also the business operators and the corporate sector so that they are aware of the situation in which the street children are in and they can appreciate possible ways of assisting the street children. The ordinary populace have to be involved so that they contribute towards nipping the problem in the bud. These findings are in agreement with Mella (2012) who pointed out the Government and NGOs should plan and implement public awareness campaigns on the importance of the public’s contribution to assist street children.

Business operators found out that Business Operators suggested that street children should be taken to properly run orphanages so that they can assist these institutions knowing that their monies will be put to good use. They were of the opinion that it would be much easier to assist then when they at one place than to assist them individually. These findings are in agreement with Abro (2012) that before launching a project related to street children, proper work plan and identification of problems by development sector is important. Ultimately, the business community will donate in big numbers to the orphanages thereby capacitating them to cater for a large number of disadvantaged children.

VI. CONCLUSIONS

This study found that Business Operators have no good relationship with street children. They perceived them as nuisance and criminals who were there to disturb their businesses. The study also found out possible ways to improve the perception of business operators towards street children. Among the possible ways there is need for awareness campaigns on the importance of the corporate to assist in alleviating economic situation of street children. In addition, business operators suggested that Government should take these street children to orphanage houses where business operators can appreciate the need to donate in kind or cash. Tax incentives need to be given to those business entities that donate towards the welfare of disadvantaged children.

Despite these entire challenges Business Operators encounter, they continue to soldier on as it more costly to relocate from the Central Business District (CBD). Sometimes Business Operators have to give street children food, menial jobs to avoid confrontational so that they can co-exist though other researchers call it exploitation of street children.

VII. RECOMMENDATIONS

The study makes the following recommendations in view of its findings:

- Government must allocate budget and provide other necessary support for programs oriented towards street children, including capacity building for organizations involved in providing services to street children, secondement of trained personnel, and support for operational costs
- The corporate sectors should also be urged to contribute to the alleviation of the street children life style. This can be done through the promotion of corporate social responsibilities
- Communities and families need to be sensitized to understand their roles and responsibilities with regard to taking care of children in society, especially vulnerable children so that street children do not interfere with activities of business operators.
- Efforts to build the capacity of communities and families to care for children for example support for income generating activities so that communities and families are empowered to provide the basic needs of children under their care. Empowering and educating the parents would be more helpful.
- Police should be specially educated and trained on how to handle cases of street children with a view towards sensitizing police to the special needs of children and ensuring that rights accorded to children under International and Zimbabwe laws are enforced.
- Business operators should unite and create a business against crime forum. Combine business against crime forum with all sectors of law enforcement that can help the CBD become conducive to conduct business and distract street children from interfering with their operations.
- Street children should be informed about the importance of attending trainings which are offered by the government and other stakeholders on child rights so that they confine their activities to what they should do and do not infringe rights of other people.
- Street children should also be encouraged to attend children’s formal gatherings and meetings such as Children’s Parliament by sending their representatives.
- Street children have also chances to improve their lives, they must interact themselves with those organizations who are working for them and act on their suggestions, keep away from drugs and sexual activities and use life saving measures in day to day activities.

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Network-Aware Dynamic VM Placement for Achieving Energy Efficient Greeny Data Centres: A Review

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Abstract—Today’s Cloud data centers consist of thousands of physical machines (PMs) including large number of computing, storage devices and network resources for the cloud applications are hosted in numerous networked Virtual Machines which are subjugated by complex applications including numerous computing and data modules with solid correspondence correlations between them. Out of these resources, network resources uphold adding complexity and claim for scalability and elasticity. Thus Virtual Machine Placement (VMP) demands a critical discussion in present scenario. Hence, proper VM placement helps to achieve energy efficiency via reduce the CO₂ emission to ensure a green computing environment for eco friendly. This paper evaluates the literature on network-aware Dynamic VM placement in cloud data centers.

Index Terms: Cloud Computing, Cloud Data Center, Green Cloud Computing, Network-aware Virtual Machine Placement, Virtual Machine Live Migration

I. INTRODUCTION

Cloud computing is an emerging and promising standard in recent years. It is gaining its popularity among organizations that wish to eliminate the strain of managing their own IT infrastructure via outsourcing the computational resources. It is a technology which provides computing resources as a utility like electricity on a metered basis that permits the operations of the workloads similar to grid computing [1]. It distributes its resources, for instance, software, storage, databases and network in consistent, economical and safe manner to a large number of users via accepted internet protocols and these resources are accumulated in geographically dispersed energy hungry data centers.

To facilitate the optimization of the overall quality of cloud services, multiple objectives could be measured, such as: work load balancing, resource utilization maximization, energy consumption minimization, etc. Over the years, several research started to investigate the networking component as one of the significant factors that impact the behavior of cloud data centers.

The quantity of energy consumption of data centers is cloning for every four years. In 2016, the worldwide data centres were used the 416.2 terawatt hours of electrical energy was considerably exceeding the UK’s total power consumption of around 300 terawatt hours [2]. It is inviting not only as a burden such as huge cost to the service provider, but also has an environmental brunt. The more amount of energy consumption means that more amount of the CO₂ emission. It is calculated in terms of Carbon footprints. Forthwith, the data centers deplete up to 3% of all worldwide electricity production, while emitting 200 million metric tons of Carbon Dioxide. The estimated global Carbon emissions by data centers in 2020 will be 670 million metric tons by the year.

II. GREEN CLOUD COMPUTING

As the speedy development of data and applications in the cyber world demands the excessive number of gigantic servers and disks are required to process them quickly within the fixed time span. Therefore, the decrease in the
energy consumption of data centers is a sticky wicket recently. Green cloud is a buzzword that forecast to attain not only the competent processing along with utilization of computing resources but also lessen the energy consumption. It refers promising ecological prosperities that Information Technology (IT) services delivered over the Internet can propose to the general public. The concept unites the two terms – green computing, means strong revolution towards a more environmentally extended computing or IT, via diverse studies, practices and observations of skilful and eco-friendly computing concepts -- and cloud computing, mentions the ultimate sign for the cyberspace and the precise title for a kind of on demand self service delivery model. Furthermore, cloud resources are allocated not only to diminish energy usage, but also reassure QoS necessities required by users by means of Service Level Agreements (SLA) [3,4].

III. NETWORK TRAFFIC IN CLOUD DATA CENTRES

Cloud suppliers are conveying vast-scale datacenters containing thousands of servers all over the world, with regard to meet the quickly growing requirements for computing, networking, as well as storage resources. These data centers are enduring a sudden big ascend in network traffic. A good deal of this traffic is composed because of the data communiqué inside the data center. The study predicts by Cisco(2016) that universal data center traffic will nearly triple from 2016 to 2021 with a combined annual growth rate (CAGR) of 24% growing from 3.6 zettabytes/year by 2021. A zettabyte is trillion gigabytes. Per month IP traffic will attain 35 GB per capita by the year 2021, up from 13 GB per capita in the year 2016[5]. The Cloud data centers will monopolize the global data center traffic stream for the anticipated future and its significance is featured by one of the top line projections from the above mentioned estimate, by 2021, in excess of three-fourths of the entire data center traffic will generated from Cloud traffic (Fig 1) which is the outcome of data communication within the data centers.

![Fig 1: Global Data Center Traffic growth (data source: Cisco).](image)

IV. VIRTUALIZATION

Virtualization is one of the key advancements in cloud computing which acts as a dominant tool. The IaaS service model maintains resource multiplexing via virtualization innovation, which recommends a way to decouple the application actions from the physical resources involved. These decoupling of resources are to be assisted by the
perception of a ‘virtual machine’ which compresses an application with a definite set of performances. It is a perfect tool to improve energy efficiency of data centers with enabling to permit the multiple virtual machines (VMs) to share the physical resources of a single server. A virtual machine (VM) is an instance of an operating system (OS) or an application environment which is installed as software, then it acts like a dedicated hardware. Usually, thousands of VMs are hosted in cloud data centers[6]. The allocation of VMs to PMs is a tough assignment in highly scalable environments, and thus may have create a great impact on the routine of the data centres. Each VM has its own characters and consumption features of distinctive amount of energy depending upon the usage of resources and thus emit dissimilar quantities of carbon footprint. The total amount of carbon footprint of the data center is relative to the energy practice by each host. The arrangement of the multiple VMs on the same physical machine facilitates in consolidating the mission and turning off other physical machines which will helps to cut down the energy consumption level to a great extent. Thus the multiple objectives should be considered, such as: improving the load balancing, maximization of resource utilization, minimization of energy consumption etc. while optimizing the whole cloud Quality of Services. Nearby years, researchers commenced to consider the networking aspects as one of the significant issues that influence the cloud data center deeds mainly related for acquiring energy efficiency.

V. VIRTUAL MACHINE MIGRATION

Virtual Machine Migration is one among the salient aspects of virtualization for efficient management of resources. The VM migration technique aids to shift virtual machines from one physical machine to another without the suspension of the VM. Migration is the potential means for the load balancing, cold spot migration as well as hot spot migration. Server consolidation or cold spot migration is the situation where the load on the host is below the lower threshold i.e., the server is considered as under loaded, and overloaded migration or hot spot migration is the situation where the active host in which virtual machine is running is not able to assure the requisites of the VM owing to its load is above the upper threshold value. VM Migration could be done by using different algorithm like first fit, best fit, worst fit, monte carlo, round robin etc. [7].

V. A. Techniques of Virtual Machine Migration

There are two categories of migration. They are:

- **Live Migration**: Live migration is the most outstanding feature of the Virtualization. It is facilitating the cloud provider to stabilize the system via migration. It helps to allot a VM to one PM to a new with little or no downtime for running activities and it is maintaining the network connections of the guest OS. User doesn’t notice any interruption in service in hot (live) migration. Live migration and the SLA governing deals with the following disputes in dynamic VM consolidation[8]:
  - Determination of the overloaded host.
  - Determination of the underloaded host.
  - Selection of the VM for migration.
  - Placement of the selected VM.

- **Regular Migration**: Regular or Cold migration is the migration of a switched-off virtual machine. The status of the VM loses and user can feel the service interruption. Through this migration, user has the option of moving the related disks from one data location to another based on their request. The VMs are not necessary to be on a shared storage.

VI. VIRTUAL MACHINE PLACEMENT

When a virtual machine is installed on a host machine, the procedure of picking the most advisable host for the virtual machine is called virtual machine placement. It is a critical process of determining the most appropriate physical host or server to host the VM. It entails by classifying the underlying hardware and network and other resources requirements together with estimated utilization of resources and the placement objective. The placement objective can either be optimizing the management of existing resources or it can be minimizing of energy consumption by switching off few servers provisionally. Selecting an appropriate host in important to ensure the
QoS parameter also. The virtual machine placement algorithms are to be designed to convene the aforementioned objectives or targets.
Subject to the target of placement, a VM placement algorithm can be classified into two kinds:

a. Power-based VMP: This algorithm is obtaining a VM to PM mapping which permits a system to be energy efficient and achieve highest resource utilization.

b. QoS-based VMP: This algorithm is obtaining a VM to PM mapping to assure and ensure the quality of service necessities to the users.

Subject to the need of migration, a VM Placement algorithm can be classified into two kinds:

a. Static VMP: In this technique, VM placement does not consider either the status of the virtual machines and physical machines, or frequency of the arrival rate of the user requests.

b. Dynamic VMP: This technique achieves optimal solutions from the current mapping of VMs at nominal cost.

VI. A. Energy Efficient VM Placement Methodologies

Following are the power-based algorithms that have been used to solve the VM placement problem to ensure the goal of energy efficiency:

a) VM Placement using Stochastic Integer Programming

Stochastic Integer Programming (SIP) is to be applied for modeling optimization problems that occupy a high amount of ambiguity. Stochastic means “having a random probability distribution or prototype that may be investigated statistically but may not be envisaged precisely.”[10]. SIP is useful in cases where real rights are unknown, but the allotment of rights is identified or can be estimated. In SIP, there are 3 phases to assign resources:

a. Reservation: Cloud broker supplies resources and approximate the requirement without the knowledge of the actual demand of users

b. Utilization: The reserved resources are being used for the actual use of cloud service users.

c. On-demand: In case the user demands exceed, the reserved resources - the additional resources - can be requested in an on-demand pay basis[12].

b) VM Placement using Constraint Programming

Constraint Programming is a widely used logical programming for combinational search problems where the results must be assured by the constraints on relations among variables. A set of constraints are fixed and they can be easily extended to involve and satisfy more requirements. The CP considers real world-problem as a constraints fulfillment problem and a general principle constraint solver analyzes result for it. Cloud service providers plan to mechanize the virtual machines placement by taking, the quality of service parameters of the applications into contemplation. It can be symbolized as a constraint programming problem.

c) VM Placement using Genetic Algorithm
The Genetic Algorithm (GA) is a population-based meta heuristic algorithm, begins with an initial set of population which applies evolution to get better mappings among VMs and PMs. It can also be termed as bin packing extended with added constraints. It is particularly applicable in situations where objective functions are dynamically changing.

d) VM Placement using Bin Packing

The bin packing-based VM placement among PMs can be utilized to locate the actual mapping of virtual machines to accessible physical machines[9]. It is feasible to cut back the running cost of active data centers by firmly packing the VMs necessitated to be ran at once onto the least number of PMs achievable. Some popular solutions of VM placement problem are:

- The First Fit (FF): First Fit begins with the most lively bin and tries to pack every item in it before going into next bin. If appropriate bin is not found for the item, then the subsequent bin is elected to locate as the new bin[12].
- First Fit Decreasing (FFD): In FFD the items are arranged in descending order and after that items are processed as in the method of using First Fit algorithm.
- Best Fit Decreasing (BFD): Like FFD, BFD also arranges items in descending order and afterwards for packing items it prefers a bin with minimum vacant space to be left there after the item is being packed.
- Worst Fit Decreasing (WFD): Worst Fit Decreasing works accurately equal to BFD apart from in one thing, rather than selecting bin with least empty space it opts bin with greatest empty space to be left there after the allotment of item on that bin.
- Second Worst Fit Decreasing (SWFD): Commensurate WFD, it just select bin with second least empty space. It is also called as Almost Worst Fit Decreasing (AWFD).
- Random Fit(RF): Randomly a PM is selected for placing VM. [10] If PM assures the resource requirement, VM starts on that PM. If it is not satisfied, another PM is randomly selected. This process will be continued for every VM.

VII. RELATED WORK

VII. A. Network-conscious virtual machine placement designs

Organizing numerous migrations from a solitary host in a specific period of time whilst the network traffic demand is at a topmost position, offers a challenging and tough dilemma, to such an extent that the cloud framework might not have sufficient assets openly accessible to meet the expansion in assets required. Accordingly, it will set aside a more extended time for various movements to be finished, which thus prompts execution debasement for VMs. In this way a host is reserved in an over utilized or under-utilized status for a supported period, influencing its Service Level Agreement(SLA), which is an agreement by the cloud supplier and client portraying the reaction time and throughput ensures.

The pioneer commitments on network-aware placement of VMs were expounded by Stage, A. et al.[11]. Depending on the learning with regard to network topology, VMs are put to streamline traffic flows in the interior of a data centre network. This advent permits work migration control amid runtime with a exclusively composed network-aware scheduler. The migration scheduler knows about the migration postponements and data transmission bandwidth requirements.

Baker,T. et al. [12] have analyzed a network-based routing algorithm - Green Director (GreeDi), which found the most energy efficient path to attain a complete green cloud computing network objective, while ensuring the customers demands, such as service response time by acting as a interconnection among the users’ jobs and the
green data centres. Linear integer programming approach was used to model the proposed algorithm. They designed three different structured routes, with regards to nodes, power along with capacity subject to the Chief POP and Central POP traversed which leading to any one of the green cloud data centres. Though they can take a judgment on which is the best energy efficient path that same one can only be finished after each victorious distribution and/or reception progression to ensure that the calculation has been completed depended on all the traversed nodes, and not only based on limit of any failure nodes. But they are not considering the time needed for transportation with energy and time needed for calculation between data centers and between consumers and data centres.

Cziva, R. et al. [13] have recommended SDN based S-CORE VM migration algorithm which explained that intersected server-network control structure to facilitate the SDN to organize live VM migration so as to minimize the network-based communication rate, of the arising traffic dynamics which cannot be predicted, and lighten overcrowding of the expensive, highly-oversubscribed links of the upper layer of a Cloud Data Centre topology. In S-CORE algorithm, link utilization and cost value are manually found out by the strength of pair wise traffic among VMs. But this algorithm is completely topology-neutral one and become static in nature. While implementing SDN dependency, all information is either already obtainable in the network or can be centrally constructed. Then the information effectively transmitted during the intact topology, whilst the kernel of the algorithm still hold its scalable and distributed behavior. Now the new converged algorithm is a scalable, topology-alert live migration algorithm that minimizes the communication charge of pair wise VM traffic flows by developing collocation and network locality.

The blend of high speed networking and virtualization limits the SDN for what it can do such as it creates controller redundancy, failure behavior and interoperability between devices from multiple vendors.

Xu,G. et al. [14] have presented BEERS, a novel energy-efficient routing algorithm designed as a SDN controller application for data center networks. This algorithm can be scheduled traffic flows in to active and the queued status and each active flow assigned a feasible link with the help of SDN controller and the queued flow is wait for a assigned path become free. This strategy can be helped to cut down the energy for the specific degree of data center traffic for migrated VMs Placement. As a limitation of this algorithm is that they are only considering the typical DC Network with identical links and not taking consideration of variant links with different topologies and bandwidth.

Yang, T. et al. [15], have investigated a new algorithm called VPTCA - an energy-efficient data center network scheduling resolution - using GA that jointly considered the virtual machine placement as well as communication traffic design minimize the power consumption in a DC Network. In the traffic message layer, VPTCA ideally used switch ports along with link bandwidth to stabilize the load and evade blockages, permitting the DC network to boost up its transmission capacity as well as saving a considerable quantity of network energy. The progression of GA stays the relationship, and inherits to the brood. Exclusively, they propose a two-tier DNA code technique along with a fresh crossover operator to guarantee that this ingrained relationship is not to be severely wrecked in the VM placement. Moreover, a vibrant routing table generation algorithm is established to keep provisional memory consumption of switches still in the huge-scale data center network traffic pattern.

Zhang,J., et al. [16] theoretically analyzed how much bandwidth is required for guaranteeing the total migration time as well as downtime of a live VM migration. After that they proposed a new transport control mechanism for guaranteeing the computed bandwidth. They are achieving these two objectives through modified pre-copy live migration algorithm. In this algorithm it is assumed that the page dirty frequency of each memory page is varying and the Cumulative Distribution Function of the pages’ dirtying frequency is a reciprocal function. Finally, to assure the computed bandwidth needed by the live VM migration, A transport control protocol, a cost-aware bandwidth sharing mechanism by Allocating switch Buffer (rSAB), is designed. Due to this mechanism the bandwidth achieved from this reciprocal-related form ensures the estimated aggregate migration time and downtime. Moreover, the transport control mechanism guarantees that the live VM migration flows gain the projected bandwidth even if there are background flows.

Ferdausa, M.H. et al[17] addressed the issue related to network-based, multiple component application placement in huge data centers. It is considered as an optimization crisis. They proposed a Network and Data location-aware
Application environment Placement (NDAP) algorithm, a greedy heuristic approach that executes concurrent placement of VMs and various data elements relating to computing, network, and storage resource demands and capacity restraints with the target of diminishing the network rate arouse due to the VM placement resolution. Due to this algorithm, reduces the distance, that data packets necessitate to move in the data center network, in order to help in localize the network traffic as well as lessens communication overhead in the topper layer network switches. As an extension of the work, they are considering to create an suitable grouping and organization of the online and offline VM placement and migration procedures with the objective of efficient network bandwidth supervision.

Duggam, M. et al. [18] have investigated autonomous network aware VM migration strategy using reinforcement learning for the choice of VMs from an over-utilized host to reduce power consumption regarding of live migration in a data centre. The RL agent studies to observe the command of the network traffic to schedule a number of VM to migrate through an energy incentive function. More over, they achieved to perform the efficient VM migration at low network traffic time, reducing congestion at peak times, and enhancing the practice of network resource at off peak times. As a weakness they were not consider the under utilized hosts and SLAV metric.

Yan, F. et al. [19] have presented a polynomial-time heuristic algorithm, named as the perturbation algorithm, is a congestion-aware paradigm as it identifies the bandwidth congestion in the VM deployment process and after that, carefully relocates the assigned VMs to remove congestion. Besides, they investigated embedding problems in generalizing the substrate topologies and then they dealt with VDC request with heterogeneous bandwidth needs. They claimed with simulation result that the algorithm balancing the tradeoff between performance and time complexity of the VM placement in divergent bandwidth. They interested to extend their work for embedding oversubscribed virtual clusters in common internet topology substrate DCNs.

Wang, R. et al.[20] have described network-conscious VM placement scheme – MAPLE - in which VMs within an ensemble that necessitate to be located on dissimilar servers are sited in a way that guarantees that the “effective bandwidth” i.e., “least amount of bandwidth essential by a traffic source to keep up particular QoS objectives” , accessible on the network pathway between servers is adequate. They argued with the experimental result that MAPLE characteristically prevails in assembly with QoS goals while concurrently assigning both computing as well as network resources in a productive approach. One drawback of this approach is that while at the adequate time of VM placement, it could be generate to sub-optimal VM placement over time, specifically if VM ensembles are arranging for a time periods.

<table>
<thead>
<tr>
<th>Author</th>
<th>Technique</th>
<th>Methodology</th>
<th>Achievements</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dong, J. et al.</td>
<td>Constraint Programming</td>
<td>Two-stage heuristic algorithms : MC-BT and BF-HC</td>
<td>i) The energy efficiency is increased due to less number of active PM's. ii) Improvement of network performance</td>
<td>High migration cost</td>
</tr>
<tr>
<td>Xia, Y. et al.</td>
<td>Stochastic Integer Programming</td>
<td>stochastic-queuing network-based framework</td>
<td>Performance metrics such as VM task accomplishment time, consumption rate, and task denial rate with different workloads is considered which is able to quantify the conduct of the migration-authorized cloud in failible environment</td>
<td>Instead of local task migration between PMs of same server, remote migration between unique cloud federations via the wide area network is not measured.</td>
</tr>
</tbody>
</table>
Table 2: Comparison of Network-oriented VM Placement Designs

<table>
<thead>
<tr>
<th>Author</th>
<th>Minimization of Traffic between VMs</th>
<th>Minimization of Traffic between PMs</th>
<th>Minimization of Traffic between Data Centres</th>
<th>Minimization of Data Transfer Time</th>
<th>Bandwidth Management of VMs</th>
<th>Communication between VMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amendola,D. et al.[26]</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>da Silva, R. A.et al.[27]</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Liu, J.et al.[28]</td>
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<td></td>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Jiang, J. W.et al.[29]</td>
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<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Duggan,M. et al.[30]</td>
<td>✓</td>
<td></td>
<td></td>
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<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

VIII. CONCLUSION
Cloud computing innovation is required to develop and give vast services and computational energy to end clients. In this setting energy effectiveness is more critical for virtualized data centres because of more power utilization, higher running cost and large amount of CO₂ discharge to the earth. Virtual Machine Placement in data centres of...
the cloud environment has been a dynamic zone of research in the previous couple of years. This report enlighten
the different placement algorithms and their execution assessment with regard to network-traffic consideration
while taking account of VM placement in optimal places in dispersed geographical areas. The goal of these systems
can minimize of energy consumption, maximization of resource utilization, enhancement of load balancing
improvement of QoS and to achieve green cloud computing. The enthusiasm towards this subject rose in 2009 and
keeps on drawing in researchers in the cloud computing enhancement territory.
During the literature survey, we note that, grading these algorithms or expressing the best one out of the many isn't
an appropriate proposal in light of the fact that each one of other VM Placement method has some particular target,
migration method, major resources and credible parameters. Despite the fact that these parameters may appear to be
fine from external view, there may have a few or the other sort of tradeoffs when profoundly overviewed. Inferable
from the workload changeability and ceaselessly changing structure and interests of applications, there is an
obligation to persistently reform these VM placement techniques.

With the detailed discussion of this study related to live VM Migration while considering not only the least
consumption of energy but also consciousness in network traffic, we reach a conclusion that the majority of the
investigations have a tendency to mitigate the network traffic in both initial placement and migration forms of
VMs. Not very many papers considered the multi-target issue however none of them utilized a multiobjective way to
deal with settle it. The effect of network resources - switches, routers etc-, usage on power utilization and the time-
changing requests are likewise components infrequently centered around.

A more profound examination of data centre network architecture and topology, resource properties and qualities
may bring forth different variations as a future scope and give inventive ways to deal with take care of down to earth
issues.

ACKNOWLEDGMENTS

The authors would like to acknowledge and thank all people who help them in different ways to fulfill their research
work.

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978-1-119-97005-7


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Dominant Contributing Factors in Increasing Mother Awareness of Complete Immunization Status for Their School-Aged children in Tangerang City in 2015

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ABSTRACT

The school-aged children immunization coverage in Tangerang City in 2014 was low on coverage during School Immunization Month program reaching only 90.84% which was lower than the national target. The complete immunization status for the children was affected by mother awareness. This study was conducted to find out the dominant contributing factors that influenced mother awareness of immunization for their school-aged children in the city of Tangerang using cross-sectional analysis. The respondents were 300 mothers who were selected using snowball sampling with data collection technique using interviews. This study found out only 73% school-aged children had complete immunization status. This study also found out that mother awareness was affected by level of education, knowledge, husband support, healthcare worker support, and AEFI records. Husband support was the most dominant factor because the analysis shows that nearly 40% husbands suggested that immunization was important to their children. The percentage could be increased by improving the role of healthcare workers and intersectoral collaboration in increasing the immunization coverage by giving more knowledge to society especially husband through counseling about the benefits of immunization to their children.

Keywords: mother awareness, immunization for school-aged children.

INTRODUCTION

The improvement of a nation’s human quality has been elaborated internationally on Millennium Development Goal (MDGs). One of the objectives is to reduce child mortality. The high number of mortality caused by disease is a major health problem, while child mortality can be prevented by immunization. Furthermore, the low coverage of mandatory immunization for school-aged children plays a big role in contributing to health problems in society, so that government should pay special attention to the problem. In 2014, the percentage of mandatory immunization coverage in Tangerang City for school-aged children was only 90.84%, it is lower than national percentage which was 95%. The contributing factors to the school-aged children complete immunization are support of parents, schools and teachers, healthcare workers (especially pediatrician), local government, referral system, and many more. The main reason why the complete immunization coverage in school-aged children remains low is the disobedience of the mother. Mother, as the closest person to children, is also the main contributor to the complete immunization. The mother disobedience is usually caused by age, income, education, occupation, knowledge, family support, healthcare workers’ attitude, as well as Adverse Effects Following Immunization (AEFI). The objective of this study was to identify factors that contribute to mother’s disobedience to their child immunization, especially related to age, income, education, occupation, knowledge, husband support, healthcare workers’ attitude, and Adverse Effects Following Immunization (AEFI) in Tangerang City in 2015.

RESEARCH METHODOLOGY

This study was conducted using qualitative research approach and cross-sectional analysis. The research population was mothers whose children were at Elementary schools in Tangerang in May 2015. The inclusion criteria for research sample was mothers of Elementary school grader (age 8-11 years old) in Tangerang, if they had more than one children, data of the youngest sibling would be used to minimize misinformation given by the mother, able to communicate, and willing to be the respondent by signing
informed consent. Minimum sample used were 300 respondents who were spread across Tangerang, and then cluster sampling was defined to get 30 cluster villages in Tangerang. The respondents were divided into 30 Good Support clusters, meaning that each cluster consisted of 10 people. The selection of the respondents was conducted using snowball sampling. The research location was in Tangerang City, Banten Province. The proposal development was initiated in September 2014, followed by data collection and analysis in early and late May 2015. The research instrument was questionnaires consisted of questions pertaining to the contributing factors that affected the immunization disobedience. For data analysis, univariate and bivariate data were analyzed using chi-square method, while multivariate analysis using logistic regression method.

RESULTS
1. Awareness Status Overview Mother of School-Age Children immunized In Tangerang 2015

Table 1

<table>
<thead>
<tr>
<th>Awareness Mother</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>219</td>
<td>73.0</td>
</tr>
<tr>
<td>No</td>
<td>81</td>
<td>27.0</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
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</table>

2. Univariate Selection

Table 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥40 years</td>
<td>252</td>
<td>84</td>
</tr>
<tr>
<td>&lt;40 years</td>
<td>74</td>
<td>16</td>
</tr>
<tr>
<td>Mother’s Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher education</td>
<td>194</td>
<td>64.7</td>
</tr>
<tr>
<td>low education</td>
<td>106</td>
<td>35.3</td>
</tr>
<tr>
<td>Mother’s Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥2,4 million</td>
<td>180</td>
<td>60</td>
</tr>
<tr>
<td>&lt;2,4 million</td>
<td>120</td>
<td>40</td>
</tr>
<tr>
<td>Mother’s Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work</td>
<td>122</td>
<td>40.7</td>
</tr>
<tr>
<td>Does not work</td>
<td>178</td>
<td>59.3</td>
</tr>
<tr>
<td>Mother’s Knowledge</td>
<td></td>
<td></td>
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<tr>
<td>good knowledge</td>
<td>211</td>
<td>70.3</td>
</tr>
<tr>
<td>Lack of knowledge</td>
<td>89</td>
<td>29.7</td>
</tr>
<tr>
<td>Husband support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Support</td>
<td>222</td>
<td>74</td>
</tr>
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</table>

3. Bivariate Selection

Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Mother’s Age</td>
<td>0.207</td>
</tr>
<tr>
<td>Mother’s Education</td>
<td>0.001</td>
</tr>
<tr>
<td>Mother’s Income</td>
<td>0.276</td>
</tr>
<tr>
<td>Mother’s Occupation</td>
<td>0.498</td>
</tr>
<tr>
<td>Mother’s Knowledge</td>
<td>0.001</td>
</tr>
<tr>
<td>Husband support</td>
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</tr>
<tr>
<td>Healthcare Workers Support</td>
<td>0.001</td>
</tr>
<tr>
<td>AEFI record</td>
<td>0.002</td>
</tr>
</tbody>
</table>

4. Multivariate Selection

Table 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>Df</th>
<th>Sig</th>
<th>Exp(B)</th>
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</thead>
<tbody>
<tr>
<td>Education</td>
<td>.943</td>
<td>.307</td>
<td>1</td>
<td>.002</td>
<td>2.569</td>
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<tr>
<td>knowledge</td>
<td>.694</td>
<td>.302</td>
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<td>.021</td>
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<tr>
<td>Husband Support</td>
<td>.951</td>
<td>.320</td>
<td>1</td>
<td>.003</td>
<td>2.589</td>
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<tr>
<td>Healthcare support</td>
<td>.645</td>
<td>.336</td>
<td>1</td>
<td>.055</td>
<td>1.906</td>
</tr>
<tr>
<td>AEFI record</td>
<td>-1.01</td>
<td>.334</td>
<td>1</td>
<td>.002</td>
<td>.363</td>
</tr>
</tbody>
</table>

RESEARCH DISCUSSION
1. Limitation of the study

Using primary data was advantageous in providing new data obtained from on-the-spot interview with the
respondents, which can be used by other researchers. However, the study used snowball sampling method that it affects the result of the study.

2. Immunization Awareness

Based on the 2014 report, it is said that only 90.84% of third elementary grader received the immunization. However, on this study, it is found that the complete immunization percentage was only 73%. The low percentage of immunization was caused by the immunization report that was based on the coverage of each school grade, not the total number of immunization received. At that moment, school-aged children who received immunization on the previous class grade would be considered to have complete immunization which applied to those who were on the third grade. The number of percentage would increase if the immunization coverage was considered as complete after children received all compulsory vaccinations regardless their school grade.

3. The Relationship between Independent Variable with Mother Awareness in Having their Children Getting Immunization

3.1 Mother’s Age

The older the mother is, the more knowledge the mother has. The premise is in accordance with the research conducted by Al-Lela (2014) and Febri (2012) who had tremendous experience with immunization. The study shows that around 58% mothers who were < 40 years old and 42% who were ≥ 40 years old had positive awareness in having their child getting immunization. However, based on the multivariate analysis, mother’s age did not have any relationship with their awareness in having their children getting immunization. Based on the writer’s analysis, the older a mother was, the more knowledge she would have. Therefore, they would know better the logical danger of the disease threat so that they were willing to do a preventive action. On the other hand, younger mothers would have less experience which was caused by the lack of exposure to useful health information and the lack of understanding the importance of immunization for their beloved children.

3.2 Mother’s Education

The respondents’ education level fell into two categories, high and low level of education. It was found out that the percentage of immunization awareness on those with high level of education was 79.4%, while the percentage of awareness on mothers who had low level of education was 61.3%. From the result of multivariate analysis, it was concluded that there was a relationship between the education level and the mother awareness in having their children getting immunization. The hypothesis that education level affected the immunization awareness for school-aged children was acceptable. It was in accordance with the study by Hartati (2008) and Ishak (2006) that mothers’ education level had a good impact on the success of immunization program. This research is also supported by a theory proposed by Notoatmodjo (2003) that a person’s knowledge could be influenced by how much information that they had not only directly but also indirectly. Knowledge can also be influenced by a person’s ability in absorbing information, so that the more information a person obtains, the better the knowledge a person has, while the less information a person obtains, the less knowledge a person has. Those information can be obtained from the mass and electronic media as well as healthcare workers and health counseling.

3.3. Mother’s Occupation

Mother’s occupation is an activity to earn a decent living. It is a predisposition factor which enables anyone to pay for health services. The respondents’ occupation status fell into two categories, working mothers and non-working mothers. From the analysis, the relationship between occupation and immunization awareness shows that the percentage of working mothers who comply to do the complete immunization was 70.5%, while the percentage that represented the non-working mothers was 74.7%. The statistics test result shows that there was no relationship between mother’s occupation and their awareness in immunizing their children. Based on the writer’s opinion, non-working mothers (housewife) did not always have less health knowledge. Although the opportunity to share information between mothers were often, sharing information was usually done while they were working. However, housewife had longer spare time that could be used to get much information from any media that could influence her child immunization awareness. Therefore, it can be concluded that mother’s occupation was not a predominant factor in child complete immunization status. The conclusion was similar to the research conducted by Isfan (2006) and Sandra (2010) that there was no relationship between mother’s occupation and immunization status.

3.4 Mother’s Income

Based on the relationship analysis between mother’s income and child immunization awareness, it shows that the percentage of respondents who earned < IDR 2.4 million/month towards the child immunization awareness was 75.6%, while the percentage of mothers who earned > IDR 2.4 million was 75.6%. It can be concluded from the statistics test that there was no relationship between mother’s income and child immunization awareness. Therefore, the hypothesis which proposed that mother’s income had influenced the child immunization awareness status was unacceptable. This research result had completely different outcome with the research conducted by Ismet (2013) and Bundt (2004) which said that family income and economic factor were related to the child immunization awareness status. The government program that gave free health service (in this case immunization)
made the respondents who had low level of income had the same opportunity with those who had high level of income to get the service. Based on the above research results and descriptive theories, it shows that government policy regarding the free child immunization could lead to the completeness of child immunization status, because every child coming from family with any level of income had the same opportunity to get the immunization or in other words, the immunization was still able to be held. Therefore, income did not really have significant influence on immunization awareness.

3.6. Mother’s Knowledge
The relationship analysis between knowledge and child immunization awareness for mothers shows that approximately 61.3% mothers with less immunization knowledge that had positive awareness to child immunization, while around 79.6% respondents who had good knowledge complied with the child immunization. It can be concluded from the statistic test result that there was a relationship between mother’s knowledge and child immunization awareness. The behavior that was based on knowledge about immunization would last forever compared to the behavior that was not based on one. Therefore, the chance that mothers with good knowledge about immunization would have their children get the complete immunization was bigger, because a person’s knowledge level would have a significant influence to their life. On this research, it was found out that approximately 80.67% of respondents who knew the immunization benefits, around 55.67% of them knew the types of immunization given during School Immunization Month Program, and around 72.67% of them knew the immunization requirements needed for the school-aged children. However, only 47.67% of mothers who knew about the complete immunization, so that they did not have their children get complete immunization because they did not think that it was important. As for the respondents who had 50% score on average, it shows that the better their level of knowledge was, the more rational and logical the mother was in dealing with problems. They would be able to find alternatives and breakthrough in solving problems, for example (regarding with child health problem) by having their children getting immunization.

3.6. Husband Support
The relationship analysis between husband support and mother awareness in giving immunization to their children shows that around 52.8% of mothers had good support from their husband would comply to do the complete immunization for school-aged children (78.3%), while mothers who did not have good support from their husband were around 52.8%. The result of statistic test shows that there was a relationship between husband support and mother awareness in giving immunization to their children. The hypothesis which said that husband support had positive influence on the child immunization awareness was acceptable. Husband who always supported their wife in giving immunization to their children was only 60%. Based on this research, it was found out that family positive response towards the implementation of immunization was influenced by knowledge they had (in this case, husband who was the closest person to the respondent regarding the importance of immunization to school-aged children.) Based on writer’s opinion, basically if mother awareness of the importance of immunization to their children was influenced by their husband support.

3.7 Healthcare Workers Support
From the analysis result between healthcare workers support and mother awareness in giving immunization to their children shows that the percentage of mothers who had positive support from them was 78.3%, while mothers who had less support were around 56.8%. It can be concluded from the result of statistic test that there was a relationship between healthcare workers support and the mother awareness in giving immunization to their children. This research explains that around 83.67% respondents had been given a specific time to discuss the importance by healthcare workers, however only 40% respondents who had been supported by them in decision-making process. The support from healthcare workers regarding the side-effect treatment of immunization for school-aged children was only 52.33%. This research was based on another similar research conducted by Ismet (2013) that shows there was a significant relationship between healthcare worker services with the complete immunization status. Based on writer’s analysis, basically, healthcare workers’ good services had significant influence on the complete immunization status for school-aged children. The support from Healthcare workers who always keep mothers informed apropos of the importance of immunization for school-aged children would influence mothers to let their children get the immunization.

3.8 AEFI (Adverse Effects Following Immunisation) in Children
The analysis result between AEFI with mother awareness in giving immunization to their children shows that nearly 67% mothers whose children had no AEFI history would comply with the immunization, and around 84% mothers whose children had light AEFI previously would comply with the immunization. It can be concluded from the statistic result that the hypothesis which said that history of AEFI in children had significance influence in mother awareness was acceptable.

Mothers whose children had AEFI before would care with the immunization rather than those mothers whose children did not had AEFI. The main reason why it happened was because the mothers prefer to give complete immunization to their children, and the light symptoms of AEFI that occurred on their children would heal by using a regular pain reliever or by using warm water compress. Therefore, mothers prefer to have more benefits from immunization rather than to have side effects.
effects from another immunization given to their children. This was in line with another research conducted by Thaib (2013) which explained the most common reason why parents did not give immunization to their children, which was caused by the fear of immunization side effects (70.6%). The same reason was also stated by Falagas (2008) that AEFI records would have significant influence on children immunization status.

CONCLUSION
1. From 300 mothers in Tangerang City who had children ranging from 8-11 years old who had been studied in May 2015, it was found out that around 73% school-aged children had the complete immunization.
2. From this study, it was found out that 58% respondents were younger than 40 years old, 64.7% mothers had high level of education, 60% mothers had income greater or equal to IDR 2.4 millions/month, 59.3% housewives, 70.3% mother had good knowledge on immunization, 74% mothers had good husband support, 75.3% mothers had good support from the healthcare workers, and 64.7% mothers had children who had light AEFI records.
3. Correlating factors with mother awareness in giving immunization to their children were level of education, knowledge, husband support, healthcare worker support, and AEFI records, while age, education, family income, and mother occupation did not have any correlation with mother awareness in giving immunization to their children.
4. AEFI records would have a protective effect where mother whose children had light AEFI from the previous immunization would comply with the Immunization.
5. The most dominant factor in influencing mother awareness of children immunization in Tangerang City in 2015 was the husband support. From this study, it was found out that approximately 40% husbands suggested that immunization was important to their children.

SUGGESTION
1. For Tangerang City Health Department
   a. Improving the role of healthcare workers in increasing the immunization coverage by giving more knowledge to society especially husband through counseling about the benefits of immunization to their children.
   b. Establishing program which is more promoting and preventive in regards to the immunization to the school-aged children by using School Immunization Month Program campaign by the Tangerang City Mayor and Health Department on printed and electronic media and formulating the Local Legislation and Regulation about immunization.
   c. Improving the role of intersectoral collaboration, for instance collaborating with Education Department in coordination with schools, collaboration with Indonesian Pediatric Association as one of the supporting factor in giving immunization services, and collaboration with Sub-district government on the society empowerment for the purpose of increasing the knowledge of society.

GLOSSARY
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--------- 2005. Pedoman Pemantauan dan Penanggulangan KIPI.
Hikmayati, Et al. (2013). Hubungan Antara Tingkat pendidikan Ibu dengan kelengkapan Status Imunisasi Dasar pada Balita Di desa Melayu ilir. FK Universitas LambungMangkurat
Keputusan Menteri Kesehatan RI nomor 1059/Menkes/SK/IX/2004 tentang pelaksanaan BIAS


http://www.who.int/immunization/monitoring_surveillance/routine/coverage/number_unvaccinated_children_year_whoRegions.pdf?ua

http://www.who.int/immunization/monitoring_surveillance/routine/coverage/number_unvaccinated_children_year_whoRegions.pdf?ua=1

Kata kunci “immunizational global coverage”, sitasi tanggal 2 September 2014.


Health and Hygiene, Knowledge, Attitude and Behavior: A Case Study at Hapania mauza of Atghoria Upazila in Pabna District


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** Graduate Student, Department of Urban and Regional Planning, Jahangirnagar University
*** Professor, Department of Geography and Environment, Jahangirnagar University

Abstract- Hygiene practice, knowledge and behavior are the driving force of health. Health is considered as the physical mental economic and social condition and satisfaction of a man and hygiene is the constitution to attain it. There are various types of diseases which directly or indirectly depend on hygiene practice. The people of the rural areas suffer from health and hygiene related diseases. This study attempts to assess the relationship among hygiene practice, behavior, attitude and knowledge about health. This study conducted a questionnaire survey on 78 respondents living in Hapania mauza. It was observed socio-economic and environmental aspects were significantly associated with health. Simple statistical techniques were used for data analysis. It was found that most of the people were engaged in business and worked as day labour and their monthly income was from 5000-10000 taka. In the study area about 55 percent used ring slab and 52 percent of the respondents used soap for washing hand after using toilet and 61 percent people used shoe in while using latrine. About 21 percent of the respondents suffered from diarrhoea, 35 percent from dysentery and 44 percent suffered from skin diseases. This study used cross tabulation and multiple regressions to analysis the relationships among hygiene practice, behavior, attitude and knowledge about health. It was observed that there existed a strong relationship among hygiene practice and health. This study observes that the methods of hygiene practice were not maintained properly. Due to the poor level of knowledge of the respondents regarding sanitation, hygiene practices and health, the people of the study area often suffered from various types of infectious diseases.

Index Terms- Heath, Hygiene, Sanitation practice, Diseases, Cross tabulation, Regression.

I. INTRODUCTION

Bangladesh is an over populated country. In a developing country like Bangladesh, almost one-third of the population lives below the poverty line. About 39 percent of the total population of South Asia lives in poverty and they have an income of less than one US dollar a day. According to the Household Income and Expenditure survey of 2010, the rate of poverty in Bangladesh has dropped to 31.5 percent. Another report opined that 8.5 percent poverty declined in the last five years (Kabir, 2011). Due to lack of education, knowledge and basic awareness, people often have a poor understanding regarding the relationships among health, water, sanitation and hygiene. In some instances, people may still practice unhygienic habits even though this understanding does exist (Das et al., 2015). However maintaining good or acceptable personal hygiene is seldom perceived and acknowledged as protection against diseases (Asha, 2013 and Farah et al, 2015). Poor health and hygiene practice and inadequate sanitary condition play a major role in developing country like Bangladesh and increases the burden of infectious diseases (Vivas et al, 2010).

II. BACKGROUND

Personal hygiene is very important for protecting and maintaining health and addressing health problems and is also fundamental to the prevention of many diseases, particularly contagious diseases (Hossain, 2012). One of the main problems in underdeveloped and developed countries of the world is lack of safe water and sanitation. Majority of the affected population are found in informal settlements, urban and rural parts of the developing countries where the practice of open defecation, poor sanitation services, and use of unsafe water persist due to knowledge gaps and improper attitude towards health and hygiene and make people unable to practice basic hygiene (Job, 2014).

The global problem of access to safe water and sanitation continues to plague the poor countries of the world (Job, 2014). According to World Health Organization an estimated 2.6 billion people, comprising about 40 percent of the world’s population live without adequate access to safe water and proper sanitation (WHO, 2010). In a developing country like Bangladesh various diseases are rampant due to lack of clean drinking water and sanitation (Amin et al., 2008). Bangladesh is a low-income country where round the year prevalence of waterborne diseases remains high. Researches indicate that washing hands without soap after defecation and before eating are common in Bangladesh (Rana, 2009). In Bangladesh, serving and eating foods with bare hands is quite common (Faruque et al, 2010). Outbreaks of food borne disease involves poor hygiene in restaurants (Todd et al, 2008) and eating food from street vendors are considered as high risk factors (Vollaard et al, 2004).
Safe water is one of the most important felt needs in public health in developing countries in the twenty first century (Sah et al., 2013). According to a World Health Organization (WHO) estimate, 1.5 million children die from diarrheal diseases each year worldwide, with 88% of these deaths occur due to inadequate sanitation, lack of hygiene practices, and poor quality drinking water (Lipson, 2010). Awareness about safe drinking water, sanitary latrines, and hygiene and related health issues are crucial factors in habituating practice in a particular context (Nath et al., 2010). This actually indicates that washing hands with soap can reduce risk of diarrhea substantially (Curtis and Cairncross, 2003; Ejemot et al. 2008) and use of sanitary latrine also reduces incidence of water borne diseases (GED, 2009).

Bangladesh has been facing a number of challenges in the water, sanitation, and hygiene sectors. Hygiene practice becomes difficult in many parts of the world, including Bangladesh. This is due to lack of safe water and proper washing materials such as soap (Centers for Disease Control, 2011). Lack of awareness about the benefits of using safe latrine, poverty, lack of space, and preference for open defecation are also mentionable barriers to health and hygiene (UNDP, 2009). All these factors impede the universal coverage of use of sanitary latrine in the country (Rana, 2009).

Knowledge regarding poor hand washing practices is particularly important and most strongly associated with the risk of diarrhea (Asha, 2013, and Farah et al, 2015). Diarrheal disease has been considered as a serious global problem (WHO, 2008) and leading cause of child mortality around the world (Boschi-Pinto, 2008) and proper hygienic behavior can play an important role in the prevention of diseases related to water and sanitation. An average of 65% of death caused by diarrheal diseases could be reduced if good hygiene practice accompanies the provision of water and sanitation. Diarrhoea can be significantly reduced through improvements of the quality of drinking water, sanitation facilities, hygiene knowledge and practices (Wong et al, 2007, Fewtrell et al, 2005 and Luby et al, 2004). Around 2.4 million deaths could be prevented annually by good hygiene practice and providing reliable sanitation and drinking water (Prüss-Ustün, 2008). Evidence shows that hand washing can reduce the occurrence of diarrheal diseases by 14-40% (Hoque, 2003). Different studies showed that hand washing can decontaminate hands and prevent cross-transmission (Kalententhal et al, 1991, 1998). The effectiveness of hand washing with soap can reduce diarrheal risk up to 47% (Curtis and Cairncross, 2003). Many studies carried out in Bangladesh suggested that hand washing is one of the factors which decreases the incidence of diarrhea in intervention areas significantly (Stanton and Clemens, 1987 and Alam et al, 1989).

Several underlying factors such as availability, affordability and negligence are associated with these unhygienic practices. Furthermore, most of the people are not much aware about the route of transmission of waterborne diseases which increase the risk notably. Even many people lack knowledge about potential risks of taking uncovered and inappropriately preserved food items, not washing hands with soap before eating, providing food to children without washing hands with soap, and not washing hands with soap after defecation (Rana, 2009).

### III. AIM AND OBJECTIVES

The aim of the research is to assess human knowledge, attitude and behavior in the study area to examine the interrelationships among health, hygiene, knowledge, attitude and resulting human behavior.

The objectives of the study are:

a) To identify the present condition of health and hygiene, knowledge, attitude and behavior of human in the study area;

b) To examine the underlying causes of diseases;

c) To analyze the behavioral aspects of the respondents in this respect.

### IV. DATA SOURCES AND RESEARCH METHODOLOGY

Both quantitative and qualitative data have been used in this study. Primary data were collected through questionnaire survey. The questionnaires contained information on household, socioeconomic information, sanitation system, hygiene practice, location and situation of water sources, different diseases that occurred among respondents during the last 2 years. The sample size was determined following the steps: Population size (N) = 400, Error level (e) = 10%, Confidence level= 95% and z-score (z) = 1.96. Data for the study were collected by questionnaire interview conducted on 78 respondents who lived in the study area. Secondary data were collected from different published and unpublished materials and books. Microsoft word, Microsoft Excel, SPSS, Arc View GIS software were used for data analysis. Both descriptive and inferential statistical tools were used to analyze the data. To examine the relationship among knowledge, attitude, behavior and hygiene practice regarding health, cross tabulation and multiple linear regression were used. A model of the relationship between explanatory variables and a response variable was developed by fitting the following linear equation:

**Multiple Linear Regression:**

\[ Y = a + b1X1 + b2X2 + b3X3 + \ldots + bXt + u \]

Where:

- **Y** = the variable are used to predict (dependent variable)
- **X** = the variable that are used to predict (independent variable)
- **a** = the intercept
- **b** = the slope
- **u** = the regression residual

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Hapania Mauza is a small administrative unit under the Atgharia Upazila in Pabna district. Total population in the study area was 1989 where male was 51.41% and female 48.59%. The density of population was 871 per sq km. Average literacy rate was 26.4% male and 16.8% female. There is only a government primary school in the study area (BBS, 2011).

V. Socio-Economic Condition and Knowledge about Health

In the study area 19.23 percent respondent are illiterate, 47.44 percent have primary education, and 17.95 percent have passed SSC and only 6.41 percent completed graduation degree (Table-1). In Bangladesh during the year of 2014 the literature rate was 71 percent (Bd news 24, 2015). Although the increase of per capita income in Bangladesh has increased significantly, the income of the population has hardly increased. It can be observed from Table-2 that 65.38 percent population income is in between 5000-10000 taka. About 5.13 percent people have an income below 5000 taka and 21.79 percent has income between 10000-15000 taka. Only 5.13 percent respondents have income up to 20,000 taka (Table-2). The national per capita income of Bangladesh is about 125999 taka (BBS, 2017). In the study area female are generally engaged in household activities and male are in outside activities. Table-3 exhibits that about 29.49 percent of the respondents are house wife, 24.36 percent are worker, 15.34 percent are engaged in small business such shop keeper, vegetable seller in local market, rice traders etc. On the other hand, about 21.79 percent are farmer and only 5.13 percent are service holder (Table-3).

| Table-1: Educational Status of the Population in the Study Area |
|-------------------|---------|----------|
| Education status  | Count   | Percentage|
| Illiterate        | 15      | 19.23    |
| Primary           | 37      | 47.44    |
| SSC               | 14      | 17.95    |
| HSC               | 4       | 5.13     |
| Honors            | 5       | 6.41     |
| Masters           | 3       | 3.85     |
| Total             | 78      | 100.00   |

| Table-2: Monthly Income |
|-------------------------|---------|----------|
| Income (Bangladeshi Taka)| Count | Percentage|
| <5000                    | 4      | 5.13     |
| 5001-10000               | 51     | 65.38    |
| 10001-15000              | 17     | 21.79    |
| 15001-20000              | 2      | 2.56     |
| 20001-25000              | 3      | 3.85     |
| 30000+                   | 1      | 1.28     |
| Total                    | 78     | 100.00   |
Table 3: Occupational Status of Population

<table>
<thead>
<tr>
<th>Occupation Status</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Holder</td>
<td>4</td>
<td>5.13</td>
</tr>
<tr>
<td>Businessman</td>
<td>12</td>
<td>15.38</td>
</tr>
<tr>
<td>Worker</td>
<td>19</td>
<td>24.36</td>
</tr>
<tr>
<td>Housewife</td>
<td>23</td>
<td>29.49</td>
</tr>
<tr>
<td>Farmer</td>
<td>17</td>
<td>21.79</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3.85</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Sources: Questionnaire Survey, 2016

VI. TOILET TYPES AND HYGIENE PRACTICE

In the study area about 55.13 percent of the respondent use ring slab toilet made with fence using bamboo, straw palm leaves, bananas leaves etc. and 33.33 percent use pucca toilet made with bricks and cement (Table 4). The table -1 also depicts that 8.97 percent respondents use kucha toilet made with soil and corrugated tin. One research indicates that about 57.95% of the households have good hygiene and sanitation system in (DPHE, 2010). About 2.56 percent uses neighboring toilet and sometime defecate in open field. Among the respondents 52.56 percent use soap, 25.64 percent use ash, 2.56 percent use only water for cleaning purpose (Table 5). In a study on 50 sub-districts it is found that about 88.1% people use soap, 8.85% people use only water and 3.15% people donot wash their hand after defecation (Rabby and Dey, 2013). It can be observed that they usually use damp soil or ash for cleaning their hand. Table -6 revelled that 61.54 percent respondents use shoe during defecation time. About 32.05 percent use shoe occasionally and 6.41 percent never used shoe while defacating.

Table 4: Different Types of Toilet

<table>
<thead>
<tr>
<th>Toilet Types</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring slab with fence</td>
<td>43</td>
<td>55.13</td>
</tr>
<tr>
<td>Pucca</td>
<td>26</td>
<td>33.33</td>
</tr>
<tr>
<td>Kucha</td>
<td>7</td>
<td>8.97</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>2.56</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 5: Hand Wash Practice after Toilet

<table>
<thead>
<tr>
<th>Hand Wash by Using</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soap</td>
<td>41</td>
<td>52.56</td>
</tr>
<tr>
<td>Ash</td>
<td>15</td>
<td>19.23</td>
</tr>
<tr>
<td>Soil</td>
<td>20</td>
<td>25.64</td>
</tr>
<tr>
<td>Only water</td>
<td>2</td>
<td>2.56</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 6: Shoe Use Practice in Toilet Time

<table>
<thead>
<tr>
<th>Shoe Use</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>48</td>
<td>61.54</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>6.41</td>
</tr>
<tr>
<td>Occasionally</td>
<td>25</td>
<td>32.05</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Sources: Questionnaire Survey, 2016

VII. DIFFERENT DISEASES

In the study area most of the people suffered from fever (93.59%), cold and cough (100 %), blood pressure (35.90%). Figure 2 shows that diarrhoea (21.79%), dysentery (55.13 %), skin diseases (44.87%) acidity (55.13%) are common diseases among the respondents in Hapania mauza. To receive treatment about 53.32% of the people go to quack doctor for treatment. People also took traditional herbal treatment. About 30% people went to government hospital for treatment.

Figure 2: Common diseases of people in last two years at study area.

Sources: Questionnaire Survey, 2016
VIII. RELATIONSHIP BETWEEN TYPHOID AND HYGIENE PRACTICE

Typhoid is a waterborne disease. It is intricately related with hygiene practice and proper sanitation system. In Hapania Mauza, Kuccha toilet (14.3%) users suffered from typhoid more than the ring slab (2.3%) and pucca toilet users (Table 7). Table 7 depicts that the respondents use soap for washing hand before meal intake did not suffer from typhoid and about 3% of them suffered from this disease and they washed their hands with only water user. Respondents who used ash for cleaning hand suffered from typhoid (6.7%) and about 50% people who used only water had been affected by typhoid disease and strikingly, about 10% of the respondents who used soil for cleaning suffered from typhoid disease (Table -7). It can be summarized that people who washed their hands with proper cleaning materials suffered less from the disease than the respondents who used only water for cleaning purpose.

<table>
<thead>
<tr>
<th>Table-7: Cross Tabulation Analysis between Typhoid and Hygiene Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toilet Types</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Ring slab</td>
</tr>
<tr>
<td>% within Toilet</td>
</tr>
<tr>
<td>Pucca</td>
</tr>
<tr>
<td>% within Toilet</td>
</tr>
<tr>
<td>Kucha</td>
</tr>
<tr>
<td>% within Toilet</td>
</tr>
<tr>
<td>Others</td>
</tr>
<tr>
<td>% within Toilet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Hand Wash Practice before Taking Food</strong></th>
<th><strong>Typhoid</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soap</strong></td>
<td>No</td>
</tr>
<tr>
<td>% within Hand wash practice before taking</td>
<td>100.0%</td>
</tr>
<tr>
<td>food</td>
<td></td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td>65</td>
</tr>
<tr>
<td>% within Hand wash practice before taking</td>
<td>97.0%</td>
</tr>
<tr>
<td>food</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Hand Wash Practice after Toilet</strong></th>
<th><strong>Typhoid</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soap</strong></td>
<td>No</td>
</tr>
<tr>
<td>% within hand wash practice after toilet</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Ash</strong></td>
<td>14</td>
</tr>
<tr>
<td>% within hand wash practice after toilet</td>
<td>93.3%</td>
</tr>
<tr>
<td><strong>Soil</strong></td>
<td>18</td>
</tr>
<tr>
<td>% within hand wash practice after toilet</td>
<td>90.0%</td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td>1</td>
</tr>
<tr>
<td>% within hand wash practice after toilet</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Shoe Use</strong></th>
<th><strong>Typhoid</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>% within shoe use</td>
<td>100.0%</td>
</tr>
<tr>
<td>% within shoe use</td>
<td>60.0%</td>
</tr>
</tbody>
</table>

Sources: Questionnaire Survey, 2016

Table- 8 espoused the dependency of typhoid with hygiene practice. One unit of increase in the number of user respectively “Yes” or “No” by for washing their hand increased the probability of Typhoid 0.038 unit where p = 0.215. Soap, Ash, soil and water had higher probability of typhoid occurrence (0.052 unit where p = 0.078). Regular use of shoe by the respondents’ also decreased one unit of the probability of Typhoid (Table- 8). If the educational status is raised, then the probability of typhoid disease decreases by 0.005 units.
Table - 8 : Regression Analysis between Typhoid and Hygiene Practice

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td>-0.252</td>
</tr>
<tr>
<td>(Constant)</td>
<td>-0.027</td>
<td>0.109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand wash practice before taking food</td>
<td>0.038</td>
<td>0.031</td>
<td>0.155</td>
<td>1.250</td>
</tr>
<tr>
<td>Hand wash practice after toilet</td>
<td>0.052</td>
<td>0.029</td>
<td>0.298</td>
<td>1.786</td>
</tr>
<tr>
<td>Shoe use</td>
<td>-0.041</td>
<td>0.028</td>
<td>-0.237</td>
<td>-1.442</td>
</tr>
<tr>
<td>Education</td>
<td>-0.005</td>
<td>0.018</td>
<td>-0.040</td>
<td>-0.285</td>
</tr>
<tr>
<td>Occupation</td>
<td>-0.001</td>
<td>0.015</td>
<td>-0.010</td>
<td>-0.087</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Typhoid

IX. RELATIONSHIP BETWEEN DYSENTERY AND HYGIENE PRACTICE

Dysentery is closely related with hand wash practice before eating. In Hapania Mauza 62.7% respondents suffered from dysentery and they used only water before taking food. And among soap users only 9.1% suffered from dysentery (Table: 9). Table: 9 also represents the relationship between toilet types and dysentery. Other types of respondents such respondents who defecated in the open space, respondents who used kucha toilets and ring slabs and pucca toilets suffered from dysentery during the last two years. It indicates that the pucca toilet users suffered less from dysentery than other types of toilet user. Types of hand wash practice after toilet and occurrences of dysentery disease are closely related. About 36% of the total respondents who used soap suffered from dysentery. About 66.7% of the respondents used ash for cleaning purpose and they were affected by dysentery. On the other hand 80% of the respondents who used soil suffered from dysentery. About 100% of the people who used only water for cleaning purpose suffered from dysentery. In the study area, respondents who never used shoe (80%) suffered from dysentery. Respondents who used shoe occasionally (76%) and who never used suffered from dysentery on a regular basis 41.7% (Table-9).

Table-9: Cross Tabulation Analysis between Dysentery and Hygiene Practice

<table>
<thead>
<tr>
<th>Toilet Types</th>
<th>Dysentery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring slab</td>
<td>Count</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>% within toilet types</td>
<td>32.6%</td>
</tr>
<tr>
<td>Pucca</td>
<td>Count</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>% within toilet types</td>
<td>73.1%</td>
</tr>
<tr>
<td>Kucha</td>
<td>Count</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>% within toilet types</td>
<td>28.6%</td>
</tr>
<tr>
<td>Others</td>
<td>Count</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>% within toilet types</td>
<td>.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hand Wash Practice before taking food</th>
<th>Dysentery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Soap</td>
<td>Count</td>
<td>10</td>
</tr>
<tr>
<td>% within Hand wash practice before taking food</td>
<td>90.9%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Water</td>
<td>Count</td>
<td>25</td>
</tr>
<tr>
<td>% within Hand wash practice before taking food</td>
<td>37.3%</td>
<td>62.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hand Wash Practice after Toilet</th>
<th>Dysentery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Soap</td>
<td>Count</td>
<td>26</td>
</tr>
<tr>
<td>% within Hand wash practice after toilet</td>
<td>63.4%</td>
<td>36.6%</td>
</tr>
<tr>
<td>Ash</td>
<td>Count</td>
<td>5</td>
</tr>
<tr>
<td>% within Hand wash practice after toilet</td>
<td>33.3%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Soil</td>
<td>Count</td>
<td>4</td>
</tr>
<tr>
<td>% within Hand wash practice after toilet</td>
<td>20.0%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Water</td>
<td>Count</td>
<td>0</td>
</tr>
<tr>
<td>% within Hand wash practice after toilet</td>
<td>.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
One unit of increase of the hand wash practice before taking food (respectively using soap and only water) increased the probability of Diarrhoea by 0.163 units (Table-10). Higher educational status had a bearing on the chance of dysentery (0.225 unit where p = 0.00). Table-10 indicates that there is a very low impact of toilet types on dysentery occurrence.

### Table -10 : Regression Analysis among Dysentery and Hygiene Practice

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>1.109 (0.238)</td>
<td>4.651 (0.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand wash practice before taking food</td>
<td>0.060 (0.079)</td>
<td>0.077 (0.449)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand wash practice after toilet</td>
<td>0.085 (0.062)</td>
<td>0.156 (0.178)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>-0.225 (0.045)</td>
<td>-0.569 (0.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet types</td>
<td>-0.002 (0.061)</td>
<td>-0.003 (0.977)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand washing before child feeding</td>
<td>-0.163 (0.062)</td>
<td>-0.264 (0.011)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Dysentery

### X. RELATIONSHIP BETWEEN DIARRHOEA AND HYGIENE PRACTICE

In the study area soil and ash users were less affected by diarrhea (35% and 60%) and soap users suffered least 2.4% (Table-11). It indicates that hand washing after defecation is an important factor in hygiene practice which can help to eradicate diarrhoea disease in the study area and the country as a whole. Pucca toilet users suffer less (3.8%) from diarrhoea than the ring slab users (20.9%). And kuccha toilet users suffered most 85.5% (Table-11).

### Table-11: Cross Tabulation Analysis between Diarrhoea and Hygiene Practice

<table>
<thead>
<tr>
<th>Toilet Types</th>
<th>Diarrhoea</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Soap</td>
<td></td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Hand Wash Practice after Toilet</td>
<td>% within Hand wash practice after toilet</td>
<td>97.6%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Ash</td>
<td></td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Hand Wash Practice after Toilet</td>
<td>% within Hand wash practice after toilet</td>
<td>40.0%</td>
<td>60.0%</td>
</tr>
<tr>
<td>Soil</td>
<td></td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Hand Wash Practice after Toilet</td>
<td>% within Hand wash practice after toilet</td>
<td>65.0%</td>
<td>35.0%</td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Hand Wash Practice after Toilet</td>
<td>% within Hand wash practice after toilet</td>
<td>100.0%</td>
<td>.0%</td>
</tr>
<tr>
<td>Ring slab</td>
<td></td>
<td>34</td>
<td>9</td>
</tr>
<tr>
<td>% within toilet types</td>
<td>79.1%</td>
<td>20.9%</td>
<td></td>
</tr>
<tr>
<td>Pucca</td>
<td></td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>% within toilet types</td>
<td>96.2%</td>
<td>3.8%</td>
<td></td>
</tr>
<tr>
<td>Kucha</td>
<td></td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

Sources: Questionnaire Survey, 2016
<table>
<thead>
<tr>
<th>Element use for hand wash before taking food</th>
<th>% within toilet types</th>
<th>Count</th>
<th>% within toilet types</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soap</td>
<td>% within use Hand wash practice before taking food</td>
<td>100.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>% within Hand wash practice before taking food</td>
<td>74.6%</td>
<td>25.4%</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Questionnaire Survey, 2016

There is a strong relation between diarrhea and socioeconomic conditions and hygiene practice. Table-12 depicts that one unit increase in hand wash practice after defecation (only water, soil, ash and soap) increases 0.05 probability of diarrhea diseases and it is statistically significant (p = 0.0.456). With the increase of one unit of personal hygiene practice of mother after children cleaning (respectively soap, ash, soil, only water) decreases 0.120 unit probability of diarrhea. It can be observed that hand wash practices decreases diarrhea significantly.

**Table -12 : Regression Analysis among Diarrhea and Hygiene Practice**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>0.200</td>
<td>0.250</td>
<td>0.798</td>
<td>0.427</td>
</tr>
<tr>
<td>Hand wash practice before taking food</td>
<td>0.163</td>
<td>0.070</td>
<td>0.252</td>
<td>2.314</td>
</tr>
<tr>
<td>Hand wash practice after toilet</td>
<td>-0.050</td>
<td>0.066</td>
<td>-0.110</td>
<td>-0.750</td>
</tr>
<tr>
<td>Shoe use</td>
<td>0.126</td>
<td>0.064</td>
<td>0.281</td>
<td>1.953</td>
</tr>
<tr>
<td>Education</td>
<td>-0.085</td>
<td>0.040</td>
<td>-0.260</td>
<td>-2.117</td>
</tr>
<tr>
<td>Occupation</td>
<td>-0.028</td>
<td>0.034</td>
<td>-0.084</td>
<td>-0.825</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Diarrhoea

**XI. CONCLUSIONS**

Hygiene practice is the precondition of good health. But hygiene means not only follow the rule of sanitation system but also gaining awareness and knowledge about the rule of maintaining hygiene. There is a lack of proper knowledge among the respondents in the study area. People have little knowledge about the adoption of proper methods of hygiene practice. Therefore treatment facilities are not available in the study area. Most of the diseases in the study area are sanitation and hygiene practice related. To avoid these diseases it is indispensable to aware people and disseminates the ideas of proper ways of hygiene practices. The ideas related to hygiene practices may be disseminated in the study area through mass education and training. Local governments and people of the area of the study area may work hand in hand to spearhead health and hygiene related disease and eradicate infectious diseases from the study area.

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Assemblages of freshwater snail's community in the Aghien lagoon in relation to environmental variables (Côte d’Ivoire; West Africa)

ALLOUKO Jean-Renaud, BONY Kotchi Yves, KONAN Koffi Félix, ASSEMIAN N’guessan Emmanuel

* Department of Environment, Jean Lorougnon Guédé University, Daloa City (Côte d'Ivoire).

**Abstract**- We studied the dynamic of aquatic snail's populations in relation to environmental variables in the Aghien lagoon. Snails and physico-chemical variables were sampled monthly from July 2014 to June 2015 at eleven sampling site. Samplings were performed by the kick sampling technique and Van Veen Grab methods. A total of 1316 individuals divided into 16 taxa belonging to 4 orders and 10 families were identified. Stations located on the banks were more diversified. Taxa such as *Melanoïdes tuberculata*, *Indoplanorbis exustus* and *Lymnaea natalensis* have appeared frequently in all stations. The stations located on the longitudinal axis of the lagoon are characterized by Thiaridae such as *Potadoma liricincta*, *Pachymelania fusca*, *Pachymelania byronensis*. The canonical correspondence analysis revealed that turbidity, pH and phosphorus strongly influenced the distribution of snail in the study sites. Three invasive species, *Aplexa marmorata*, *Indoplanorbis exustus* and *Melanoïdes tuberculata* were reported. Several surveyed species in our basins are important intermediary host of parasites, particularly Planorbidae *Indoplanorbis exustus* who constituted potential risk to public health.

**Index Terms**- Fresh water Snail, population, dynamic, Aghien lagoon, Côte d'Ivoire

I. INTRODUCTION

Benthic macroinvertebrates are of importance to aquatic biologist because they can indicate pollutional effects on the environment (Chapman and *et al.*, 1982). Snails occupy a prominent place among aquatic organisms suitable for biological monitoring (Goldberg, 1986; Salaniki, 1989) and they are used often for passive and active biomonitoring and in hazard and risk assessment (Borcherding and Volpers, 1994; Allan J.D. and Flecker, 1993; Kiblut, 2002). Then, the distribution of aquatic organisms relative to their habitat is of central importance to ecology (Nanami and *et al.*, 2005). Studies established a pattern of relationship between aquatic fauna, depth, substrate and organic contents of sediment (Ramirez and *et al.*, 1998; Edia and *et al.*, 2013; Bony and *et al.*, 2013). Moreover, stream-dwelling macroinvertebrates are generally thought to be distributed according to environmental factors (Minshall and Robinson, 1998). Furthermore, according to Nanami and *et al.* (2005), numerous studies have suggested that variability in physical factors, chemical factors and biological factors provide diverse habitats, and species specific habitat association of organisms in response to environmental variability has been found. Thus, the nature of this distribution provides an initial insight into the types of ecological processes that regulate populations and assemblages. Despite its importance, few studies have been published on the distribution of benthic macroinvertebrates among stream habitats for tropical systems. In Côte d’Ivoire, little information is available about the ecology of aquatic snails in Aghien lagoon. This study aims to show the population dynamic of aquatic snail's communities in relation to environmental variables in this lagoon.

II. MATERIALS AND METHODS

**II.1 Study site**

The Aghien Lagoon is located in the Southeastern of Côte d'Ivoire between latitudes 5°22'N and 5°26'N and longitudes 3°49'W and 3°55'W (Figure 1). This lagoon is located to the north of the Ebrié Lagoon from which it is separated by the Potou Lagoon. The Aghien and Potou Lagoons communicate through a natural channel (Koffi and *et al.*, 2014). The Aghien Lagoon could reach 11 m deep (Guiral and Ferhi, 1989). This lagoon covers an area of 20 km² for a perimeter of 40.72 Km. It is supplied by two main tributaries, Djibi and Bété Rivers, and is almost exclusively continental all year long (Traoré and *et al.*, 2014). This gives to the hydrosystem a fluvial character (Alikö, 2017). The Aghien Lagoon is subject to an equatorial climate characterized by four seasons (Durand and Chantraine, 1982). The monthly distribution of these seasons is shown in Table I.

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II.2 Sampling procedure

Sampling sites were selected to cover a fair degree of habitat heterogeneity in Aghien Lagoon. Studies stations are located along the main axis of the lagoon with two transects perpendicular to the longitudinal transect (Figure 2). The first transect is located opposite the of Akandjé city in order to determine if the water quality varies according to the distance to shore. The second transect is located in the western area of the lagoon. Macroinvertebrates sampling was carried out for twelve months at monthly intervals between June 2014 and May 2015.

Benthic fauna were sampled in each of the eleven stations defined on Aghien lagoon following a longitudinal rampe with a kick net (250 microns mesh size) following SASS method (South African Scoring System) (Dickens and Graham, 2002). The samples were collected for two to three minutes by submerging the kick net and dragging it into the water column. The net has also been banged against the bottom substrate to dislodge and collect sediment organisms. The collect was also done using a Van Veen grab. At each site, three (03) sediment samples corresponding to a total area of 0.15 m² were taken at several depths. At the exit of water, the contents net were washed on a sieve of 0.5 mm. All samples were fixed in 70% alcohol. In the laboratory, all samples were sorted using a binocular microscope, counted and identified at the lowest taxonomic level by combining the appropriate key (Dejoux and al., 1981; Mary, 2000).

At each campaign, each sampling site was characterized by measuring water temperature (°C), turbidity (NTU), pH, conductivity (μS/cm), and dissolved oxygen (mg/l) with portable sensors. Water were taken from each sample site (station), stored in polyethylene bottles (500 ml) and kept at a temperature below 4°C to stop all the activities and metabolism of the organisms in the water. At the laboratory, these water samples were kept in a refrigerator for further determination of phosphorus, Phosphate, ammonium (NH₄⁺; mg/l), nitrate (NO₃⁻; mg/l) and nitrite (NO₂⁻; mg/l).

Table I:- The four climatic seasons of the Aghien Lagoon according to Durand and Chantraine (1982).

<table>
<thead>
<tr>
<th>Season</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long dry season (LDS)</td>
<td>December, January, February, March</td>
</tr>
<tr>
<td>Long wet season (LWS)</td>
<td>April, May, June, July</td>
</tr>
<tr>
<td>Short dry Season (SDS)</td>
<td>August, September</td>
</tr>
<tr>
<td>Short wet season (SWS)</td>
<td>October, November</td>
</tr>
</tbody>
</table>

Figure 1: Location of the Aghien Lagoon in the South-Eastern of Côte d’Ivoire.
I.3 Data analysis

Biological indices such as Taxa richness (S); Abundance, Shannon index (H) and Equitability (J) were used in the calculation of taxa richness and diversity (Ramade, 2003)
- Taxa richness (S): is a measure of species richness
- Shannon index diversity (H), \[ H = - \sum p_i \log_2 p_i \] Where \( p_i \) represents the relative abundance of species i in the sample (\( p_i = n_i / N \)).
- Equitability J index (\( H' = \log 2 S \)). \[ J = H' / \log 2 S \] Where; H was the Shannon and weavers index S was the number of species in samples.
- Occurrence percentage (F): \[ F = \frac{F_i \times 100}{F_t} \] where \( F_i \) = number of records containing species i and \( F_t \) = total number of surveys conducted. Depending on the value of F, four groups are distinguished (Albertoni, 2007) : - very frequent taxa (\( F \geq 70\% \)); - frequent taxa (40% \( F <70\% \)); - infrequent taxa (10% \( F <40\% \)); - sporadic taxa (\( F <10\% \)).

The Shapiro-Wilk normality test was made to evaluate the normality of the different physicochemical parameters measured. The Kruskal-Wallis (multiple comparisons) and Mann-Whitney (two-sample comparison) tests were performed for the different comparisons. The distribution patterns of the taxa data were displayed using the Self-Organizing Map (SOM) by means of the toolbox developed by (Kohonen, 1995) for Matlab. The SOM training was made to classify the 132 samples (11 stations x 12 campaigns) according to the distribution of the aquatic snails. A map of 20 cell (4-line x 5-column) was chosen because the smallest quantification and topography errors are obtained at this size In order to characterize the distribution of the populations of these insects according to physicochemical parameters, a canonical correspondence analysis was carried out (Palmer, 1993) using the CANOCO program (Canonical Community Ordination, Version 4.5). The analysis was used in RDA (ReDundancy Analysis).

III. RESULTS

III-1 Variations of physicochemical parameters

Table II present the different averages of the physicochemical parameters. For all the abiotic descriptors considered, there are no significant differences between the variations in the different studied stations (Kruskall Wallis test \( p>0.05 \)). However, for the abiotic, there is a significant difference between the variations from one season to another (Kruskall Wallis test and Mann-Whitney U test \(<0.05 \)) (Table II).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>LWS</th>
<th>LDS</th>
<th>SWS</th>
<th>SDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>27.64±1.02</td>
<td>27.13±2.92</td>
<td>28.40±1.41</td>
<td>26.94±0.69</td>
</tr>
<tr>
<td>Conductivité (μs/cm)</td>
<td>79.74±6.52</td>
<td>70.74±7.30</td>
<td>66.90±2.63</td>
<td>54.53±3.19</td>
</tr>
<tr>
<td>pH</td>
<td>8.07±1.05</td>
<td>7.56±0.75</td>
<td>7.63±0.56</td>
<td>6.72±0.62</td>
</tr>
<tr>
<td>Total phosphorus (mg/l)</td>
<td>0.38±0.40</td>
<td>0.2±0.17</td>
<td>0.24±0.08</td>
<td>0.26±0.13</td>
</tr>
<tr>
<td>Phosphate (mg/l)</td>
<td>0.08±0.05</td>
<td>0.10±0.15</td>
<td>0.07±0.10</td>
<td>0.12±0.05</td>
</tr>
<tr>
<td>Dissolved oxygen (mg/l)</td>
<td>5.07±0.83</td>
<td>7.67±0.85</td>
<td>6.89±0.83</td>
<td>5.50±1.03</td>
</tr>
<tr>
<td>Nitrates (mg/l)</td>
<td>1.37±1.14</td>
<td>0.41±0.40</td>
<td>1.35±0.95</td>
<td>1.79±1.00</td>
</tr>
</tbody>
</table>
Nitrites (mg/l) | 0.02±0.03<sup>a</sup> | 0.01±0.0<sup>a</sup> | 0.04±0.07<sup>b</sup> | 0.11±0.10<sup>c</sup>
---|---|---|---|---
Ammonium (mg/l) | 0.18±0.14<sup>a</sup> | 0.16±0.17<sup>a</sup> | 0.27±0.30<sup>b</sup> | 0.13±0.05<sup>c</sup>

III.2 Taxonomic composition
For the branching of snails, a total of 1316 individuals were collected belonging to the classes of gastropods and bivalves. This class contains 09 families including 04 belonging to the Cenogasteropods, 04 belonging to the Basommatophores and 01 to the Archeogasteropods. The most diverse families are Thiariidae and Planorbidae with respectively 05 and 04 taxa. Bivalves are the least diversified class with only one taxon (Musculium) belonging to the family Sphaeriidae of the order Veneroids.

Spatial variations of the diversity index data are presented in Tables III. The station ST11 had the greatest taxonomic richness while the largest number of individuals (387 ind.) was harvested at the station ST10. However, in open water any taxon of snail has been recorded at the station ST5. Globally, the stations on the banks have more diversified taxonomic richness than those located in open water (ST3, ST5, ST7 and ST9). The Shannon H index at the stations ST2 and ST4 are the highest (1.913 and 1.912) while the station ST3 has the lowest value (0.9743). For equitability, the stations ST4 and ST9 had the higher values (0.9195 and 0.9366) while the lowest value is noted at the station ST10.

Table III : Spatial variations of diversity index

<table>
<thead>
<tr>
<th>Diversity</th>
<th>ST1</th>
<th>ST2</th>
<th>ST3</th>
<th>ST4</th>
<th>ST5</th>
<th>ST6</th>
<th>ST7</th>
<th>ST8</th>
<th>ST9</th>
<th>ST10</th>
<th>ST11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxa Richness_S</td>
<td>7</td>
<td>9</td>
<td>3</td>
<td>8</td>
<td>0</td>
<td>10</td>
<td>5</td>
<td>12</td>
<td>4</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Individuals</td>
<td>87</td>
<td>183</td>
<td>8</td>
<td>172</td>
<td>0</td>
<td>67</td>
<td>36</td>
<td>208</td>
<td>19</td>
<td>387</td>
<td>149</td>
</tr>
<tr>
<td>Shannon_H</td>
<td>1.432</td>
<td>1.913</td>
<td>0.9743</td>
<td>1.912</td>
<td>0</td>
<td>1.797</td>
<td>1.343</td>
<td>1.868</td>
<td>1.298</td>
<td>1.584</td>
<td>1.895</td>
</tr>
<tr>
<td>Equitability_J</td>
<td>0.7359</td>
<td>0.8706</td>
<td>0.8869</td>
<td>0.9195</td>
<td>0.7804</td>
<td>0.8343</td>
<td>0.7516</td>
<td>0.9366</td>
<td>0.6374</td>
<td>0.6999</td>
<td></td>
</tr>
</tbody>
</table>

III.3 Seasonal variation of Snails abundance
Seasonal variation of snail’s abundance was indicated in Figure 3. The short wet season recorded the highest abundance of snails with 433 individuals recorded while the least abundance is recorded in the short dry season. At the taxa level, *Indoplanorbis exustus* was most abundant during the short wet season. The *Melanoides tuberculata*, *Indoplanorbis exustus*, *Lymnaea natalensis*, *Pachymelania byronensis*, *Pachymelania fusca* *Potadoma liricincta* and *Aplexa marmorata* taxa were recorded in all four seasons. However, *Bulinus guernei* and *Bulinus truncatus* were only harvested in a single season.

Figure 3 Seasonal abundances of snails

III.4 Snails Occurrences
The taxa occurrences are presented in Table IV. Taxa such as *Melanoides tuberculata*, *Indoplanorbis exustus* and *Lymnaea natalensis* have appeared frequently in all stations located on the banks of the Aghien lagoon (ST1, ST2, ST4, ST6, ST8, ST10 and ST11). However, in the stations located in the middle of lagoon, there is sporadic appearance of taxa like *Musculium sp.* and *Melanoides tuberculata*, whereas the Thiariidae *Pachymelania byronensis*, *Pachymelania fusca* and *Potadoma liricincta* were collected infrequently in the downstream station of the lagoon (ST7 and ST9).
**Table IV**: List and occurrences of aquatic snails taxa in the Aghien lagoon: Code: **** = very frequent taxa (F ≥ 70%); *** = frequent taxa (40% F <70%); ** = infrequent taxa (10% F <40%); * = sporadic taxa (F <10%).

<table>
<thead>
<tr>
<th>ORDRE</th>
<th>FAMILLE</th>
<th>TAXON</th>
<th>ST1</th>
<th>ST2</th>
<th>ST3</th>
<th>ST4</th>
<th>ST5</th>
<th>ST6</th>
<th>ST7</th>
<th>ST8</th>
<th>ST9</th>
<th>ST10</th>
<th>ST11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vénéroïdes</td>
<td>Sphaeriidae</td>
<td><em>Musculium sp.</em></td>
<td>-</td>
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<td>*</td>
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<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Archaeogastéropodes</td>
<td>Neritidae</td>
<td><em>Septaria borbonica</em></td>
<td>-</td>
<td>*</td>
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<td>-</td>
<td>-</td>
<td>****</td>
<td>-</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>Lymnaeidae</td>
<td><em>Lymnaea natalensis</em></td>
<td>** ***</td>
<td>****</td>
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<td>****</td>
</tr>
<tr>
<td>Physidae</td>
<td><em>Aplexa marmorata</em></td>
<td>** ***</td>
<td>****</td>
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<td>-</td>
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<td>-</td>
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</tr>
<tr>
<td>Planorbidae</td>
<td><em>Bulinus guernej</em></td>
<td>-</td>
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</tr>
<tr>
<td><em>Indoplanorbis exustus</em></td>
<td>** ****</td>
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<td>****</td>
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<tr>
<td><em>Bellamya capillata</em></td>
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<tr>
<td>Ampullariidae</td>
<td><em>Lanistes varicus</em></td>
<td>* **</td>
<td>-</td>
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<td>-</td>
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<td>-</td>
<td>**</td>
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<td>-</td>
<td>****</td>
</tr>
<tr>
<td>Bithyniidae</td>
<td><em>Bithynia tentaculata</em></td>
<td>-</td>
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<td>**</td>
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</tr>
<tr>
<td>Hydrobiidae</td>
<td><em>Hydrobia gabonensis</em></td>
<td>* **</td>
<td>-</td>
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<tr>
<td>Thiaridae</td>
<td><em>Bridouxia giraudis</em></td>
<td>-</td>
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<tr>
<td>Melanoïdes</td>
<td><em>Melanoïdes tuberculata</em></td>
<td>** ****</td>
<td>* ****</td>
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<tr>
<td><em>Pachymelania byronensis</em></td>
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<tr>
<td><em>Pachymelania fusca</em></td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>Potadoma liricincta</td>
<td>* **</td>
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<td>-</td>
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</tr>
</tbody>
</table>
III.5 Classification of samples from SOM

The cells of the self-organizing map were classified into three groups (I to III) from a hierarchical classification analysis of the SOM cells with the Ward method and the Euclidean distance (Figure 1). The groups are illustrated by different patterns on the Kohonen map (Figure 4, 5). Group III (test G, p < 0.05) contains the samples mainly from stations ST9 and ST11. This group is restricted to taxa such as Musculium sp., Septaria borbonica, Potadoma liricincta, Pachymelania byronensis and Pachymelania fusca. Group II (G-test, p < 0.05) is composed of samples mainly from ST4, ST6, ST10 and ST2 stations and is composed of taxa such as Aplexa marmorata, Bellamya capillata, Bithynia tentaculata, Bridouxia giraudis, Bulinus truncatus, Bulinus guernei, Indoplanorbis exustus, Lanistes varicus, lymnaea natalensis and Melanoides tuberculata. However, the group I has no indicator taxa but contains samples from stations ST6, ST 7 and ST10.

**Figure 4:** A: Hierarchical classification of SOM cells with the Ward method. B: Classification of samples with environmental variables in the SOM layer. The Latin numbers I, II and III= represent different identified groups by clusters. The acronyms in the hexagonal units represent different samples (station–month–number of sample).
Figure 5. Component planes displaying the contribution of each environmental variable to classification of samples. Dark represents high values of each variable, whereas pale is for low values. The values were calculated during the learning process of the network. Apm = Aplexa marmorata, Bec = Bellamya capillata, Bit = Bithynia tentaculata, Brg = Bridouxia giraudis, But = Bulinus truncatus, Bug = Bulinus guernei, Ine = Indoplanorbis exustus, Lav = Lanistes varicus, Lyn = Lymnaea natalensis, Met = Melanoïdes tuberculata, Mus = Musculium sp, Pab = Pachymelania byronensis, Paf = Pachymelania fusca, Pol = Potadoma liricincta, Seb = Septaria borbonica.

III.6 Influence of physicochemical parameters on the distribution of snails:

A redundancy analysis (RDA) was performed between the 10 physico-chemical parameters and the abundances of the 15 taxa of aquatic snails (Figure 6). The representativity of all the axes is very significant (p-value < 0.05). Axis I is significant (p-value = 0.0017) and expresses 51.16% of the information, Axis II expresses 27.1%, for a total of 78.26% for both axes. The analysis of the graph shows that phosphorus, pH and turbidity was most influenced the variation of abundances of snails. Axis I reveals an association of phosphorus, ammonia, nitrite and nitrate with Aplexa marmorata, Bulinus guernei and Melanoïdes tuberculata while Pachymelania fusca, Potadoma liricincta, Septaria borbonica, Bridouxia giraudis and Bulinus truncatus are associated with turbidity. This taxa are negatively pegged to parameters like pH, phosphorus, temperature, nitrates and ammonia. On this same axis I, the conductivity is associated with Pachymelania byronensis and negatively correlated with Bellamya capillata and Bithynia tentaculata which are associated with phosphate. On axis II, Pachymelania fusca, Potadoma liricincta, Septaria borbonica, Bridouxia giraudis and Bulinus truncatus are influenced by very low temperatures, pH and dissolved oxygen levels. However, taxa such as Indoplanorbis exustus and Lymnaea natalensis are almost unaffected by the measured physicochemical parameters.
Overall, at the spatial level, all the means of the abiotic variables do not differ significantly between the stations while they differ according to the seasons, this shows that the variations of these parameters correlate with the impacts induced by the seasons but are not influenced by human activities in their immediate environment. The fluctuations observed would be attributable to a homogeneous distribution at all the stations of the Aghien lagoon of the impacts of anthropogenic and seasonal activities such as domestic and industrial discharges, runoff water (Humbert, 2012).

In general, the faunal composition of lagoon snails corresponds to that described in African freshwaters (Ogbeibu and Oribhabor, 2002; Diomandé and Gournè, 2005). The gastropods are divided into three orders: Basommatophores, Cenogasteropods and Archeogasteropods. This class contains 09 families However, the order of the Cenogastropods are quite well diversified with 08 species belonging to 04 families. The most diverse families are Thiaridae and Planorbidae. Species such as Lymnaea natalensis, Melanoïdes tuberculata, Indoplanorbis exustus, Aplexa marmorata, which are intermediate hosts of parasites of Schistosoma mansoni (Diomandé, 2009) frequently appeared in the records. The best indices of diversity namely great taxonomic richness, abundance and Shannon index were recorded at the stations located on the banks of the Aghien lagoon, which would be linked to favorable conditions for the proliferation of certain species of snails such as plants. This is not the case at the stations located in the open where all the organisms such as Potadoma liricincta, Pachymelania fusca and Pachymelania byronensis have only taken from the bottom of the water. This finding is consistent with the results of stations located along the longitudinal axis of the lagoon which are preferentially populated by Thiaridae.

This observation is correlated with the SOM map result which classifies them in group III, which states that these snails are found preferentially in downstream of the Aghien lagoon towards the canal with the Potou lagoon. Group II given by the SOM shows that the snails have a preference for shelters located on the bank and near to habitations where there are domestic discharges that would induce a change in environmental conditions.
Canonical analysis shows that turbidity, pH and phosphorus have strongly influenced the dynamics of snail’s population in the Aghien lagoon, which shows the impact of seasonal human activities on the distribution of these organisms. Indeed, through the residues of the factories and agricultural activities, the mineral elements are precipitated in the lagoon by the runoff waters which would modify strongly the turbidity, the contents in phosphorus and acid.

V. CONCLUSION

Several species of snails collected in the Aghien lagoon are important intermediate hosts of parasites, particularly Planorbidae Indoplanorbis exustus, which pose a potential risk to public health was most abundant in the four seasons. The stations on the banks are richer and more diversified than those located in open water. Phosphorus, pH, and turbidity mainly influence the spatial distribution of snails. Melanoides tuberculata is a quasi-ubiquitous species whose spatial distribution is weakly influenced by pH, phosphorus and turbidity.

ACKNOWLEDGEMENT

Data of this study were collected during the project “Study of the water quality of the Aghien Lagoon” and authors are grateful to the promoters of this project: “Agence Française pour le Développement” (AFD) and “Ministère des Eaux et Forêts de Côte d’Ivoire”.

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Abstract: Insurance plays a major role in the life of the humanity. The citizenry has gradually come to realize the necessity of insurance and these needs are unending as long as life exists. The purpose of this study was to establish the influence of consumer behaviour on the uptake of insurance service in the Cooperative Insurance Company (CIC), Kericho branch. The specific objectives of this study were to determine demographic, economic, social and psychographic factors that influence consumer behaviour in insurance uptake. The study used descriptive research design. The targeted population was 300 customers of CIC insurance Kericho. The study utilized simple random sampling technique to select 171, customers. The data was collected by the use of structured self-administered questionnaires. The study found that there is a significant relationship between consumer behaviour and insurance uptake and that economic factors, demographic, product awareness greatly influence the uptake of insurance services, whereas social factors are less significant on insurance uptake. The study therefore recommends that insurance companies should profile their clients according to the economic and demographic characteristics and develop unique products and marketing strategies for each segment.

Key words: Determinates, Insurance uptake, CIC, Kenya

I. INTRODUCTION

Consumer behaviour is the activities people undertake when obtaining, consuming and disposing of products and services (Batra & Kazmi, 2008). According to Kotler,(2008), Consumer behaviour is the study of how individuals make decisions to spend their available resources (time, money, effort) on consumption related items. Consumer behaviour study is based on consumer buying behavior, with the customer playing the three distinct roles of user, payer and buyer. Consumer behaviour blends from psychology, sociology, marketing and economic. Schiffman and Kanuk (2007) defines consumer behaviour as the behaviour that consumers display in searching for, purchasing, using, evaluating, and disposing of products and services that they expect will satisfy their needs. Consumer behaviour is the study of the processes involved when individuals or groups select, purchase, use or dispose of products, services, ideas or experiences to satisfy needs and desires. (Solomon, Bamossy, Margaret & Askegaard 2013) attempts to understand the decision-making processes of buyers, both individually and in groups. It studies individual consumers such as demographics and behavioral variables in an attempt to understand people’s wants. Blackwell, Miniard and Engel (2006) states that relationship marketing in an influential asset for customer behaviour analysis as it has a keen interest in the re-discovery of true meaning of the re-affirmation of the importance of the customer. According to (Kotler 2008), consumer behaviour is influenced strongly by cultural, social, personal and psychological factors. Every group or society has a culture. Cultural factors exert a broad and deep influence on consumer behaviour.

Marketers need to understand the subculture and social class of the targeted group. This will avoid ineffective marketing and embarrassing mistakes. Each culture contains smaller subcultures. Subcultures include nationalities, religions, racial groups and geographical regions. Subcultures make up important market segment and marketers design products and marketing programs tailored to their needs. Every society has some form of social class structure. Social class can be determined by income, occupation, education, wealth. Marketers are interested in social class because people within a given social class tend to exhibit similar buying behavior. People with different cultural and subcultural characteristics have different product and brand preferences (Schiffman & Kanuk 2007). Consumer behaviour is influenced by social factors. A person’s reference groups like the family, friends, social
networks, professional association strongly affect product and brand choice (Blackwell et al. 2006). According to Solomon et al., (2013), People who are grouped within the same social class are approximately equal in terms of their social standing in the community. They work in roughly similar occupations, and they tend to have similar lifestyles by virtue of their income levels and common tastes. These people tend to socialize with one another and share many ideas and values regarding the way life should be lived. Some groups and individuals exert a greater influence than others and affect a broader range of consumption decisions. Personal factors including age and life- cycle stage, lifestyle, personality and self-concept influence consumer behaviour. People change the goods and services they buy over their lifetimes.

Marketers try to create products and services that will provide the desired benefits and permit the consumer to reduce this tension (Solomon et al., 2013). According to Kotler (2008), psychological factors such as motivation, perception, learning, and beliefs and attitudes affect consumer behavior. Each of these provides a different perspective for understanding the workings of the buyer’s behavior. Insurance is a way of reducing uncertainty of occurrence of an event. It has assumed many functions; the basic purpose being to derive plans to counteract the financial consequences of unfavorable events. Insurance is the protection and security against unforeseen risks, whose two primary functions are to provide adequate coverage at a reasonable rate of premium and to pay losses promptly and fairly. While it does not stop the event from happening, it acts as a cover against the financial consequences of such risks (Ogutu, 2004). Insurance is a process of transferring risks from one individual called insured to another called the insurer. The insurer pays the insured financial losses incurred because of an occurrence of unexpected insurable event. For this service, the insured pays the insurer a premium. Insurance is the most superior method of handling risks. This is because it transfers risks to those with the financial ability and technical knowledge to handle them, Muriithi & Onuong’a (2011).

According to (Brainard, 2008), the importance of insurance in business, economic growth, and particularly in financial services sector cannot be overemphasized. The indemnification and risk pooling properties of insurance facilitate commercial transactions and the provision of credit by mitigating losses as well as the measurement and management of non-diversifiable risk more generally. According to (Narayanan 2010), insurance plays a major role in the life of the humanity. Slowly people started to realize the necessity of the insurance and these needs are unending as long as life exists. In fact insurance is not restricted for any category neither of the society nor in term of cast, ages or life styles. Also many people have a notion that Insurance is very good form of an investment, which is not right. The life insurance industry has become increasingly competitive in recent years. Consumer behavior and satisfaction from insurance products depends upon various attributes like search, experience and credence factors. Life Insurance is a professional service which is characterized by high involvement of the consumers, due to the importance of tailoring specified need, the variability of the products available, the complexity involved in the policies and processes and ultimately the need to involve the consumer in every aspect of the transaction. All these characteristic features cause customers to seek long term relationships with their insurance agents, their service providers, in order to reduce risks and uncertainties. Potential consumer are driven to buy life insurance policy for one or more of three major reasons that is, security of money invested, saving for one or more specific purposes and the availability of tax benefits.

As at June 2012, the Kenyan economy had 45 licensed insurance companies, 24 transacting general insurance business, 14 transacting life insurance businesses, while 7 are composite insurers – transacting both life and general insurance business. Other members of the insurance industry as at June 2012 included 154 insurance brokers, 126 insurance investigators, 26 insurance surveyors, 20 loss adjusters, 23 medical insurance providers and 78 licensed motor assessors. Others are 2 licensed claims settling agents and 10 licensed risk managers (IRA, 2012). This makes the Kenyan insurance industry one of the largest among the 54 African countries. Masinga (2005) asserts that life assurance provides cover to an individual policy holder against ill health, disability, premature death, natural calamities and financial stability in old age. The penetration of life insurance among the Kenyan population is also low compared to other countries. Insurance in Kenya is known to have been in existence for over sixty years now with the first insurance companies believed to have been owned by British insurers during the colonial times. The industry is governed by the Insurance Act (1994) and regulated by the Insurance Regulatory Authority. The Insurance Regulatory Authority (IRA) was created by the Insurance (Amendment) Act of 2006 and came into operation on 1st May 2007.

In Kenya there were 46 licensed insurance companies at the end of 2010, 22 companies wrote non-life insurance business only, 9 wrote life insurance business only while 14 were composite (both life and non-life). There were 163 licensed insurance brokers, 23 medical insurance providers (MIPs) and 4223 insurance agents. Other licensed players included 120 investigators, 80 motor assessors, and 21 loss adjusters, 2 claims settling agents, 10 risk managers and 26 insurance surveyors. (AKI 2010). The penetration of insurance in Kenya is low compared to leading countries in Africa and Asia. According to a research report by SBO research for Association of Kenya Insurers (AKI) in May 2008, the Association was concerned with the low market penetration of insurance in Kenya and the poor public perception of insurance by the general public. The
research finding was that the low income and informal sector market has little access to formal financial services for the management of risks. The poor engage in various types of risk pooling and informal insurance schemes to mitigate risks. The penetration of the Kenyan insurance industry stands at 2.63% of the GDP in the year 2014. This is considered to be very low compared to other countries in Africa such as South Africa, which has a penetration of 9.94%. The penetration of insurance among the Kenyan population is also low as compared to other countries. A good example is Malaysia, which has an estimated 41% of the population covered by some form of life insurance in comparison to Kenya that has less than 1% of the population insured. (SBO,2010)

The performance of the insurance industry in Kenya seems to be poor yet the industry’s importance of the insurance sector cannot be underrated (Etemesi 2004). This study therefore seeks to determine the effects of consumer behaviour in uptake of insurance service. CIC Insurance limited was started off in 1968 as an insurance agency. CIC Insurance has transformed to be one of the leading insurance company in Kenya. CIC insurance is a composite insurance company as it writes all classes of business. According to Insurance Regulatory Authority (IRA) report released in September 2014, CIC Insurance limited is the second largest insurance company in Kenya by the market share and it’s the leading micro insurance in Africa. CIC Insurance targets its market through the cooperative movement which is vibrant in Kenya. CIC Insurance limited has 27 branches across Kenya and it is also in Uganda, South Sudan and Malawi.

The insurance industry plays a critical role in the economy of many states globally as it provides financial solutions to many enterprises. Despite this critical role, there is a concern that the insurance uptake in Kenya is very low. Insurance penetration in Kenya is characterized with low penetration ratios below 1% and it is only in the year 2010 for the first time it recorded 1.05%. This compared to Taiwan at 14.5%, South Africa, 12%, Namibia, 5%, and the World, 3.2% is very low, Malaysia, 41% for the Life insurance. Whereas, the Economic uptake in Kenya has been growing, 2005(5.8%), 2006(6.4%), 2007(7%) the penetration ratio for life insurance during the period was 2005(0.78%), 2006(0.76%), 2007(0.83%), Motor insurance is the common product and has higher uptake than other products as it is compulsory Kenya. The uptake of Non-Life products is 3.5% of the Kenyan population as per the AKI reports of 2014, which is very low. Despite studies indicating that consumer behaviour plays a critical role in product and service uptake in AKI reports. However, there are no known studies in Kenya linking consumer behaviour and uptake of financial services in insurance sector. Therefore, there is limited knowledge inherent in the literature regarding factors affecting consumer behaviour specifically in the insurance industry in Kenya. Literature reveals several potential factors including demographic, economic, social and psychographic factors. It is however not exactly known to which extent these factors influence the consumption of insurance services. Today’s consumers face a growing range of choice in the products & the services they can buy. A company needs to understand the influence of consumer behavior for long term success of their marketing programme. The company’s goal is not only to get a customer, but more importantly the company should retain customers by understanding the behavior of consumers, thereby making relationships in the longer run. This study therefore was to establish the influence of consumer behaviour on insurance uptake in Kenya.

The study was conducted in CIC insurance, Kericho branch. CIC Insurance limited is the second largest insurance company in Kenya by the market share and it’s the leading micro insurance in Africa. It is also one of the fastest growing financial service companies in East Africa. CIC Insurance limited is a composite company and it underwrites all classes of business thus it provides a good sampling frame. Kericho has many savings and credit cooperative societies (SACCOs) which are the main clientele of CIC Insurance. By targeting CIC Insurance the researcher would be able to capture more respondents who are consumers of Insurance services.

II. LITERATURE REVIEW

According to Batra & Kazmi (2008), described consumer decision making process, buyers’ black box and importance of consumer behaviour studies for marketers in order to understand what satisfy the ultimate consumer. The authors described vital characteristics of Indian consumer and competitive advantages in Indian context for the marketers. The consumer decision process, buying roles and consumer black box are discussed in detail. The various steps evolving consumer decision making are linked with the life stages. Young buyers, women and children considered as uprising consumers groups as a part of competitive market situations. Hawkins et al, (2007) identified various factors affecting consumer behaviour for buying such as demographic and social influences (family and household), group influence, and impact of advertising and internal influences (learning, perception, and attitude). The authors elucidated the topics such as types of consumer decisions, purchase involvement and product involvement. The book also emphasized on information search process and various ways for providing relevant information to the consumers are recommended in this study. The authors also emphasized on individual judgment and proposed that the ability of an individual to distinguish between similar stimuli is called sensory discrimination which could involve many variables related to individual preferences. Lazar & Schifffman (2007), suggested that, consumer behaviour as individual differs as from group.
Bitta & Della (2004), proposed that consumer behaviour studies play an important role in deciding marketing segments and marketing strategies. The authors recommended that consumer is often studied because certain discussions are significantly affected by their behaviour or expected actions. For this reason such consumer behaviour is said to be an applied discipline. Such applications can exist at two levels of analysis. Market segmentation, consumer decision making and buying behaviour is considered as core marketing activities in designing effective marketing strategies. The micro perspective involves understanding consumers for the purpose of helping a firm or organization to accomplish its objectives. On the other hand macro or societal perspective consumers collectively influence economic and social conditions within an entire society. The authors discussed factors affecting consumer behaviour at micro and macro level for making a purchase decision. Karunik & Schiffman(2006), highlights dynamic business environment is turbulent as never before and the service industry as promising as never before. In this era of intense competition companies understand the customer is the king in the market and success depends a lot on the efficiency of the managers in delivering the promised product or services. The responsibility lies on the organizations to develop a culture, ethics, responsibility, value and quality services should be offered to achieve higher level of customer satisfaction. Dynamic consumer behaviour is required to analyze various factors affecting consumer purchase decision directly or indirectly.

Zeithaml & Bitner (1993), highlights on various ingredients of services marketing such as consumer behaviour in services, services designs and standards, delivering and performing service and managing service promises. The book focused on various challenges and issues of service marketing, the GAPS model of service quality and customer defined service standards. The book discussed service quality models and service preference models in detail. The book also recommended uniformity in quality standards should be implemented. Indian Insurance A Profile by Narayanan (2010), highlighted features of Indian insurance markets, development of insurance sector in India, major players in insurance sector and insurance products offered to Indian policyholders. The book also provided detail of growth of life insurance and general insurance in India with appropriate statistics. Various phases of growth and development of insurance sector are presented in an efficient manner. The comparison of life insurance and General insurance is also provided in Indian and global context. The detail of LIC and private players is given in this book related to number of life insurance policies, growth in life insurance premium, life insurance density and number of agents in life insurance.

Bhole & Mahakud (2009), focused on Financial Institutions and Markets: Structure, Growth and Innovations,” the book elucidated IRDA policy reforms, Indian Financial System since 2002 and insurance sector reforms. The aggregate view of Indian insurance is presented is three developmental phases since 1818. Policy development, structure and various types of insurance plans are defined with evaluation process. The growth of financial services, financial sector reforms and role of regulators in financial reforms has been discussed in this book. The Boston Consulting Group recently conducted a study on consumer perceptions about insurance industry under its major brands entitled “Leveraging Consumer Insight in Insurance”. The study was done in mid-2009 focused on four major markets France, Germany, Japan, and United States and was based on a survey of more than 1000 people in each market, along with in-depth workshops and interviews.

The consumer attitude towards insurance is the first step in tapping full potential of consumers in a marketplace. The second step was to segment consumers on the basis of their perceptions about insurance, rather just according to income, wealth, life stage etc. This segmentation should then be enriched with insight into purchasing and channel preferences. Life insurance and age has shown a significant relationship according to the some preliminary studies conducted in seventies and eighties. Baek and DeVaney (2005) found that the effect of age was positive and significant, but Chen et al. (2001) found a negative significant relationship between age and life insurance demand, whereas Gandolfi & Miners (1996) argued that age was not a significant factor in purchase of life insurance. Baek and DeVaney (2005) used Probit, Tobit and Heckman model to investigate the impact of bequest motives on savings based on the estimates of the demand for life insurance, using the 1975 Longitudinal Retirement History Survey data. The youngest respondent was 64 years old and the oldest respondent was 69 years old in the 1975 survey. The effect of age on life insurance holding was also examined in the models. The results of all three models showed that the probability of life insurance holdings fall with age. Baek and DeVaney (2005) pointed out that this negative relationship reflects dissaving behaviour of the respondents. Using the 1984 LIMRA data, Gandolfi & Miners (1996) found that age was negatively associated with the demand for life insurance for husbands, while the age variable was not significant in the model while studying life insurance demand for wives.

Baek & DeVaney (2005), agreed in their research that there is a positive relationship between education and life insurance demand. They recognized that those who have a better education will purchase more life insurance. This is due to the fact that households with greater education can expect their incomes to continue to increase at a faster rate and for a longer period of time. Baek & DeVaney (2005) further examined the effect of human capital, bequest motives and risk on term and cash value life insurance purchased by households by using 2001 survey of Consumer Finance Data. They explained this
positive relationship was due to a greater loss of human capital when the household head dies. Households with a head with greater education have potentially higher incomes. The death of such a household head will bring more financial loss to the family as compared with those with lower education. Hence, the purchase of life insurance for those with greater education increases as the value of the lost human capital increases. The authors explained that higher educated people may believe that inflation often decreases the cash value of life insurance from a savings standpoint and hence declines their need for life insurance. Family size and number of children were found to be significant explanatory variables for determining the demand for life insurance in many studies. Showers & Shotick (1994). In contrast, Anderson & Nevin (1975) obtained the result that there is no significant association between family size and the purchase of life insurance using the data of Consumer Decision Processes.

Previous studies have consistently concluded that, if household heads or husbands are employed, more life insurance will be purchased by individuals or households. Ferber & Lee (1999) developed a one period model of the amount of life insurance purchased by a married couple with data from the Wisconsin Assets and Income Survey. The dependent variable in this study was the face amount of life insurance held by the husband. The results showed that occupation of husband had a positive impact on the amount of life insurance purchased. Gandolfi & Miners (1996) found that the wife’s employment status has a negative impact on the husband’s life insurance ownership. They argued that full-time labor force participation by the wife reduces the husband’s life insurance demand. (Gandolfi & Miners,1996). The analysis of Baek & DeVaney (2005) indicated that labor force participation by the wife enhanced the purchase of both cash value and term life insurance of the household. Limited researches have examined the influence of health status and life expectancy on the life insurance purchase. Zhu (2007) studied an individual’s choices on the purchase of life insurance and the purchase of stocks using one-period and two-period models. Zhu argued that when an individual decided the purchase of life insurance and stocks would consider his personal circumstances, such as wealth, future income, health status and survival probability, attitudes toward risk and bequest. Zhu found that an increased probability of surviving encouraged the individual to hold more life insurance. (Zhu, 2007) Similarly, Baek & DeVaney (2005) showed that a household with a healthy head spends more on life insurance expenditures (Baek & DeVaney, 2005) said that his product makes good sense, particularly when the protection is purchased against potential losses so large as to be catastrophic, such as total destruction of one’s home, a large accident liability judgment, or death of primary family breadwinner. However, it has long been recognized that this sensible product is difficult to sell. There are many papers and research studies that imply that behavioral patterns, purchasing motives and consumption of certain products and services differ significantly in relation to social class affiliation. Jha (1999) commented that improvement in life span and advancement in medical science had changed the customers” needs for insurance products worldwide. The focus of the insurers in matured market of the west had shifted to pension, health care and protection products.

Marital status has also been found to strongly affect both household and individual life insurance demand in previous studies (Hammond et al., 1967; Mantis & Farmer, 1968). Mantis & Farmer (1968) were among the first to examine how marital status influences life insurance demand of households. Multiple linear regression analysis was used on data obtained from the Life Insurance Fact Book (1929-1964). Premium expenditures were used as the dependent variable to see if there was an association with six demographic independent variables. They expected that married men would spend more money on life insurance than single men. But the analysis showed a negative association between marriage and life insurance premium expenditures. Gupta & Mayur (2004) conducted a study on the topic Social Health Insurance Development (India Country Assessment Report). According to a research report submitted to Institute of Economic Growth, Delhi, India by Gupta, Mayur, despite a government policy on health, the health sector is currently changing shape mostly due to market forces. In this set up, change for greater health coverage takes on a more urgent tone and policymakers need to act now, rather than later, to prevent the high costs of inaction and letting the objective of “Health for All” even more difficult to attain. The health system in India is ripe for moving towards “Coverage for All” system, which would take care of the “Health for All” objective to a great extent. First of all, it has to be understood that mere lip service is not going to make “Health for All” happen. There has been a tendency to not think beyond the current set up, which admittedly is a good one for a minority of our population. The need of the hour is for the same minority, who are often in the helms of policymaking, to understand that serious changes need to be made to the system if one wants to fulfill the basic objectives outlined in the health policy. While any change is difficult, the one that involves more than one department and organization is admittedly more so. It is, however, entirely possible to bring about these changes over the next several years, if a beginning is made now. (Gupta & Mayur, 2004); Hasanbanu & Nagajyothi, (2007) concluded that there is significant relationship between age, educational qualification, gender, occupation and income of respondents and their level of investment with taking LIC policies and further concluded that there is no significant relation between marital-status, family type and family size and their level of investment with taking LIC policies.
Income is commonly found to be positively related to the demand for life insurance, holding other factors constant. The effect of current income on life insurance demand is examined in Showers & Shotick (1994). It also used Tobit analysis to analyze the effect of household characteristics on the demand for total life insurance with data from the Consumer Expenditure Survey in 1987. The dependent variable used was premium expenditures on life insurance products. They assumed that life insurance was a normal good. The Tobit analysis indicated that a positive relationship existed between income and expenditures on life insurance premiums. They explained that as income increased the household has a motive to buy more life insurance policies because life insurance is bought as a function of the income replacement needed, in the event of an unexpected death of the major wage earner. There are inconsistent conclusions in previous research regarding the effects of net worth or wealth on life insurance purchase decisions. Some authors believed that there was a positive relationship between net worth or wealth and the demand for life insurance Hau, (2000). Since life insurance provide protection for households’ wealth. Using the data from the Panel on Consumer Decision Processes (1968-1971), Anderson and Nevin investigated the variables associated with the amount and type of life insurance purchased by a sample of young newly-married couples. The data were analyzed through Multiple Classification Analysis (MCA). The results of MCA showed that net worth was a positive and significant factor in explaining both the amount of life insurance purchased and the purchase of term life insurance.

Several researchers have examined whether consumers are sensitive to market rates of interest for making life insurance purchases. Hasanbanu & Nagajyothi, (2007) indicated that the interest rate has a different effect on the demand of insurance depending on its short or a long run situation. In the short run, the demand increases with higher interest rates, whereas in the long run, the interest rate has no direct influence on the demand for life insurance. RNCOS (2006) is an agency which collects data for remote areas predicted India as one of the fast emerging economies on the world map as a strong economy and a global power. The country is going through a phase of rapid development and growth. All the vital industries and sectors of the country are registering growth and thus, luring foreign investors. And insurance sector is one of them. To throw light on the Indian insurance sector, RNCOS has launched its report “Emerging Rural Insurance Market in India” that gives an extensive research and in-depth analysis of the insurance sector in India. This report helps clients to analyze the leading-edge opportunities critical to the success of the insurance industry in India. Based on this analysis, the report gives a future forecast of the market that is intended as a rough guide to the direction in which the market is likely to move. Bhatt and Jain from IIM Ahmedabad have conducted a study on “Factors affecting the demand of health insurance in micro insurance schemes. The study emphasized on factors effecting demand of health insurance and their purchase decisions. Health insurance schemes are assuming significant importance in reaching large number of peoples. The result indicates that income and healthcare expenditure are significant determinant of health insurance purchase. It is widely believed that homeownership is positively related to the amount of insurance purchased. Gandolfi & Miners estimated the influence of income and the value of household production on the amount of life insurance purchased for both husbands and wives. They also investigated whether the influence differed by gender. The data in their study was collected by the American Council of Life Insurance (ACLI) and the Life Insurance Marketing and Research Association (LIMRA) in 1984. Husbands and wives were examined separately and total, group and individual life insurance were used as three separate dependent variables in the Tobit model. They did not separate term policies from cash value policies due to the data limitations. The analysis indicated that home ownership was strongly positive in all the equations for both husbands and wives.

Using consumer panel data from a mid-sized southwestern city, Burnett & Palmer (1984) explored 14 psychographic factors, such as work ethic, self-esteem, community involvement, fatalism, socialization preference, and religious salience and so on, as influential in determining life insurance demand. They found that life insurance is related with personality traits of individuals. The results showed that if people are self-sufficient and believe that they are in control of their own well-being, they will buy more life insurance. Other interesting results include: people who are more likely to own life insurance purchase are individuals who are not opinion leaders, are not price conscious, are not information seekers and are low in self-esteem. Social class, Culture and Social Groups: Since the late 50’s, the question of superiority of one criterion over another has been a subject of many research studies. Early researchers, for example, argued that social class was a better variable than income as a predictor of consumer behaviour. Hasanbanu & Nagajyothi, (2007) investigated the relationship between life insurance premium expenditures and various demographic characteristics of households. Marital status and race were included among the independent variables. The authors believed that race reflect some cultural differences, such as attitudes toward death, family, individualism and risk aversion. These differences explain some variation about premium expenditures among households. Using the cross-sectional data, they found that marital status was negative and significant and race was not significant in the multiple linear regression analysis where premium expenditure was the dependent variable.
The process of consumption has long been associated with sex and gender, thus, it comes as no surprise that consumer researchers often examine the effects of these variables on consumer behaviours. It also comes as no surprise that much is known about sex and gender and how they impact buying and consuming activities. Yet there is one gender-related variable, gender identity, that has both intrigued and perplexed behaviour researchers for over four decades. Gender identity, sometimes referred to as an individual's psychological sex, has been defined as the "fundamental, existential sense of one's maleness or femaleness" (Spence 1984, p. 83). Since gender is culturally derived, gender identity is similarly rooted in cultural understandings of what it means to be masculine or feminine according to Sehrawat & Kundu (2007). For many years, sex and gender were thought to be inseparable that is, men were masculine and women were feminine. But what consumer behaviour researchers, among others, recognized long ago was that some men were more feminine than masculine while some women were more masculine than feminine. In the postmodern culture in which we now live, this separation of gender from sex is even more apparent in services. Sehrawat & Kundu (2007) have conducted a study on buying behaviour of rural and urban consumers in India. The study aims to establish whether the residential background of consumers has a varying influence on their buying decisions. The study shows that rural and urban policyholders feel that the ease of carriage, lightness of weight, transparency and consistency, simplicity have a strong influence on buying decision on urban consumer as compared to rural policyholder. Gopalakrishna (2008) conducted a study on life insurance products and their innovations and development. The research provides details of the benefits given to the insured and different types of offerings available in the market.

Gupta, (1996) examined, via consumer interviews, the impact of the National Association of Insurance Commissioner's Model Life Insurance Solicitation Regulation as implemented in New Jersey. A substantial portion of the insurance buyers sampled did not become aware of the provisions of the regulation aimed to improve their buying ability. Further, many life insurance buyers were not well informed concerning the nature and operation of life insurance contracts and in particular, the life insurance policies that they had purchased. A package of reforms is very much in the offering. There is an immediate need of a regulatory framework to open up the insurance industry. Mittal, (1998) analytically examined the global market to observe how the new sense of competition which will come to the market after the liberalization will affect the non-life insurance markets structure and operation in India. Alagiri & Vellingiri (2008) conducted a research on life insurance in India. The research gives an account of the developments and throws light on the present scenario in the field of life insurance. The research discusses various aspects of life insurance services and role of private players, government and regulatory bodies in life insurance sector. Service Quality Dimensions: Parasuraman et al (1985) proposed the gap model of service quality that operationalized service quality as the gap between expectation and performance perception of the customer. Later on, service quality has also been defined broadly as “consumers assessment of the overall excellence or superiority of the service” (Zeithaml et al, 1993). It was viewed as an attitude or global judgment about the overall excellence of a service, with comparison of expectations and performance as the measuring tools.

Although service quality structure was found rich in empirical studies on different service sectors, service quality modeling in life insurance services was not adequately investigated. Further, for service quality modeling, a set of dimensions was required, but there seems to be no universal dimension; it needs to be modified as per the service in consideration. Thus, the dimensions issue of service quality requires reexamination in context of life insurance services. Although numerous researchers have made theoretical and empirical contribution to the study of service quality in various industries, (like banking, healthcare, education) the area of life insurance was not adequately researched. Some previous studies in this area focused exclusively on relational qualities (Crosby & Stephens, 1987) and on the generic “SERVQUAL” format of quality measurement (Parasuraman et al, 1994). Power (2005) has conducted a study in America on Collision Repair Satisfaction Study. As per the study the insurance providers suggested that Communication is a Key in Achieving Customer Satisfaction with the Collision Repair Process. Maintaining a comprehensive and consistent dialog with the buyer throughout the claims process is critical for insurance providers in achieving customer satisfaction with the collision repair process. Insurance providers meet customer expectations through effective communication generally achieve higher levels of overall satisfaction. According to the study for expanding the insurance business, due weight age is required to be given to innovative marketing practices. This means studying the changing psychology of the prospects and subsequent arrangements to transform them into actual users of the services. The strategy should also consider the possibility of new entrants into the scene making the insurance business more competitive (Power 2005). Anil (2002) has conducted a study on customer equity. The study emphasized on customer equity and customer satisfaction based on critical evaluation of Insurance Companies are showing for the concern for their customers and changing the Customer Relations Management Practices. The study also discussed various problems faced by policy holders in India. This concern is called “Customer Equi”. To counter new challenges, LIC tied up with the IT giants, IBM and Wipro, to design its Customer Relations Management Programme.
Market watchers feel that “Big Brother” LIC and the Big 4 nationalized insurance companies should redesign and restructure their public relations and publicity activities to inform customer about the good work that is being done by them and measures being initiated to meet the increasing demand of the customer. The prime objective of these activities is to achieve highest possible level of customer satisfaction. (Anil, 2002) A model developed by Parasuraman et al (1985) deals with the nature of service quality and avers that customer satisfaction was the chasm between a customer’s service quality expectation and the actual service delivery. Customer satisfaction has a positive influence on retaining customers among different variety of services and products. A conceptual model of service quality through empirical research was developed by Parashuraman et al. The model highlights the following five service quality gaps: Buyer expectations-management perceptions about buyer expectations, Management perception of buyer expectations-service quality specifications actually set, Service quality specifications-actual service delivery, Actual service delivery- external communication about services. The final gap- result of four other gaps. “SERVQUAL” method is also known as the RATER model because it prescribes measuring satisfaction in these five dimensions: Reliability: A company’s ability to perform the promised service dependably and accurately. Assurance: The knowledge, competence and courtesy of employees and their ability to convey trust and confidence. Tangibles: Physical facilities, equipment and appearances that impress the customer. Empathy: The level of caring, individualized attention, access, communication and understanding that the customer perceives. Responsiveness: The willingness displayed to help clients and provide prompt service. (Parasuraman et al, 1985). Kekreet al (1995) conducted a study with focus groups and over 2500 responses from a questionnaire to discover what factors customers drive their satisfaction for software products. They analyzed the results to develop seven dimensions of customer satisfaction for product software: Capability, Usability, Performance, Reliability, Instability, Maintainability and Documentation.

A study conducted by Dass (2007) in banking industry concluded that service quality is continuously evolving a customer satisfied today may not be satisfied in the near future as their needs are changing with the time span and life cycle stages. Banks should continuously monitor the service quality to avoid erosion of service quality and mitigation by customers to another bank. Dass, (2007). Coleman (1989) has discussed a determinance ranking of evaluating criteria used by the bank customers. The determinants are categorized in three broad categories importance rating of bank characteristics, difference rating of bank characteristics and determinance ranking of bank characteristics. Several attributes related to these characteristics are analyzed and studied such as speed, efficiency of services, friendly attitude of personnel, availability of credit, hours of operation, full service offerings, recommended by friends, services charges, location, parking and so on. Jagdeep (1990), have proposed a model of consumer complaining behavior (CCB). It illustrated the variety of actions possible. Buyer may not complain to the seller but to formal third parties, bureau or a newspaper. They may engage in private CCB activities such as telling friends and relatives about the bad experiences and changing their own patronage behaviour.

Dass(2007), conducted a study on customer satisfaction in banking industry with special reference to Service quality model. As per their study the service quality was a construct that was continuously involving a customer satisfied today might not be satisfied in future due to their changing needs and aspirations. Instead of resting on their laurels the bank should continuously monitor the service quality levels to avoid migration and switching of customer to another bank.

III. RESEARCH METHODOLOGY

The study used descriptive research design. (Knupfer &McLellan, 2001), postulate that descriptive research does not fit neatly into the definition of either quantitative or qualitative research methodologies, but instead it can utilize elements of both, often within the same study. Therefore the design was suitable in this research as it allowed for investigation of population through selecting samples to analyze and describe the characteristics of the population. This approach was necessary for extensive research and yields quantitative and numeric description of some part of the population.

The study was carried out in Kericho County, located in the South Rift Kenya, targeting CIC insurance customers within the county. The target population was constituted of 300 customers of CIC Insurance Kericho branch. The source of information about the customers was obtained from CIC Kericho office data bank. The customers have different insurance policies with CIC Insurance. The sample size was selected from the target population. The sample size was 171 customers. The sample size was determined according to Morgan formula (1979), given a margin error of 0.05 at 95.0% confidence level.

\[
n = \frac{N \cdot e}{1 + N(e)^2} = \frac{300}{1 + 300(0.0025)} = 171
\]

The study adopted simple random technique. This method helped the researcher to achieve a desired representation of the customers. During the study, structured questionnaire was used. The structured questionnaires gave unbiased information as the
respondents gave out their own experience without the influence of the researcher although it was challenging when the respondent is illiterate. The questionnaires were administered by the researcher.

To ensure the reliability of the instrument used, the study used test-retest reliability. This was obtained by administering the same test twice over a period of time to the sample size. The scores from time one and time two can then be correlated in order to evaluate the test for stability over time. To ensure validity of the instrument the study used content validity. Content validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. If the instrument contains a representative sample of the universe, the content validity is good. Its determination is primarily judgemental and intuitive. It can also be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards, but there is no numerical way to express it. (Kothari,2004). The pool of questions were be subjected to a panel of experts in insurance field, constituted of managers to scrutinize the content.

The study used of structured questionnaires administered by the researcher to the customers of CIC Insurance customers within Kericho County. The researcher provided an introduction letter from the university to the respondents. After the data had been collected, the questionnaires were checked for any errors and then summarized. The summarized data was analyzed by use of descriptive statistics including means, frequencies. The relationship between the dependent variables and independent variables were determined by use of correlation and regression analysis was used to test the hypothesis. The findings of the study were presented by use of bar graphs, tables and charts. The study required the participation of human respondents and as such the research process observed ethic issues in order to ensure privacy and safety of respondents. Permission was sought from the management of CIC insurance, Kericho branch. This involved explaining the aim and purpose of the study and contribution to the organization. Once the permission was obtained, the targeted respondents were assured that participation is voluntary. Assurance was given that no disclosure of name will be required to ensure confidentiality for the information given in the questionnaire.

IV. FINDINGS AND DISCUSSIONS

Cross tabulation was used to compare variables showing number of cases in falling into each combination of the categories. Chi-Square. Pearson’s correlation (R) was used to test the significance of variables in the study. To make a conclusion about the hypothesis at 95% confidence level, the p-value of the Chi-Square statistic should be less than .05 (which is the alpha level associated with a 95% confidence level). If the p-value < .05 and the critical chi square value is more than the calculated value then it is concluded that the variables are independent of each other and hence there is no statistical association between them.

Demographic information shows the characteristics of the elements in the sample size: As such the researcher sought to establish the general information of the respondents, which forms the basis under which the interpretations are made. Demographic factor one analyzed the gender of the respondents. This information was necessary to enable the researcher to obtain information on whether the respondents were either male or female. From the figure below its was evidenced that more males than females were in the sample, making up to 57.83% compared to their female counterparts at 42.37%. The age distribution of the respondents assumed a normal curve, with those aged between 29-39 years having highest frequency at 38.14% followed by those at age bracket between 40-50 years at 35.59%. The youthful respondents at 18-28 years and older ones had lower frequencies at 9.3% and 16.9% respectively. The sample thus was representative of all ages capable of insurance uptake in the area under study. There was indication that insurance uptake among the youth is low. The findings showed that respondents with college and bachelors level of education made up the largest numbers having 33% and 47%. Secondary level of education had the smallest numbers (2.5%) followed by those with PhD level at 4.2%. Respondents with primary level of education and those with masters made up 5% and 7% respectively.

The study sought to establish the proportions and frequencies of insurance uptake by gender, age, marital status and education level.

<table>
<thead>
<tr>
<th>Table 1: Gender insurance uptake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of insurance</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>General Insurance policy</td>
</tr>
<tr>
<td>Life Insurance Policy</td>
</tr>
<tr>
<td>Both Life Insurance Policy and General insurance policy</td>
</tr>
</tbody>
</table>

www.ijsrp.org
According to gender factor, men have a higher level of uptake of insurance (57.6%) than women (42.4%). Majority of the respondents have taken up general insurance 43%, compared to those who have taken life insurance 32%. Findings also show that more female 59% have taken up life insurance than the male 41%. The study however found that only 25% of the respondents have taken up both life and general insurance. From the study it is evident that the male have taken more insurance policies than the female. Hasanbanu & Nagajyothi, (2007) states that there is significant relationship between gender and insurance uptake, as it has been found out by the study.

Table 2: Insurance uptake by Age

<table>
<thead>
<tr>
<th>Age category</th>
<th>Life Insurance Policy</th>
<th>General Insurance policy</th>
<th>Both Life Insurance Policy and General insurance policy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-28 years</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>29-39 years</td>
<td>16</td>
<td>24</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td>40-50 years</td>
<td>5</td>
<td>20</td>
<td>17</td>
<td>42</td>
</tr>
<tr>
<td>Above 50 years</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>51</td>
<td>30</td>
<td>118</td>
</tr>
</tbody>
</table>

Source: Field data, September 2016

Age category with higher level of uptake is between 29-39 years which has a small range with ages between 40-50 years. Therefore, it is true from this result that insurance is largely consumed by people at ages between 29-50 years making a total of 73.7%. Ages below 28 years and those above 50 years make up only 26.3%. This aspect of age is significant in determining insurance uptake. Young people purchase life insurance policies than the old age people, this is in agreement with AKI report (2014). Also Hasanbanu & Nagajyothi, (2007) confirmed that there is significant relationship between age and insurance uptake. These findings suggest that insurance companies need to focus more on the youth to maximize their sales and make life insurance products for the old.

Table 4: Insurance uptake and Marital status

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Life Insurance Policy</th>
<th>General Insurance policy</th>
<th>Both Life Insurance and General insurance policies</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>13</td>
<td>3</td>
<td>3</td>
<td>19(16%)</td>
</tr>
<tr>
<td>Married</td>
<td>23</td>
<td>46</td>
<td>25</td>
<td>94(80%)</td>
</tr>
<tr>
<td>Widowed</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5(4%)</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>51</td>
<td>30</td>
<td>118</td>
</tr>
</tbody>
</table>

Source: Field data, September 2016

From the study, married people 80% take up insurance as compared to unmarried (single) 16% and the widowed 4%. This aspect of marital status is significant in determining insurance uptake. The married were seen to be pro insurance than the single and the widowed. The married prefer to be secured from risk and have savings for their children, the widowed would wish to have the same but lacks of economic stability takes a toll on them and are less likely to take insurance. Gupta & Mayur (2004) also indicate that marital status is significant to insurance uptake. Therefore there is need for insurance company to tailor products for married people as this is a good market to focus on.

Table 4: Education Level and insurance uptake

<table>
<thead>
<tr>
<th>Type of Policy</th>
<th>Life Insurance Policy</th>
<th>General Insurance Policy</th>
<th>Both Life Insurance Policy and General insurance policy</th>
<th>Total</th>
</tr>
</thead>
</table>

Source: Field data, September 2016

www.ijsrp.org
From the study, the distribution of the respondents by education level seems to take the general pattern in the Kenyan population where most of the population is skewed towards college and bachelors’ degree. It suggests also that most customers are probably among the working class. It also indicates that educated people have product knowledge about the insurance products thus taking up insurance. Therefore insurance companies should design ways of incorporating the informal sector. Baek & DeVaney (2005), agreed in their research that there is a positive relationship between education and insurance demand. They recognized that those who have a better education will purchase more insurance.

The study sought to find out whether monthly income and premium paid per year do have a linear relationship with insurance uptake. Table 5 shows the results.

### Table 5 Correlations between insurance uptake and Monthly income.

<table>
<thead>
<tr>
<th>Insurance policy Uptake</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
<th>Monthly Income</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance policy Uptake</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Insurance policy Uptake</td>
<td>.466**</td>
<td>.000</td>
<td>118</td>
</tr>
<tr>
<td>Monthly Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.466**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td>1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.000</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>118</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field data, September 2016

The correlation coefficient between insurance uptake (Type of policy) and income earned per month is 0.466 which is a positive correlation though not strongly correlated since its closer to one. However, this correlation is statistically significant (P-value 0.00) which is less than significance level 0.01 and it is sufficient to conclude that there is a linear relationship between monthly income and insurance uptake. This indicates that monthly income influence the ability of a consumer to take up variety of insurance policies. High income earners can be targeted to take up multiple policies. Also insurance companies should come up with affordable policies for the low income earners. Showers & Shotick (1994) indicates that a positive relationship existed between income and insurance uptake.

### Table 6 Correlations between insurance uptake and premium paid per year

<table>
<thead>
<tr>
<th>Type of Policy</th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Policy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Premium paid per year</td>
<td>.152</td>
<td>118</td>
<td></td>
</tr>
<tr>
<td>Premium paid per year</td>
<td>-.133</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Source: Field data, September 2016

Unlike Monthly income of an individual, premium paid per year was not statistically significant at 0.01 level (p-value 0.152). It is negatively correlated with Pearson correlation -0.133. This leads to the conclusion that there is weak (negative) linear relationship between insurance uptake and premium payment. The study sought to establish the association of the variables and insurance uptake. Chi square tests were used to test the association among the study variables. The test uses specifically grouped or categorical variables (ordinal or nominal). To apply this, the study calculated the mean of all indicators of each dependent variable to obtain a unit variable to be used in testing that variable. The study based the test on 5% (0.05) level of significance meaning that the conclusions made in this study were at 95% confidence level. In chi-square test, there are two coefficients (statistic) that are vital in the study namely; Pearson chi-square and Cramer’s V. Pearson Chi-square is used to test the associations while Cramer’s V are to test the strength of association. When measures of association between variables such as Cramer’s V are used, values below 0.10 indicate a Weak relationship between the variables, values between 0.10 to 0.30
indicate moderate relationship while the value 0.30 above indicates strong relationship between the variables.

<table>
<thead>
<tr>
<th>Table 7 the association of the variables and consumer behaviour on insurance uptake</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pearson Chi-Square</strong></td>
</tr>
<tr>
<td>Demographic factors</td>
</tr>
<tr>
<td>Economic factors</td>
</tr>
<tr>
<td>Psychographic factor</td>
</tr>
<tr>
<td>Social factor</td>
</tr>
<tr>
<td>Claim settlement</td>
</tr>
<tr>
<td>Perception towards insurance</td>
</tr>
<tr>
<td>Product awareness</td>
</tr>
</tbody>
</table>

Source: Field data, September 2016

This table gives various chi-square values for the various variables affecting the insurance uptake in the study area. The variables were statistically significant based on the p-values given apart from the Social factors and Perception towards insurance, p-values 0.062, and 0.104 respectively which are greater than 0.05. Thus variables: Demographic factors (18.706, p-value 0.017), Economic factors (8.213, p-value 0.050), Psychographic factor (13.663, p-value 0.034), Claim settlement (16.424, p-value 0.0037) and Product awareness (15.115, p-value 0.057). These chi-square values therefore enable us make inferences about our sample and thus the population concerning the influence of consumer behavior on insurance uptake.

It’s evident from the Cramer's V values that there is moderate (values between 0.1-0.3) to strong (> 0.3) relationship between the following variables with the insurance uptake with no values < 0.1. There is strongest relationship between economic factors and insurance uptake with Cramer's V values > 0.3 (0.331) followed with those with moderate association demographic factors, claim settlement, product awareness and psychographic factor 0.282, 0.264, 0.253 and 0.241 in that order. The social factors and perception towards insurance have no association with insurance uptake having Cramer’s V value < 0.1 (0.97 and 0.037) confirmed by significance level > 0.05 (0.062) and (0.104) respectively indicating no statistical significance.

V. CONCLUSIONS AND RECOMMENDATIONS

The findings of the study indicates that economic factors have P-value (0.05) is equal to significance level (0.05), therefore we fail to reject the null hypothesis. This leads to conclusion that there is a relationship between economic factors of consumers and insurance uptake. Therefore, aspects such as income, wealth and interest rate have a bearing on the rate of insurance uptake. Demographic factors P-value (0.017) is less than the significance level (0.05), therefore we fail reject the null hypothesis. Conclusion is therefore that there is a relationship between demographic factors of consumers and insurance uptake. Age of an individual determines whether he takes insurance or not similarly to marital status as indicated in chart 4.1 which indicates 80% of the married take insurance compared to single (16%) and widowed counterparts (4%). Education level also plays a role in insurance uptake; more people with tertiary and masters level of education make up a larger chunk of those taking up insurance, that is 33% and 47% respectively. On whether psychographic factors such as lifestyle, preferences, social class and attitudes and preferences have an influence on insurance uptake; its sufficiently shown by the fact that its p-value (0.034) is less than significance level (0.05) suggesting that its statistically significant and the strength of this relationship is moderate with Cramer’s V value of 0.241. From these we can therefore fail to reject the null hypothesis and conclude that there exists a relationship between psychographic factors of consumers and insurance uptake.

On the contrary as compared to previous factors, social factors as not statistically significant p-value (0.062) which is >0.05 also the Cramer’s V coefficient (0.097) confirms having weak relationship with insurance uptake. So we fail to reject the null hypothesis. The alternative hypothesis is thus adopted and we conclude that there is no relationship between social factors of consumers and insurance uptake. Also to note are other contributory factors to uptake of insurance as Claim settlement and Product awareness which have moderate relationship with Cramer’s V values (0.264, 0.253) respectively and thus existence of some relationship with uptake, although Product awareness is not statistically significant p-value (0.057) which is >0.05. Claim settlement is statistically significant P-value (0.037). Government regulations have an influence on insurance uptake, more of people take vehicle insurance as result of government guidelines.

From the study, it is evident that consumer behaviour is significant to insurance uptake. It is important that marketers in the insurance industry these factors to increase the insurance penetration in Kenya. Economic, demographic and psychographic factors greatly influence insurance uptake. Social factors are less significant to insurance uptake. Also other...
factors such as claim settlement, product awareness and product awareness highly influence insurance uptake. The strongest factors from the study that influence insurance uptake are economic and demographic factors whereas the weakest factor is social factors. From the study, the researcher recommends that; insurance companies have policies that gather the needs of all people, that is the wealthy and the low income earners. This will make insurance policies be affordable to all. As demographic factors have strong influence on insurance uptake the insurance companies should have product for each group. Insurance companies should have invest more on product awareness and claim settlement as this greatly influence insurance uptake. 

The aim of the study was to investigate influence of consumer behaviour on the uptake of insurance services, it is then established that economic, demographic and other factors including product knowledge, product awareness and claim settlement contributes much to the low uptake of insurance services. Further research on products offered by the insurance companies to the market can be done. Also research can be done to establish the reason why there is low uptake of insurance services in Kenya.

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Employee Perceptions in the Workplace: Discrimination, Work Motivation, Teamwork/Citizenship, and Locus of Control

Ana Marafuga, Toni DiDona, Jamila Paradas, Antonio E. Cortes, and Mercedes Perera

Carlos Albizu University

Abstract- Research regarding discrimination is plentiful with a general understanding that it can induce stress, prevent access to opportunities, and affect interpersonal relationships (Jang, Chiriboga, & Small, 2008; Miller & Kaiser, 2001). However, research has not yet clarified a relationship between perceived discrimination with other constructs such as work motivation, teamwork/citizenship, and locus of control (LOC). For that reason, the purpose of this study will be to explore those relationships. A sample of 443 participants completed an online survey containing a series of demographic questions, a set of questions regarding the participant’s perception of having been discriminated against, as well as valid and reliable measures of the constructs: work motivation, teamwork/citizenship, and LOC. This was done using a convenience, snowball sampling technique, limited to employed individuals 18 years or older. The results showed that individuals who perceived discrimination had, on average, higher LOC scores (x = 44.88) than those who did not perceive discrimination (x = 39.70). This indicates a higher external LOC score for those who perceived discrimination; meaning they were more likely to see themselves as victims of circumstances beyond their control. However, no significance was found in comparing those who perceived discrimination and those who didn’t with the constructs of work motivation and teamwork/citizenship. This study will contribute to the body of knowledge on perceived discrimination by providing additional insight on its relationship with work motivation, teamwork/citizenship, and LOC.

Index Terms- perceptions, discrimination, work motivation, teamwork/citizenship, locus of control, workplace

I. INTRODUCTION

Over the last 52 years, laws have been enacted to prohibit discrimination in the workplace. One of the first laws was Title VII of the Civil Rights Act of 1964 (Title VII), which made it illegal to discriminate on the basis of race, color, religion, national origin, or sex (EEOC, 2017a). This law was followed by additional pieces of legislation designed to prevent a wider variety of other forms of discrimination. Examples include but, are not limited to: The Age Discrimination in Employment Act of 1967 (ADEA), The Pregnancy Discrimination Act of 1978, and Title I of the Americans with Disabilities Act of 1990 (ADA) (EEOC, 2017b). Despite these laws, discrimination in the workplace continues to exist as evidenced by the 91,648 discrimination charges received by the EEOC in 2016 (EEOC, 2017c). Interestingly, the results of a meta-analysis study on self-reported racial discrimination strongly suggested that what an employee considers to be fair treatment at work may change along with societal changes, such as employment laws (Triana, Jayasinghe, & Pieper, 2015). The researchers also recommended that employers should be aware of major changes in societal norms and rules, in addition to, employment laws.

As different types of discrimination (age, disability, sexual orientation, gender identity, and race/ethnicity) were explored, the need for organizational policies to address discrimination and include diversity training was identified as a common element in the research (e.g. James, McKechnie, Swanberg, & Besen, 2012; Bjelland et al., 2010; Ragins & Cornwell, 2001). An exploratory study with regards to age discrimination, suggested both older and younger workers may feel disparate treatment when it comes to promotions (James et al., 2012). This led the researchers to recommend that the decisions to develop and promote employees need to be based on transparent standards unrelated to age. In another study that evaluated EEOC charges filed regarding age and disability, it was determined that termination issues made up about 60-70% of the charges filed under ADA and/or ADEA (Bjelland et al., 2010). The researchers go on to suggest that inadequately structured employer policies and practices were the reason for these charges.

In a study regarding perceived discrimination against gays and lesbians in the workplace, the results showed that if an organization had supportive policies and practices in place in addition to protective legislation, gay employees would be more likely to disclose their sexual orientation (Ragins & Cornwell, 2001). A qualitative study with 26 transgender males who were from the United States discussed how some of these individuals were fearful of being fired for revealing that they were transgender (Dietert & Dentice, 2009). The researchers suggested that these fears came from unsupportive management and discriminatory behavior by coworkers.

Ghumman, Ryan, Barclay, & Markel, (2013), noted a rise of 96% in religious discrimination claims in the workplace based on EEOC statistical data from 2000 through 2010. The researchers also noted that the rise was related to the legal ambiguities around Title VII, increases in religious diversity and expression in the workplace, as well as, characteristics that are unique to religion as compared with other types of discrimination.

While the previous studies recommend for employers to establish better policies and practices in addressing discrimination and incorporating diversity training, a study by
Barak, Cherin & Berkman (1998), shows the importance of also recognizing how people are treated once those policies and practices are implemented. In the study, a company had undergone some changes to promote their value for diversity, showed an interesting dilemma in incorporating these new policies and practices. The researchers administered a company-wide survey and later conducted additional follow-up interviews of 22 employees. These interviews provided further support for the survey results in which Caucasian men viewed the company’s practices as fair and inclusive, whereas men and women who were racial/ethnic minorities along with Caucasian women viewed it otherwise. In addition, racial/ethnic minorities and Caucasian women had a stronger value for diversity than did Caucasian men. During the interviews, managers stated that they were color/gender blind. The researchers found this hindered their ability to realize and appreciate the differences amongst employees. Barak et al. (1998), recommended that in addition to diversity training being offered to all employees, it is important for managers to also recognize how people are being treated and potential issues associated with that treatment.

With the abundance of research articles referring to the importance of establishing organizational procedures, practices, and diversity training to address discrimination, the question still remains to better understand individual’s experiences with perceived discrimination in the workplace. A theoretical study on coping with stigma found that discrimination can potentially prevent access to opportunities as well as affect interpersonal relationships (Miller & Kaiser, 2001). Another study (Triana et al., 2015) showed there was a negative relationship between perceived racial discrimination and organizational citizenship behavior (OCB). However, further investigation is still needed. This leads the researchers to take a more comprehensive look at perceived discrimination and its relationship with the following three constructs: work motivation, teamwork/citizenship, and locus of control (LOC). In the sections that follow, the researchers take a more in-depth look at each of these three factors to gain a better understanding of them and their relationship with perceived discrimination in the workplace.

II. WORK MOTIVATION

Organizations are unaware of employees’ perceptions, which may affect work motivation positively or negatively. In a large number of studies and reviews done throughout the years, psychologists have agreed about the importance of motivation in the workplace (Clark, 2003). Work motivation can be related positively or negatively to the workforce. Although, work motivation seems to be a term used loosely in conversation in order to convey what may be occurring in organizations, research findings in correlation with perceptions of discrimination are less abundant. However, it may be of use knowing in which ways employees’ work related perceptions can influence organizations, and which will better assist in properly motivating and maintaining employees motivated. The lack of research has been the main conflict for researchers. Most research is centered on why discriminators discriminate and has overlooked those being discriminated (Deitch, Barsky, Butz, Chan, & Bradley, 2003; Dion, 2002). One particular study by Di Marco et. al. (2016) tries to understand the consequence of perceiving a discriminatory work environment on employees’ health. The research aimed to identify a mediating effect of job satisfaction in the relationship between employees’ perceptions of a discriminatory environment and their health and the statistics established that a relationship exists between employees’ perceptions of a discriminatory work environment and their health. Therefore, Di Marco et. al. (2016) concluded, that when people consider their organization is being discriminatory against employees who belong to a minority group, their health is affected negatively. This previous study can be related to motivation, as motivation has been found to be directly linked to performance and well-being in organizations (Tremblay, Blanchard, Taylor, Pelletier, & Villeneuve, 2009).

Work motivation has been the center of conversation for more theories than any other topic in the workforce; it is seen as a foundation (Tremblay et. al., 2009). The Self-Determination Theory (SDT) has greatly impacted the development of a large number of organizational and managerial practices to promote a better workplace for employees and to enhance work productivity (Tremblay et. al., 2009; Pinder, 2008). The self-determination theory is based on people's innate tendencies and needs (Gagne & Deci, 2005). SDT evolved from research on intrinsic and extrinsic motivation. Extrinsically motivated individuals work on tasks because they believe that participation will produce wanted external rewards, like money, and high praise (Ryan & Deci, 2000). On the contrary, intrinsically motivated people perform tasks and act a certain way because they find their job pleasurable and the mere task is reward enough (Gagné et. al., 2010). However, in order to be self-determining, according to Gagne and Deci (2005), people should be the ones to decide how to behave in their environment.

Through the years an extensive amount of definitions have been developed to explain work motivation (Pinder, 2008). Pinder (2008) also states that the definitions have risen from various theories that underlie motivation; where a number of behavioral thinkers have dedicated time to study human behavior while offering pieces that make up the definition. To better understand work motivation, Pinder (2008) combined parts of various interpretations and definitions to describe work motivation as “a set of energetic forces that originate both within as well as beyond an individual's being, to initiate work-related behavior, and to determine its form, direction, intensity and duration” (p. 11). Those combined parts are indicated within SDT as intrinsic and extrinsic motivation. Intrinsic motivation meaning an individual’s drive comes from within, and can be influenced by the individual’s own values, goals and enjoyment (Singh, 2016) and extrinsic motivation means the drive to achieve comes from an outside source or encouragement (Singh, 2016). Organizations have goals, and motivation is the driving force that allows individuals to achieve those said goals. Additionally, perceptions of discrimination can be powered by demographics, intrinsic and extrinsic forces, one’s need to be self-determined, and the urge to meet certain needs based on priority and have a relationship with an individual’s work motivation. With the lack of research being the present theme, it is the goal of this study to assess the relationship between perceived discrimination and work motivation. Therefore, it is hypothesized that there is a significant difference in work motivation when perceived discrimination is present.
III. TEAMWORK/CITIZENSHIP

Teamwork is known as a set of feelings, actions, and thoughts that each member of the team shares with one another that are essential to the operation of a group and allow for coordinating group tasks, adaptive performance, and fulfillment of task objectives that result in valuable outcomes (Morgan, Glickman, Woodard, Blaiwes, & Salas, 1986; Salas, Sims, & Klein, 2004). After doing a lengthy literature review of both empirical studies and theoretical models, Sala, Sims, and Burke (2005) suggest five core components that are essential to teamwork effectiveness: team leadership, mutual performance monitoring, backup behavior, adaptability, and team orientation. The first component, team leadership, refers to someone’s capacity to organize, plan, motivate members, assess performance, develop knowledge, skills and abilities, coordinate and direct activities and tasks, as well as, promote a positive work environment. Mutual performance monitoring is the capability to implement adequate strategies of tasks and establish a common perception of the team atmosphere to effectively audit team members’ performance. Backup behavior is the ability to alternate workload between teammates to acquire equilibrium during busy work shifts, and it is also the ability to predict the needs of team members based on their individual responsibilities. Adaptability is the modification of strategies according to the information of the environment through the application of reallocation of intrateam resources and backup behavior. Lastly, team orientation is the disposition to consider other people’s behavior during team interactions, and is also the belief that team goals are more important than the independent goals of each member.

Furthermore, study findings demonstrate the difference of teamwork levels between employees of an organization. According to Kiffin-Petersen and Cordery (2003), trust in coworkers and management are strong predictors of employee preference to participate in teamwork, and employees who have worked long amount of years for an organization have more negative attitudes towards teamwork than younger employees. With that in mind, it is important to understand the value of teamwork in the workplace. A review of survey-based research demonstrated support for teamwork’s contribution to organizational performance (Delauere, Hoogem, Procter, & Burridge, 2007). Also, teamwork has been found to have a positive relationship with operational performance, increased productivity, and the quality and efficiency of employees (Hamilton, Nickerson, & Oxan, 2003; Cohen, Ledford, & Spreitzer, 1996). Godard (2001) explains that teamwork has a statistical and positive relationship with job satisfaction, task involvement, organizational commitment, belongingness, employee empowerment, and Organizational Citizenship Behavior (OCB). Likewise, OCB is an employee’s behavior or action that is not obligated by the job role or description; instead, it is based on personal election and contributes to the company’s efficiency (Organ, 1988).

According to Podsakoff, MacKenzie, Paine, and Bachrach (2000) the different types of citizenship behaviors include: helping behavior, sportsmanship, organizational loyalty, organizational compliance, individual initiative, civic virtue, and self-development. OCB has been found to contribute to effective teamwork performance, Podsakoff, Ahearne, and MacKenzie (1997) found in their research that citizenship behaviors like helping behavior; which refers to voluntarily helping other fellow co-workers and/or preventing conflicts that may occur in the work environment (Podsakoff et. al., 2000), and sportsmanship, which is when an employee shows tolerance to impositions and dilemmas, while not complaining when inconveniences occur (Organ, 1990), had a significant effect on teamwork performance quantity. Meanwhile, only helping behavior had a strong impact on performance quality. OCB was found to be positively correlated to teamwork performance in highly task interdependence orientated groups (Nielsen, Bachrach, Sundstrom, & Halfhill, 2012). Another study’s findings suggested that the more employees trusted and were attracted to their coworkers, and felt valued by their organization, the more they were to exhibit citizenship behaviors within the organization even when there was demographic dissimilarity amongst coworkers (Chattopadhyay, 1999).

Additional published research suggested a connection between discrimination and OCB. Ensher, Grant-Vallone, and Donaldson (2001) measured employee’s perceptions of discrimination from three sources: supervisors, coworkers, and the organization. Findings showed that all three sources of discrimination had an effect on organizational commitment and job satisfaction, as well as, citizenship behavior. As a matter of fact, Brenner, Lyons, and Fassinger (2010) conducted a study where they measured the effect of heterosexism (willingness of an organization to act out against heterosexism, and a type of discrimination directed towards homosexual and bisexual people) and workplace outness (identity disclosure of being homosexual) on perceived OCB of gay and lesbian employees. Willingness of the workplace to act out against heterosexism was predictive of the workplace outness, which in turn positively predicted OCB helping behavior, while (Brenner et. al., 2010). Also, the study showed that there was a strong relationship between outness and the citizenship behavior of organizational compliance (Brenner et. al., 2010), which according to Borman & Motowidlo (1993) means to be obedient to the regulations and policies of the company.

Regarding the extent of the literature reviewed above, there were several studies that suggested a difference of teamwork and OCB levels between employees (Chattopadhyay, 1999; Kiffin-Petersen et. al., 2003). Also, some studies presented the possible effects certain types of discrimination may have on citizenship behaviors (Ensher et. al., 2001;Brenner et. al., 2010). Therefore, it is hypothesized that there is a difference in the teamwork/citizenship test scores between participants who perceived discrimination and those that did not perceive discrimination.

IV. LOCUS OF CONTROL

Locus of control (LOC) is primarily concerned with learned behavior and the nature and effects of reinforcements. Many factors exist within an individual’s work environment that may either enable or hinder performance of a behavior. Factors, such as skills and willpower, are internal to the individual, while factors like task demands and another person’s actions are
external to the individual (Ajzen, 1985). According to Ajzen (2002), people differ in the degree to which they view rewards, punishments, or other outcomes and events in their lives caused by their own actions or by factors out of their control. Thus, the distinctions between internal and external causes of a behavior are important in maintaining job satisfaction and increasing employee retention, especially since most current careers are self-directed.

LOC was first introduced by Rotter’s (1966) social learning theory of personality, is an individual's internal or external source of drive and motivation, identified as an influential factor on people’s work attitudes and behavior (Erbin-Roesemann & Simms 1997). Rotter’s (1966) locus of control theory separates LOC into two types, internal and external. Individuals with an internal LOC believe that life events depend upon the behaviors and characteristics they possess (Erbin-Roesemann & Simms, 1997), therefore individuals possessing a high perception of internal LOC tend to be more self-confident and assertive, taking responsibility for their own success and failure (Erbin-Roesemann & Simms, 1997). In contrast, individuals with an external LOC perceive reinforcement as an outcome of their environment and not their own behaviors. Hence, those possessing an external LOC perceive themselves as victims of circumstances beyond their control, and see their success and failure on a job as caused by outside forces, e.g. luck (Cadini, Maass, Lombardo, & Frigerio, 2006).

Research has shown that individuals who possess a high locus of control increase their efforts to perform at actual levels of performance (Weiss & Sermann, 1973). On the other hand, people with low self-esteem tend to lower their standards or withdraw altogether from a task (Brockner, 1988). A study performed by Ng and Butts (2009), observed work environments and strategies useful for retaining employees. The researchers hypothesized employee’s intentions to stay at a job as linked to available opportunities for learning, availability of rewards for performance, and high internal versus external LOC. Their results showed a positive relationship between all three variables and high internal LOC.

However, according to Ajzen’s (2002) study on perceived behavioral control versus locus of control, researchers tried to clarify assumptions that identified internal and external locus of control as either having control or lack of control over performance of the behavior. A closer look at these assumptions revealed that perceived control over an event is independent of the internal or external locus of the factors responsible for it (Ajzen, 2002). Thus, implying that a person’s self-efficacy is also an important factor when analyzing people’s beliefs of having control over the behavior (Ajzen, 2002).

As discussed previously, an individual’s work environment consists of various factors that can either allow personal and career development or stunt any feasible possibilities for advancement. According to Ng & Butts (2009), there are four valuable characteristics of a nurturing work environment—information sharing, job significance, opportunity for learning, and availability of rewards for performance. If these aspects are not being met within an organization, lower job satisfaction and higher turnover will be the end result. Hence, when an employee believes there to be perceived discrimination within their place of employment, chances are their LOC or beliefs of being able to control their environment may become affected.

Being discriminated against can induce stress and reduce an individual’s psychological well-being (Jang, Chiriboga, & Small, 2008). In a study conducted by Jang, Chiriboga, & Small (2008), relationships between perceived discrimination and positive and negative affect were explored. The findings demonstrated the role of sense of control as a mediator. Data from the Midlife Development in the United States (MIDUS) survey with an N = 1,554; age range = 45 to 74, revealed exposure to a discriminatory experience coupled with a low sense of control to result in increased negative affect. Findings suggested that those with a high sense of control are less perceptible to discrimination and are more resilient to psychological distress (Jang, Chiriboga, & Small, 2008). Therefore, it is hypothesised that there is a significant difference in LOC when discrimination is perceived.

V. Method

Participants

Participants were recruited using convenience, snowball sampling and participation was limited to individuals employed at least part-time and were 18 years or older at the time of taking the survey. Participants who selected unemployed or retired in the survey or who were not 18 years or older were prevented from continuing the survey.

Procedure

The researchers contacted participants through email, text messages, and social media outlets such as LinkedIn, Facebook and Instagram using a unified recruitment message for all communication forums was used. Prior to completing the online survey, participants were provided with an informed consent. The informed consent outlined the point of the study, confidentiality and the right to withdraw at any moment. The informed consent also specified that there were no known risks to participating and it guaranteed their anonymity. After reviewing the informed consent, participants had the choice of selecting I agree or Do not agree. Only the participants that selected I agree were able to complete the survey.

VI. Instrumentation

The online survey link was hosted on Google Forms and compiled of three instruments. Participants were asked 2 self-developed question by the researchers, “Have you ever felt discriminated against by other employees/managers at your current place of work?” Participants had the option of selecting yes, no, or other, in order to assess perceived discrimination. Only if yes was selected, participants were asked an additional question, “What do you feel was the reason(s) for the discrimination?” and given various choices to select from. The discrimination section was followed by the instrument questionnaire of work motivation, teamwork/citizenship, and locus of control (LOC).

The first instrument, The Motivation at Work Scale (MAWS) (Gagne et. al., 2010), is a 12-item scale which
measures how different types of work motivation may be influenced by situational factors. Participants would indicate their reasons for doing a specific job using a 7 point Likert-scale with anchors that range from 1 (not at all) to 7 (exactly). The scale was developed following the dimensions of motivation that fall under self-determination theory; such as intrinsic and extrinsic motivation concepts. The concepts are broken into subscales: intrinsic, extrinsic, identified regulation, and introjected regulation. Three questions fall under each subscale, with a Cronbach’s alpha (α) reliability of the overall scale being .89.

Next was the Teamwork/Citizenship (CIT) 9-item scale, which has five items that are reverse scored (Peterson & Seligman, 2004). This instrument is an adapted scale found within the 24 revised International Personality Item Pool - Value in Action (IPIP-VIA) (iippi.org, 2017). For this scale, participants would indicate how accurately each statement described them on a 5 point Likert-scale with anchors that ranged from 1 (very inaccurate) to 5 (very accurate). The instruments Cronbach α reliability coefficient index of this scale equals .78. The final instrument used was the Work Locus of Control (WLCS), (Spector, 1988) a 16-item scale, eight of which are reverse scored. Participants would indicate their beliefs about jobs in general on a 6 point Likert-scale, 1 (disagree very much) to 6 (agree very much). The scale is scored so that those exhibiting more external LOC received higher score. The internal consistency or coefficient α, ranges generally from .80 to .85 according to Spector’s (1988) English language version. Research conducted by Bond & Bunce (2003) indicated the test-retest reliability for a year as .57, and .60 by Moyle (1995). The WLCS has been shown to relate to a variety of work variables, including job performance and job satisfaction. Also, relatable to counterproductive behavior and organizational commitment. Permissions for all instruments were either acquired from their original authors or the instrument was found in a public domain for educational purposes.

VII. RESULTS

A total of 443 participants completed the survey, however, the researchers removed participants who did not complete the survey, or who selected unemployed or retired and were not 18 years or older. This left the researchers with 428 participants of whom were employed at least employed part-time and 18 years or older at the time of taking the survey. The sample age ranged from 19 to 70 with the average age being 38.61 and a mode of 27. There were more female (61.4%) than male (38.6%) participants. There was 51.17% that self identified as Hispanic/Latino, 37.79% were White/Non-Hispanic, 6.31% were Black/African American, and 1.17% were Asian. The sample consisted of 86.65% working full-time at over 40 hours per week and 13.35% working part-time with 68.61% being professional level employees, 9.84% were technical, 9.13% were administrative, and 7.96% were self employed. Majority of the sample had a Bachelor’s degree (40.28%), the next highest degree were those with a Master’s degree (22.25%), followed by an Associate’s degree (9.84%), and a Doctorate degree (5.38%).

The first t-test, looked at the index scores of the Work Motivation Scale for people who answered ‘Yes and No’ for perceiving discrimination at their current job. Group 1 with an N= 315 said they have not perceived being discriminated at their current job. From the participant that answered ‘No’, the average score is 51.14, the median score 51, and the mode 47. In Group 2 with N = 113 people said that they have perceived being discriminated at their current job had an average of 50.21, a median score of 50 and a mode of 49. The homogeneity of variance score for Work Motivation Scores shows a significance (p) of .630; since this is greater than the α level of .05, this suggests that there is no statistically significant difference between the variances of the two groups; the pretest criterion passed. The n for each group as shown in the descriptives table, are greater than 30; this criterion also passes. The t-test revealed there is no difference in the work motivation test scores between the group that did perceive discrimination and those that did not.

For the following t-test, it was hypothesized that there is a difference in the teamwork/citizenship test scores between participants who perceived discrimination and those that did not perceive discrimination. After passing the pre-test criteria (normality, n quota, and homogeneity of variance), the t-test statistics was administered. No significant difference in the teamwork/citizenship test scores between participants who perceived discrimination and those that did not perceive discrimination was found.

In the third t-test, it was hypothesized that there is a difference in the discrimination test scores between participants who perceived discrimination and those that did not perceive discrimination. As previously mentioned, participants were divided into two groups- those who perceived discrimination (YES); N=112, with a mean of 44.83, and standard deviation of 11.454 in their place of work and those who did not (NO); N= 315, with a mean of 39.70, and standard deviation of 11.24. The pre-test requirements were satisfied and resulted in a significant p-value of .000, showing significance between perceived discrimination and locus of control. Hence, a difference in discrimination scores between participants who perceived discrimination and those that did not perceive discrimination was found.

VIII. DISCUSSION

Two of the three t-tests administered did not result in any significance. Locus of Control was the variable that showed a significant relationship to perceived discrimination. According to Spector (1988), the U.S. norms on 5,477 people from 37 samples had means of 40.0, with a mean standard deviation of 9.9, and a mean coefficient alpha of .83. Our results showed that individuals who perceived discrimination had, on average, higher LOC scores (44.88) than those who did not perceive discrimination (39.70). This indicates a higher external LOC score for those who perceived discrimination; meaning they were more likely to see themselves as victims of circumstances beyond their control. Spector’s findings compared to our own, indicate that those with a high sense of control are less perceptible to discrimination and are more resilient to psychological distress (Jang, Chiriboga, & Small, 2008).

Additionally, the researchers discern that whether an employee perceives being discriminated against in the workplace shows no bearing on their level of Work Motivation and
Teamwork/Citizenship but, that perceived discrimination possibly has some influence over an employee’s LOC being external or internal. However, a closer look at individual questions within the MAWS and CIT scales could reveal other significant findings, showing that perceptions of discrimination may have a relationship with other constructs, apart from work motivation, locus of control, and teamwork/citizenship, that haven’t been looked at. The researchers recommend investigating deeper into these constructs, as well as others. Additionally, separating teamwork/citizenship into two separate instruments may further provide better insight in understanding the organizational citizenship behavior and teamwork relationships individually with a person’s perception of discrimination. This study can contribute to the body of knowledge on perceived discrimination by providing additional insight on its relationship with work motivation, teamwork/citizenship, and LOC.

IX. LIMITATIONS

There are several limitations in this study. First, a convenience sampling method was used due to the limit of time, funds, and other resources. This limits the generalizability of the findings that aren’t representative of the population. In other words, the sample isn’t representative of the population. It is to be noted that certain adjustments were made to some of the responses in the perceived discrimination question and the grouping of race/ethnicity categories in order to better analyze the data. For the discrimination question, some participants responded to perceived discrimination “N/A” or “not in my current job, but yes in others” instead of yes or no. In those cases, it was decided to analyze them as a No response for the purposes of doing descriptive and inferential statistics. Furthermore, the Work Locus of Control Scale (WLCS), since locus of control is a continuum from high to low, cut offs that would distinguish the Work Locus of Control Scale (WLCS), since locus of control is a continuum from high to low, cut offs that would distinguish.

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ISSN 2250-3153


722


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Assessment of Nutritional Status for Displaced Pregnant Women in Thi-Qar Governorate

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**Assist. Professor, Maternity Nursing, Health and Medical Collage Techniques, University of Al-Forat Al-Awsat - Iraq.

Abstract

**Background:** Maternal nutritional status during pregnancy has been a known factor to have significant impact on pregnancy outcomes, especially on birth weight. **The study aims:** It is to assess the nutritional status of displaced pregnant women in Thi-Qar governorate, and to find out relationship between nutritional status and other factor such as (demographical variable & reproductive variable). **Methodology:** A descriptive analytic study has been conducted on non-probability purposive sample of (100) displaced pregnant women select from primary health care centers at Thi-Qar governorate. This study has been conducted during the period of 1st April until (10)th June 2017. A questionnaire is used as a tool of data collection to fulfill the study. A content validity which is carried out through 13 panel of experts. Reliability and validity is determined by a panel of experts. A descriptive and inferential statistics are used to analyze the data. **Result:** The result of the study (32%) of the study sample are within the age group (21-25) years old. The levels of education (37%) are graduated from secondary school. (93%) of the study sample are housewives. (78%) of the study sample their residency was from urban area. (47%) of the study sample have sufficient to some extent income. (53.0%) of the study sample living in caravan and (86%) of the study sample 5 member in their household size. **Conclusion:** The majority of the study sample is from age group (21-25) years, secondary school and less, housewife's, urban, lack of eating basic meals daily, lack of eating animal food rich in iron intake. Most of the study sample is with anemia during pregnancy. **Recommendation:** the study recommended that collaborative work between the ministry of health and other sector to provide health education for women about good nutrition quality and quantity is needed.

**Index terms** - Assessment, Nutritional Status Displaced, Pregnant Women,

**Introduction**
Pregnancy is an anabolic process and therefore a woman’s nutritional requirements must raise during pregnancy so as to allow for the foetus and maternal tissue (associated with pregnancy) to develop \(^1\).

Perfect nutritional intake is necessary for the health, reproductive performance and survival of the pregnant women, which is important for the development of the fetus \(^2\).

Unfortunately, in war-torn countries, such as Iraq, where thousands of people are displaced from their homes and are forcible to seek asylum, pregnant women are possibly susceptible to numerous risks as a result of lack of adequate nutrition.

Malnutrition and growth failure result from a insufficiency of protein and energy as well as inappropriate intake of micronutrients, particularly through gestation \(^3\).

Pregnant women, essentially, require additional protein for the initial disposition of tissue and maintenance of new tissue \(^3\).

A pregnant woman’s nutritional status during and before pregnancy has numerous implication for her health as well as the future health of her children. It has been established throughout various studies that inadequate nutritional intakes before and during pregnancy may potentially effect and impact the health of the mother and child in the long term \(^4\).

**Study Objectives**

1. It is to assess the nutritional status of displaced pregnant women in Thi-Qar governorate.
2. and to find out relationship between nutritional status and other factor such as (demographical variable &reproductive variable).

**Methodology**

**Design of the study**

Cross -section study of the study is conducted to assess nutritional status of displaced pregnant women in Thi-Qar Governorate
setting of the study

The present study is conducted in Thi-gar governorate mention in table (1)

Table (1): The Distribution of study sample according to their setting

<table>
<thead>
<tr>
<th>Health Care Centers</th>
<th>Study Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 shapan health center ,</td>
<td>25</td>
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<tr>
<td>Al hawra health center</td>
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<tr>
<td>Al gadder Health Center</td>
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<tr>
<td>Al sadeq Health Center</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

sample of the study :

Non-probability purposive sample of (100) displaced pregnant women, who have selected from PHCc mentioned above The study sample select according to following criteria .

Inclusion Criteria :

A- Displaced pregnant women who attends the PHCC.
B- Women with single pregnancy

Exclusion Criteria are:

A- Displaced pregnant women chosen for the pilot study are excluded from their sample .
C- Women who have twin pregnancy or triple.

Result of Study

Table (2): Distribution of the study sample according to demographic characteristic

<table>
<thead>
<tr>
<th>Items</th>
<th>Rating</th>
<th>F.</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
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<tr>
<td></td>
<td>21-25 years</td>
<td>32</td>
<td>32.0</td>
</tr>
</tbody>
</table>

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Table (2) shows that (32.0%) of the study sample are within the age group (21-25) years, (37.0%) are graduated from secondary school graduated. (93.0%) of the study sample are housewives. (78.0%) of the study sample their residency was from urban area. (47.0%) of the study sample have sufficient to some extent in their socioeconomic status. (53.0%) of the study sample living in caravan. and (86.0%) of the study sample are above 5

<table>
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<tr>
<td>31-35 years</td>
<td>16</td>
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<tr>
<td>more than 35</td>
<td>4</td>
<td>4.0</td>
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<tr>
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<td>28.0</td>
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<tr>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Sufficient</td>
<td>9</td>
<td>9.0</td>
</tr>
<tr>
<td>sufficient to some extent</td>
<td>47</td>
<td>47.0</td>
</tr>
<tr>
<td>Insufficient</td>
<td>44</td>
<td>44.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of house</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Own house</td>
<td>6</td>
<td>6.0</td>
</tr>
<tr>
<td>Rent house</td>
<td>41</td>
<td>41.0</td>
</tr>
<tr>
<td>Caravan</td>
<td>53</td>
<td>53.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household size</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3 to 4 member</td>
<td>14</td>
<td>14.0</td>
</tr>
<tr>
<td>above 5 member</td>
<td>86</td>
<td>86.0</td>
</tr>
</tbody>
</table>
members in their household size.

Table (3) : Distribution of the study sample according to reproductive characteristic history (n=100).

<table>
<thead>
<tr>
<th>Items</th>
<th>Rating</th>
<th>F.</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at marriage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-18 years</td>
<td>52</td>
<td>52.0</td>
<td></td>
</tr>
<tr>
<td>19-24 years</td>
<td>37</td>
<td>37.0</td>
<td></td>
</tr>
<tr>
<td>25-30 years</td>
<td>10</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>31-36 years</td>
<td>1</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Gravida</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primigravida</td>
<td>51</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>2-3</td>
<td>35</td>
<td>35.0</td>
<td></td>
</tr>
<tr>
<td>4 and above</td>
<td>14</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>Para</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>51</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>30</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>19</td>
<td>19.0</td>
<td></td>
</tr>
<tr>
<td>Number of abortion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>82</td>
<td>82.0</td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>12</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>6</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Number of live children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>53</td>
<td>53.0</td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>19</td>
<td>19.0</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>28</td>
<td>28.0</td>
<td></td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>51</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>36</td>
<td>36.0</td>
<td></td>
</tr>
<tr>
<td>caesarean section</td>
<td>13</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Interval among last pregnancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primigravida</td>
<td>51</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>under 2 year</td>
<td>34</td>
<td>34.0</td>
<td></td>
</tr>
<tr>
<td>2 years &amp; above</td>
<td>15</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>Gestational age</td>
<td>14-28 weeks</td>
<td>35</td>
<td>35.0</td>
</tr>
</tbody>
</table>
Table (3) shows that (52.0%) of the study sample their age of marriage is between 13-18 years, (51.0%) of the study sample are Primigravida, (51.0%) of the sample don’t have deliveries, (82.0%) don’t have abortion, (53.0 %) don’t have alive children, (51.0%) Primigravida, (51.0%) don’t have interval because are Primigravida , (65.0%) of the study sample gestational age 29-40 weeks, (89.0%) of the study sample don’t breast feeding during the current pregnancy.

Table (4) : Distribution of the study sample according to complication during pregnancy (n=100)

<table>
<thead>
<tr>
<th>Items</th>
<th>Rating</th>
<th>F.</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complication during this pregnancy</td>
<td>PIH</td>
<td>10</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>GDM</td>
<td>10</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>Hyperemesis gravidaram</td>
<td>5</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>Anemia</td>
<td>69</td>
<td>69.0</td>
</tr>
<tr>
<td></td>
<td>Dental problem</td>
<td>6</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Table (4) shows that (69.0%) of the study sample suffers from anemia.

Discussion of the Study

Part I:Discussion of the socio demographic characteristic for displaced pregnant women. Table (2)The results of the present study show that the high percentage of the study sample is within the age group (21-25 ) years old. This result matches the result of Rashash et al 2015 (5) who found in his study that the majority of the study subjects age were between (21-25 ) years old.

In addition, the level of education, the present study indicates that the highest percentage of the study sample are secondary school graduates . This result disagrees with Nigeen et. al., 2015 (6); Al Asadi et. al., 2013 (7) in their study, they mentioned that there is high percentage of study sample are illiterate .
Regarding to occupation the most of study sample were housewife. This result came along with Qiu, et al., 2014 (8); Sadat et al., 2012 (9) in their study that the majority of study sample are housewife.

Relative to the residency, the present study shows that the majority of both groups are living in urban residential area. This result agrees with the result of Teimouri et. al., 2015 (10); they mentioned that both groups are living in urban residential area.

Inaddition to household size study sample are above 5 member in their household size, the result supported UBOS, 2006 (11) who found that the figure of 9 members in a household is much higher than that quoted for the northern region, which was estimated to be on average about five persons per household.

Concerning socioeconomic status, the highest percentage of study group is sufficient to some extent. This result agrees with Shaikh et al., 2011 (12) in their study they mentioned that the majority of study group are barely sufficient.

part II: Discussion of the reproductive characteristic for displaced pregnant women.

Table (3) In relation to the age of marriage, high percentage of study sample are between 13-18 years. This results supported by Miranda, et al. 2012 (13) in their study which indicated that the highest percentage of both groups have equal or more 15 years.

About number of gravidity, the majority of the sample in study sample have 4 and above numbers of pregnancy. This result comes along with Alijahan, et al. 2014 (14) who indicated that the highest percentage of both groups are multi gravid.

Relative to the number of parity, high percentage of the study sample are Primigravida. This result disagrees with van den Broek, et al. 2014 (15) in their study which indicated that the highest percentage of study sample are (parity 1–4).
The present study shows that the majority of study sample have not their births spaced. This result is supported by Alijahan, et al., (2014)\(^{(14)}\), in their study which indicated that the highest percentage of study sample have their births spaced.

Part-III: Discussion of the study sample according to complication during pregnancy.

Table (4) Also the present study shows that the majority of study group suffers from anemia as complication during present pregnancy which disagrees with (Alijahan, et al. 2014)\(^{(14)}\); (Al-Dabbagh and Al-Taee 2006)\(^{(16)}\) in their study they mentioned that most of study samples had no complication during present pregnancy.

References

5. Rashash Doaa ,screening iron deficiency anemia among postpartum women attending primary health care center at Al-Nasiriya city ,2015


Evaluation of Biofilm Production in *Acinetobacter baumannii* with Reference to Imipenem Resistance

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**Abstract- Background**

*Acinetobacter baumannii* has emerged as an important and problematic nosocomial pathogen. It is responsible for most of infections associated with medical devices, e.g., vascular catheters, cerebrospinal fluid shunts or Foley catheters. It causes several types of infections including pneumonia, meningitis, septicemia, and urinary tract infections. Carbapenems are the drug of choice for treatment but now resistance to these group of drugs is spreading. Mechanism of resistance may be due to production of carbapenemase enzyme or due to biofilm production.

**Aims:** The study aims to detect and examine the correlation between biofilm production and imipenem resistance among the clinical isolates of *Acinetobacter baumannii* and also to detect inhibitory effects of EDTA on biofilm production.

**Materials and Methods:**

A prospective cross-sectional study was conducted to detect imipenem resistance and biofilm production from various clinical samples. A total of 130 clinical isolates of *A. baumannii* from various clinical specimens like pus, tracheal aspirate, sputum, wound swab, urine, blood, endotracheal tip, etc. were screened for imipenem resistance by Kirby Bauer disk diffusion method and further confirmed by agar dilution method according to CLSI guidelines 2015. Biofilm production was done by microtitter plate method and biofilm inhibition was further done by microtitter plate method using ethylenediaminetetraacetic acid (EDTA).

**Results and Conclusion**

In our study imipenem resistance was 47.69% by agar dilution method and biofilm production was seen among 88 isolates out of 130 isolates. Most of imipenem resistant strains were biofilm producers. There was strong association between biofilm production and imipenem resistance (p value: 0.000005 at p<0.05).55-75% reduction of biofilm was seen by using EDTA.

**Index Terms-** biofilm, imipenem, EDTA

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**I. Introduction**

Acinetobacter are ubiquitous, Gram-negative bacteria found in wide range of sources such as soil, water, food products and medical environments (Bergogne-Berenzin&Towner, 1996). *Acinetobacter baumannii* is sophisticated nosocomial weapon to jeopardize health care settings of 21st century.[1] It occupies second position after *Pseudomonas aeruginosa* for being most common nosocomial, aerobic, non-fermentative, Gram negative bacilli pathogen.[2] Infection caused by *A. baumannii* is hard to treat since it can acquire resistance to multiple antimicrobial agents. [3] Some of the challenges in the prevention and treatment of the infections caused by this opportunistic pathogen are its remarkable widespread resistance to different antibiotics and its ability to persist in nosocomial environments and medical devices. [1]

Carbapenems are often used as a last resort for the treatment of infections due to multiresistant *Acinetobacter baumannii* isolates. However, acinetobacters may develop resistance to carbapenems through various combined mechanisms, including AmpC stable derepression, decreased permeability, altered penicillin-binding proteins (PBPs) and, rarely, efflux pump overexpression.[4]

Costerton et al. define biofilm as “a structured community of bacterial cells enclosed in a self-produced polymeric matrix adherent to an inert or living surface.”[5] Organisms producing biofilms are highly resistant to antimicrobial drugs than non-biofilm producing organisms. In some extreme cases, the concentrations of antimicrobials required to achieve bactericidal activity against adherent organisms can be three- to four-fold higher than for those bacteria which do not produce biofilm, depending on the species and drug combination.[6]

Mechanisms responsible for antimicrobial resistance in organisms producing biofilms may be delayed penetration of the antimicrobial agents through the biofilm matrix, altered growth rate of biofilm organisms, and other physiological changes due to the biofilm mode of growth.[7]

In addition, due to the emergence of multidrug-resistant (MDR) and pan-resistant strains of this species; there is rapid growth of interest in *A. baumannii*. [8-10]. Therefore, this very study was done to determine the frequency of biofilm formation by different methods and correlate biofilm formation with development of multiple antibiotic resistances among clinical isolates of *A. baumannii*. Furthermore the study also investigated about the inhibitory effects of chelating agent like EDTA on biofilm production.

**II. Materials and Methods**

The present study was conducted in department of Microbiology, SRM Medical Hospital College and Research Center, Potheri, Kattankulathur for one year and 2 months during period from Dec 2013 to April 2015. A total of 130 isolates of *A. baumannii* from various clinical specimens like pus, tracheal aspirate, sputum, wound swab, urine, blood, endotracheal tip, etc. were included in this study. During this period all isolates of genus Acinetobacter satisfying the criteria being oxidative in oxidative-fermentative test, production of acid

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from lactose 1% and 10%, growth at 31°C, 41°C and 44°C included in the study.

Test for Imipenem Resistance:

Kirby Bauer Disk diffusion method was used for testing the isolates for imipenem (10 µg) resistance along with other antibiotics. Interpretation of antimicrobial susceptibility testing by disc diffusion test was done as per Clinical Laboratory and Standard Institute (CLSI) Guidelines 2014.

Determination of MIC:

MIC determination was done only for imipenem by agar dilution method. Muller Hinton agar with following concentration of the antibiotics was prepared 1, 2, 4, 8, 16, 32, and 64µ/ml. The strains were incubated at 37°C for 4 hours in peptone water. The turbidity was adjusted to 0.5 McFarland standard and the surface of each plate inoculated with 1×10⁴/spot. Incubate at 37°C aerobically for 24hrs. Plates are examined for growth and compared with positive growth control plate without the antibiotic agent.

Interpretation: (as per CLSI guidelines)

According to CLSI standard the expected breakpoints are follows:
- Imipenem:
  - ≤4µg/l: Sensitive.
  - = 8µg/l: Intermediate.
  - ≥16µg/l: Resistance.

BIOFILM PRODUCTION (using microtiter plate method):

2-3 similar colonies of Acinetobacter baumannii was inoculated into 5 ml trpticase soy broth and was incubated overnight at 37°C.230 µl of trpticase soya broth was dispensed in flat bottomed microtiter plate wells.20 µl of trpticase soy broth (TSB) culture of test isolate was added in the wells containing 230 µl of TSB and incubated for 24 hours at 37°C. Then the plate was decanted and washed thrice with Phosphate Buffer Saline (PBS) pH 7.2. 230 µl methanol was dispensed into the wells and incubated for 20 minutes. The wells were then decanted and stained with safranin for 20 minutes. The wells were again decanted and washed with PBS. The stained cells adherent to the wells was resolubilized with 33% Glacial acetic acid. Blank, Positive control, Negative control was also included followed by the isolates which were tested in triplicate for each. The optical density (O.D) of each well was quantified at 490 nm using automated BioRad laboratory ELISA reader, India.

Interpretation

The classifications were:
- No biofilm formation: OD≤ODc;
- Weak biofilm formation: 2×ODc≥OD>ODc;
- Moderate biofilm formation: 4×ODc≥OD>2×ODc;
- Strong biofilm formation: OD>4×ODc, according to Stepanovic et al. (2004).

Inhibition of biofilm formation by EDTA

The inhibitory effect of EDTA on biofilm formation was evaluated using A. baumannii 19606 which formed the highest amount of biofilm. A 200 µl aliquot of A. baumannii suspension was inoculated into each well of a flat bottomed 96-well polystrene plate and was incubated overnight at 37°C in both with and without EDTA 125 mg/L, after which the amount of biofilm produced was measured as described above.

III. RESULTS

DISTRIBUTION OF ACINETOBACTER BAUMANNII IN VARIOUS CLINICAL SPECIMENS:

<table>
<thead>
<tr>
<th>Clinical Specimen</th>
<th>Number of Isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pus</td>
<td>41 (31.53%)</td>
</tr>
<tr>
<td>Tracheal aspirate</td>
<td>37 (28.46%)</td>
</tr>
<tr>
<td>Sputum</td>
<td>23 (17.69%)</td>
</tr>
<tr>
<td>Wound Swab</td>
<td>10 (7.69%)</td>
</tr>
<tr>
<td>Urine</td>
<td>10 (7.69%)</td>
</tr>
<tr>
<td>Blood</td>
<td>7 (5.38%)</td>
</tr>
<tr>
<td>ET tip</td>
<td>1 (0.76%)</td>
</tr>
<tr>
<td>Broncheal wash</td>
<td>1 (0.76%)</td>
</tr>
</tbody>
</table>

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CLINICAL PROFILE OF PATIENTS:

![Clinical Profile Diagram]

Determination of Imipenem resistance by Disk Diffusion method:
Out of 130 isolates of *A. baumannii* 38.46% (50) were imipenem sensitive, 3.07% (4) were intermediate and 58.46% (76) were resistant.

DETERMINATION OF MINIMUM INHIBITORY CONCENTRATION BY AGAR DILUTION METHOD:

<table>
<thead>
<tr>
<th>DRUG</th>
<th>No. of isolates Sensitive</th>
<th>No. of isolates Intermediate</th>
<th>No. of isolates Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMIPENEM</td>
<td>5</td>
<td>9</td>
<td>62 (47.69%)</td>
</tr>
</tbody>
</table>

COMPARISON BETWEEN KIRBY BAUER DISC DIFFUSION METHOD AND MINIMUM INHIBITORY CONCENTRATION BY AGAR DILUTION METHOD:

The resistance pattern of the isolates varies in Kirby Bauer disk diffusion and Minimum inhibitory concentration (MIC) by agar dilution method as follows:

<table>
<thead>
<tr>
<th>DRUG</th>
<th>DISK DIFFUSION</th>
<th>AGAR DILUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMIPENEM</td>
<td>76 (58.46%)</td>
<td>62 (47.69%)</td>
</tr>
</tbody>
</table>

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Biofilm production was tested for all 130 isolates of *A. baumannii*. Out of 130 isolates; 23 isolates were strong, 50 isolates were moderate and 27 isolates were weak and 30 isolates were non biofilm producers. Out of 62 imipenem resistant isolates by agar dilution, 20 were strong, 32 were moderate, 4 were weak biofilm producers and 6 were non biofilm producer. Out of 13 imipenem intermediate strains, 5 were moderate and 8 were weak biofilm producers. There was significant co-relation between biofilm production and imipenem resistance (p value: 0.000005) at p<0.05.

<table>
<thead>
<tr>
<th>Biofilm production</th>
<th>Imipenem sensitive (n=55)</th>
<th>Imipenem resistance (n=62)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Moderate</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>Weak</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>NON-Biofilm</td>
<td>26</td>
<td>6</td>
</tr>
</tbody>
</table>
INHIBITION OF BIOFILM FORMATION BY EDTA:
A total of 45 isolates comprising 15 each of strong, moderate and weak biofilm producers were taken for study. Biofilm production was markedly reduced (55-70%) in presence of EDTA.
All 15 strong biofilm producers became moderate biofilm producers, of 15 moderate biofilm producers, 13 became weak and 2 were moderate and all 15 weak biofilm producer became negative after addition of EDTA with significant reduction in biofilm production ranging from 55-75%.

IV. DISCUSSION

130 isolates of Acinetobacter baumannii was isolated from various clinical samples in the present study and 47.69% samples were from respiratory (Tracheal aspirate 28.46%, Sputum 17.69%, ET tip 0.76%, Bronchial wash 0.76%), followed by pus (28.46%) and wound (7.69%), urine (7.69%) and blood (5.38%) samples.
In study done by Anil Chaudhary et al. maximum 59 (57.8%) isolates were obtained from respiratory secretions followed by blood (16 (15.7%)) and pus (10 (9.8%).
In study of SM Amudhan, U Sekar, Arunagiri K, B Sekar, A. baumannii were isolated from clinical specimens such as blood (n = 25), respiratory secretions (n = 62), pus and wound swab (n = 18), cerebrospinal fluid (n = 4), body fluids (n = 3) and urine (n = 4).
Similar results were seen in study conducted by Abhisek Routray et al. maximum isolates were from pus samples (43.07%), tracheal aspirate (23.07%), sputum (15.38%) and urine (7.69%).47.69% imipenem resistance was found in our study by agar dilution in our study.
While in study done by Abhisek Routray, P. Lavanya et al. resistance to imipenem was 21.71% by agar dilution.
Among the 113 isolates, 80 (70.8%) isolates were resistant to imipenem with MICs ranging from 64 to 512 mg/ml in the study done by Drissi.
Resistance to imipenem by agar dilution was 46% in the study done by Anu Madanan Sunu Kumari et al. which is similar to our study. Nahid H Ahmed et al stated 100% resistance to imipenem in his study. The MIC values for imipenem were over 16 mg/ml for 97.4% of the isolates, Ahmed et al.
Out of 76 Imipenem Resistance isolates 15 (19.73%) were MBL producer and 66 (50.76%) in our study. However MBL production and carbapenemase production was lower 13.3% and 26.6% respectively in study done by Anu Madanan Sunu Kumari et al.
Biofilm production was tested for all 130 isolates collected in this study, of which 25 were strong, 52 were moderate and 27 were weak and 26 were non biofilm producers. Out of 62 imipenem resistant isolates by agar dilution, 23 were strong, 35 were moderate, 4 were weak biofilm producers. Out of 13 imipenem intermediate strains, 5 were moderate and 8 were weak biofilm producers in our study.
Anu Madanan Sunu Kumari et al. found that out of 65 isolates tested; 7 were strong biofilm producers, 18 were moderate biofilm producers, 20 were weak biofilm producers and 20 were non biofilm producers. Among 30 strains which were resistant to imipenem by agar dilution method 7 were strong, 13 were moderate and 10 were weak biofilm producers.
Fifty-six (63%) isolates formed biofilm in study done by J. Rodriquez-Ban et al. In the current study, 90% of strains were biofilm former (56.7% strong, 23.3% moderate, 10% weak biofilm former) in study of Nermim H. Ibrahime et al.
Overall the present study demonstrated high level of carbapenemase resistance (47.69%) among the strains of Acinetobacter baumannii. Biofilm producers showed increased level of resistance towards imipenem than the non-biofilm producers. Moreover, use of chelating agents like EDTA can be used for flushing solution of devices. Biofilm production might be associated with high rate of colonization and persistence related to high rate of device related infection.

REFERENCES
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Response of Wheat to Salicylic Acid

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2Bangladesh Agricultural Research council, Dhaka, Bangladesh

Abstract-Pot experiment was conducted to examine the effect of different levels of salicylic acid (SA) to wheat during November 2015 to March 2016. In this experiment three different levels of SA were used. The different levels of SA were; S0 = 0 mM, S1= 0.2 mM and S2 = 0.4 mM. The experimental results showed that different levels of SA showed significant influence on morphological, yield contributing character and yield of wheat. The foliar application of SA in higher doses at S2 = 0.4 mM increased plant height (63.60 cm), leaf number (10.94), tillers number (2.71), effective tiller numbers plant-1 (2.22), Membrane Stability (71.53%), spike length (10.45cm), number of spikelet spike-1 (18.10), number of effective spikelet spike-1 (14.63), number of grains spike-1 (35.78), grain yield plant-1 (1.9 g) and 100 grain weight (4.20 g) compared to S0 = 0 mM and S1= 0.2 mM doses of SA. Therefore, it is suggesting that higher doses of SA increased yield of wheat by improving morphological and yield contributing character.

Index terms-Wheat; Salicylic acid; Yield

1. Introduction

Agriculture is the source of food and one of the largest sectors of economy all over the world. Wheat (Triticum aestivium L.) is one of the most important cereal crops under Poaceae family grown throughout the world including Bangladesh. It is one of the most important winter crop which is sensitive to temperature. It was reported in 2016 that the world production of wheat was 749 million tons, making it the second most-produced cereal after maize (1.03 billion tons) (FAO, 2016; FAOSTAT, 2016). In Bangladesh, average yield and total production of wheat has been estimated 3.086 m t/ha & 13,47,926 metric tons, respectively (BBS 2015). It is being a staple food of millions of people which contains large amount carbohydrates and protein. In Bangladesh wheat production rate is very low due to lack of using plant growth regulators (PGRs) like Salicylic acid, Jasmonic acid, amino acid, sugar, nutrient supply etc. It is well known that, Salicylic acid (SA) is an endogenous plant growth regulator which participates the regulation of physiological process of plants as well as defense mechanism. SA is a well-known naturally occurring signaling molecule that affects various physiological and biochemical activities of plants. SA is phenolic compound involved in the regulation of growth and development of plants, and their responses to biotic and abiotic stress factors (Raskin, 1992; Khan et al., 2012a,b,c 2013b; Muira and Tada, 2014). The exogenous application of SA enhanced the photosynthetic rate and also maintain the stability of membranes thereby improved the growth of barley plants (El-Tayeb, 2005). SA lowered the level of active oxygen species and therefore the activities of SOD and peroxidase (POX) were also lowered in the roots of young wheat seedlings (Shakirova et al., 2003). Therefore, this experiment was conducted to examine the influence of different levels of SA on morphological, yield contributing character and yield of wheat.

2. Method and Materials

This was a pot experiment conducted in the net house at the field laboratory of Agricultural Botany Department, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka. The location of the site is 23°74´N latitude and 90°35´E longitude with an elevation of 8.2 meter from sea level under the agro-ecological zone of Modhupur tract, AEZ-28 during November 2015 to March 2016 to examine the influence of different levels of SA on morphological, yield contributing character and yield of wheat variety BARI Gom 24 is known as variety, Prodip. The experiment was laid out in single factors in Completely Randomized Design (CRD) with five replications. Treatments of the experiment were S0 = 0 mM SA (Control), S1 = 0.2 mM SA and S2 = 0.4 mM SA. The total pot number was 3×5=15. Each earthen pot was 35 cm in diameter and 30 cm in height. The soil was put into the pot which contains 10 kg soil per pot. All pots were filled on 30 November 2015. Weeds and stubbles were completely removed from the soil. Salicylic acid (SA) was sprayed exogenously at 0, 0.2 mM and 0.4 mM concentrations which were maintained by adding 0, 0.03 g and 0.06 g SA respectively per liter of water and 0.1% of Tween-20 was used as an adhesive material. At 35, 45 and 55 day after sowing (DAS) the SA solution was sprayed by a hand sprayer at 10.00-12.00 am. After the germination of seeds, various intercultural operations such as irrigation, weeding, top dressing of fertilizer and plant protection measures were accomplished for better growth and development of the wheat seedlings.
3. Result and Discussion

Plant height (cm)

It is well known that, salicylic acid (SA) is an endogenous plant growth regulator which participates the regulation of physiological process of plants as well as defense mechanism. Numerous author stated that SA treatment enhances the plant growth in terms of root, shoot, length and biomass production. Growth stimulating effects of SA has been previously reported in soybean (Gutierrez-coronado et al., 1998), wheat (Shakirova et al., 2003). However little is known about the influence of SA to change the morphological characters of wheat including plant height in our climatic and edaphic condition. Therefore, I used different concentrations of SA to find the contribution of SA on change in plant height of wheat. The experiment results showed a significant effect on plant height of wheat with SA at 60 DAS (Table 1). The tallest plant height was recorded 63.6 cm from S₂ or 0.4 mM SA whereas the smallest plant height 61.55 cm from S₀ or control. The increase of plant height of wheat dependents on different concentrations: higher concentration showed better results than lower concentration. Kang et al., 2012 reported that, SA increase plant height, dry mass and less wilting of leaves in wheat plant. The positive effect of foliar application of SA on the growth parameters and water status have also been reported under stress conditions (Khodary, 2004; Hussein et al., 2007 ;). All together these results suggest that SA increased plant height of wheat as other growth promoting substances.

Number of leaves per plant

The leaf number is a fundamental morphological character for plant growth and development as leaf is the main photosynthetic organ. SA is a well-known naturally occurring signaling molecule that affects various physiological and biochemical activities of plants. Salicylic acid is a plant growth regulator that plays a significant role in abiotic stress. Usage of Salicylic acid had showed significant variation on the number of leaves per plant of wheat at 60 DAS (table 1). The highest number of leaves per plant was recorded 10.94 from S₂ or 0.4 mM SA and lowest number of leaves per plant was recorded 9.6 from S₀ or control. The increase of leaves number of wheat dependents on different concentrations: higher concentration showed better results than lower concentration. Farahbakhsh and Saiid (2011) who reported that high concentration of SA (200 ppm) caused an increase of 74.94% in leaf area and number of leaf. Zhou et al. (1999) also indicate that SA increases the leaf number in sugarcane plants. From these results it was found that SA increased leaves per plant of wheat.

Number of Tiller per plant

It is well known that, Salicylic acid (SA), a group of phenol compounds, is an endogenous growth regulator. SA and other salicylates are known to affect various physiological and biochemical activities of plants and may play a key role in regulating their growth and productivity (Hayat et al., 2010). In present study, Usage of Salicylic acid had showed significant variation on the number of tillers per plant of wheat at 60 DAS (Table 1). The highest number of tillers per plant was recorded 2.71 from S₂ or 0.4 mM SA and lowest number of tillers per plant was recorded 2.24 from S₀ or control. Similarly Shakirova et al. (2003) found that the positive effect of SA on number of tillers plant⁻¹ of wheat can be increased due to its influence on the other plant hormones. Azimi et al. (2013) also reported that SA had significant effects on number of tiller per m² and maximum tiller was observed at 1.5mM across SA treatments. So, these results suggest that SA increases tiller per plant of wheat as other growth promoting substances.

Number of Effective Tiller plant⁻¹

Variation of the number of effective tiller plant⁻¹ of wheat at 60 DAS had been influenced significantly by the Application of SA (Table 1). The highest number of effective tillers per plant was recorded 2.22 from S₂ or 0.4 mM SA and lowest number of effective tillers per plant was recorded 1.86 from S₀ or control. Azimi et al. (2013) reported that SA had significantly effects on number of tiller per m² and maximum tiller was observed at 1.5mM across SA treatments. So, these results suggest that SA increases effective tiller per plant of wheat which consistent with many other previous findings.

Table:1. Data on plant height, leaf number, tiller number and effective tiller number of wheat at 60 DAS as influenced by different levels of salicylic acid

<table>
<thead>
<tr>
<th>Salicylic acid level</th>
<th>Plant height</th>
<th>Leaf No.</th>
<th>Tiller No.</th>
<th>Effective tiller No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₀</td>
<td>61.55c</td>
<td>9.60b</td>
<td>2.24c</td>
<td>1.86b</td>
</tr>
<tr>
<td>S₁</td>
<td>62.91b</td>
<td>10.68a</td>
<td>2.45b</td>
<td>2.01b</td>
</tr>
<tr>
<td>S₂</td>
<td>63.60a</td>
<td>10.94a</td>
<td>2.71a</td>
<td>2.22a</td>
</tr>
<tr>
<td>Lsd(0.01)</td>
<td>0.07</td>
<td>0.45</td>
<td>0.35</td>
<td>0.23</td>
</tr>
<tr>
<td>Cv%</td>
<td>7.11</td>
<td>4.51</td>
<td>8.50</td>
<td>9.58</td>
</tr>
</tbody>
</table>

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Spike Length (cm)

Spike Length was significantly influenced by the Application of Salicylic Acid (Table 1). The highest Spike Length was recorded 10.45 cm from S2 or 0.4 mM SA and lowest Spike Length was recorded 9.72 cm from S0 or control. SA and other salicylates are known to affect various physiological and biochemical activities of plants and may play a key role in regulating their growth and productivity (Hayat et al., 2010). So, it was clear that with application of SA correspondingly increase Spike Length.

Number of Spikelet per spike

Number of Spikelet per spike had been influenced significantly by the Application of Salicylic Acid (Table 2). The highest Number of Spikelet spike\(^{-1}\) was recorded 18.10 from S2 or 0.4 mM SA and lowest Number of Spikelet spike\(^{-1}\) was recorded 15.98 from S0 or control. The Number of Spikelet spike\(^{-1}\) significantly increased with the increase of Salicylic Acid. Aldesuquy et al. (2012) stated that mechanism of SA induced yield enhancement might be an increase in the number of spikelets because SA has the capacity to both directly or indirectly regulate yield. These results are in a good agreement with those obtained by Khan et al. (2003) with maize and soybean. From the study of results it was found that higher concentration of SA increases Number of Spikelet spike\(^{-1}\) than lower concentration in wheat.

Number of Effective Spikelet per spike

Number of Effective Spikelet per spike\(^{-1}\) had been influenced significantly by the Application of Salicylic Acid (Table 2). The highest Number of Effective Spikelet per spike\(^{-1}\) was recorded 14.63 from S2 or 0.4 mM SA and lowest Number of Effective Spikelet per spike\(^{-1}\) was recorded 12.90 from S0 or control. The Number of Effective Spikelet per spike\(^{-1}\) significantly increased with the increase of Salicylic Acid. Aldesuquy et al. (2012) stated that mechanism of SA induced yield enhancement might be an increase in the number of spikelets because SA has the capacity to both directly or indirectly regulate yield.

Number of Grain spike\(^{-1}\)

Number of Grain spike\(^{-1}\) had been influenced significantly by the Application of Salicylic Acid (Table 2). The highest Number of Grain spike\(^{-1}\) was recorded 35.78 from S2 or 0.4 mM SA and lowest Number of Grain spike\(^{-1}\) was recorded 30.57 from S0 or control. Abdelkader et al., (2012) stated that SA promotes crop production and counteracts the yield components inhibition caused by abiotic stresses, including drought stress in wheat plants. So it can easily understand that the Number of Grain per spike significantly increased with the increasing level of Salicylic Acid.

Grain Yield Plant\(^{-1}\) (gm)

Grain Yield per Plant had been influenced significantly by the Application of Salicylic Acid (Figure 1). The highest amount of Grain Yield per Plant was recorded 1.9 gm from S2 or 0.4 mM SA and lowest amount of Grain Yield plant\(^{-1}\) was recorded 1.57 gm from S0 or control. Zhou et al. (1999) reported that maize stem injected with SA produced 9% more grain weight. These results are consistent with the present morphological and yield contributing characters such as plant height, number of leaves Plant\(^{-1}\), tillers Plant\(^{-1}\), effective tillers Plant\(^{-1}\), number of spikelet spike\(^{-1}\), number of effective spikelet spike\(^{-1}\) and number of grains spike\(^{-1}\). From this experiment it was found that the Grain yield plant\(^{-1}\) of wheat increase is concentration dependent, higher concentration showed better results than lower concentration.

100 Grain Weight (gm)

It is well known that, Salicylic acid (SA) is an endogenous growth regulator which participates the regulation of physiological process of plants as well as defense mechanism and growth. However little is known about the influence of SA to increase the 100 Grain Weight of wheat in our climatic and edaphic condition. Therefore I used different concentrations of SA to find the contribution of SA on change in 100 Grain Weight of wheat. 100 Grain Weight had been influenced significantly by the Application of Salicylic Acid.
The highest amount of 100 Grain Weight was recorded 4.20 gm from S2 or 0.4 mM SA and lowest amount of 100 Grain Weight was recorded 3.37 gm from S0 or control. The amount of 100 Grain Weight was significantly increased with the increase of Salicylic Acid. Some studies have indicated that salicylic acid can enhance the plant growth, yield and quality (Khodary, 2004). El-Tayeb (2005) reported that SA pretreatment increased grain weight in the barley seedlings. These results are consistent with the present morphological and yield contributing characters such as plant height, number of leaves Plant\(^{-1}\), tillers Plant\(^{-1}\), effective tillers Plant\(^{-1}\), number of spikelet spike\(^{-1}\), number of effective spikelet spike\(^{-1}\) and number of grains spike\(^{-1}\) (Table 1 and 2). These results suggest that higher doses of SA increased 100 Grain Weight of wheat than lower doses.

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The Menace of Open Defecation and Diseases in The Nadowli-Kaleo District, Ghana.

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Abstract: A good sanitation practice is very imperative in human lives. Hence, defecating openly is a bane to human health killing children under five years in every 15 seconds. Efforts made by philanthropists to ameliorate this cancer proved futile while there are still one billion people defecating openly globally despite the pragmatic strides. In Ghana, for instance, US$290 million is spent on open defecation yearly when the government needs US$79 million to combat the menace. Discouragingly, Ghana improves its sanitation by 1% yearly and the Upper West Region is ranked second in open defecation with 78.7%. In the Nadowli-Kaleo district, people are seen defecating into gutters, toilet premises and yet much has not been done. The study investigates factors influencing open defecation in the Nadowli-Kaleo district. The study employed case study design where purposive sampling technique was used to select the communities and respondents. Primary and secondary data were used where Interview guides were utilised and analysed qualitatively. The study revealed among others that inadequate toilet facilities, filth, and attitude are the main causes of open defecation. Socio-cultural, economic, health factors influenced people to resort to defecate openly. This pelted residents with diarrhoea, typhoid, dysentery and snake bites. The study concluded that open defecation constituted a real danger to people’s health. It was recommended that the government should support communities with some incentives to empower members to build their own toilet facilities. Environmental sanitation officers should endeavour to ensure proper supervision for toilets to be emptied to eschew unpleasant scent.

Keywords: Menace, Defecation, Diseases, Sanitation, Health

Introduction

Access to improved latrines at home and in public places is a crucial defence against faecal-oral transmission of pathogenic agents to humans and the environment (Mara et al, 2010; Kvarnstrom et al, 2011). This however has been always the opposite, because people around the world, especially in the developing countries cover great distance to access toilet facilities (Arku, 2010). This problem has been noted by the United Nations for which they have endeavoured to make sanitation facilities accessible to 1.8 billion people between 1990 and 2010 (Connor, 2015). Yet, the problem persists. In consequence, there are still 1.1 billion people who have no access to any form of toilet facility which compels them to defecate openly, thereby posing serious sanitation threats to human lives (Feris, 2015). According to Annex (2014), open defecation threatens people’s lives with cholera, hepatitis A, diarrhoea, dysentery and other sanitation related diseases, increasing mortality rate of people particularly children globally for which Sub-Saharan Africa is not an exception. Water Aid report (2014) revealed that out of the 1.1 billion people around the world practicing open defecation, 227 million are in Sub-Saharan Africa with many living in rural areas.

In Ghana, for instance, the country is only able to improve its sanitation by 1% every year (Water Aid, 2012). The early assertion by Bartram and Cairncross (2010) espouse that household latrines in Ghana are inadequate and few public toilets are over utilized and poorly managed. The author further noted that the cost of accessing toilet facilities in Ghana has been a major challenge especially among the poor. Mazeau et al (2014) corroborate that the average cost of public toilet per entry often varies from 10 pesewas (US$ 0.04) (for a “public managed” toilet) to 25 or 30 pesewas (US$ 0.12) (for a “private managed” toilet). Osumanu and Kosoe (2014) opine that there is a high prevalence of open defecation in all the ten (10) regions of Ghana as a result of lack of access to toilet facilities. The Upper West Region for instance, ranks second in open defecation with a percentage of 78.7 (Water and Sanitation Sector Monitoring Platform, 2013). In the Nadowli-Kaleo District, open defecation is unacceptably high. Though the local government has endeavoured to migrating the district on to the CLTS programme as part of WASH programme which aims at shaming communities from open defecation, the practice is in the ascendancy. People, especially children are seen squatting around the premises of public toilets and bushes defecating openly (Dangah, 2012). Therefore, it is not surprising that, only 12.5% of the population have access to toilet facilities at home, 9.9 % use public toilet facilities whiles 77.6 % of the household have no toilet facility and resort to the bush and fields as a toilet facility (GSS, 2013). This indicates that open defecation is at its peak posing serious sanitation threats to the inhabitants (GSS, 2014). A report by GSS (2015) reiterated that diarrhoea, one of the diseases caused by open defecation ranks third in the Nadowli-Kaleo District. It is against this drawback that
the study sought to investigate the state of open defecation, factors influencing open defecation practices and implications of open defecation. This paper is subsumed into four sections which includes introduction, methods findings and discussion.

Methodology

The study was conducted in the Nadowli-Kaleo District of the Upper West Region of Ghana. According to the GSS report (2014), Nadowli-Kaleo District is centrally located in the Upper West Region of Ghana. The district is bordered to the South by Wa Municipal, West by Burkina Faso, North by Jirapa and Lambussie-Karni Districts and to the East by the Daffiama-Bussie-Issa District. A case study design was employed to collect in-depth information from the respondents as asserted by Yin (2015). This helped to solicit deeper information of the topic under investigation. This confirms Yin (2015) allusion that, case study design offers an in-depth study of a particular situation and narrows down to a very broad field of research into one easily researchable topic. This design was imperative because it allowed the use of a qualitative approach which permits the utilisation of non-probability sampling and unstructured interview guide to target appropriate respondents. The study targeted 52 household’s heads, 2 Environmental sanitation officers and a healthcare Officer. This was adequate to attain the standards of thematic saturation in qualitative research as stressed by Creswell (2014). A purposive sampling was used to select two communities within Kaleo and the respondents. This was done via purposive criteria (Yin, 2003). Primary and secondary data were sourced. The data were analysed qualitatively via constant comparative analysis where concepts and ideas from the interviews were coded and categorized into like and unlike themes.

Findings and Discussion

This section presents the findings of the study, which borders on the state of open defecation, the factors influencing open defecation practices and the implications of open defecation.

The state of open defecation in the selected communities

Table 1: households’ toilets in the communities

<table>
<thead>
<tr>
<th>Number of households with or without toilet facility</th>
<th>Number of households’ toilets in the selected communities</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number households with toilet facility</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>The number of household heads with toilet under construction</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>The number of household heads whose toilet has been destroyed by the rain</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>The number of household heads without toilet facility</td>
<td>33</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>52</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: field work, 2016

From table 1, majority (63%) of the respondents have no toilet facility at home, some of the respondents have had their toilet facilities destroyed by a heavy rain, only 15% have an effective toilet facility in use and 10% have their toilet under construction. Therefore, this is a clear indication that majority (85%) of the respondents have no access to toilet facilities and resorted to using the forest as a toilet facility since the communities have a public toilet. This confirms Ghana Statistical Service Report (2014) that majority (77.9%) of the households do not have access to toilet facilities and this impels them to resort to open defecation in the communities thereby fouling the environment. In addition, respondents were interviewed to solicit information about the actual causes of open defecation. Figure 1 details their responses.
Figure 1 indicates that majority (50%) of the respondents attributed open defecation to inadequate toilet facilities within the various houses and in the community at large as indicated in this study earlier. Additionally, 25% of the respondents explained that filth at the toilet facilities, especially the public toilet motivate them to defecate openly. In subsequence, 18% of the respondents disclosed that attitudes and distance are the reasons for which they defecate in the bush or field. The study revealed that children and other relatives who use the household toilets and public toilets defecate on the floor of the toilet instead of defecating directly into the toilet holes which makes the toilet unhygienic. An elderly woman expressed the view that:

“It is not advisable using the toilet facility at all, the toilet is too dirty and children defecate all over. There are always heaps of faeces on the floor; you cannot get a place to even stand to defecate, so it is important using the tick forest behind the toilet”

(field interview, 2016).

This statement indicates that respondents wished to use the toilet facility, especially the public toilet, but defecating haphazardly at the toilet facilities makes it unattractive for users. This makes the place very dirty and smelly for which users prefer to resort to the bush to the use of the toilet facilities. This refutes United Nations Report (2013) that majority of the people prefers using the bush as their toilet facility to the using of public toilet because of their attitudes. Per the views stipulated in figure 1, respondents were of the view that inadequate toilet facility and filth, especially in the public toilets are the main causes of open defecation as espoused by Mazeau et al (2014). Furthermore, 13% of the respondents disclosed that open defecation is at its peak due to peoples’ attitude of refusing to use toilet facilities either at home or the public. The assemblyman expressed the view that even though, toilet facilities are inadequate the people would fail to use the toilet when new ones are built since they have acclimatised themselves with the free range (open defecation). In addition, few respondents were of the view that, the distance from their houses to the toilet is very far. An elderly in one of the communities remarked that:

“This community has no toilet facility and the nearby community has a toilet, but looking at the distance from my house to the toilet is very far. If want to use the public toilet I might ease on myself. Hence, using my backyard farm or any nearby bush is more convenient than visiting the toilet” (field interview, 2016).

The narration shows that distance makes it difficult for people, especially children, the sick and the aged to utilise the facility which impels them to resort to open defecation thereby escalating the state of sanitation.
Plate 1: community toilet
Plate 2: Public toilet surroundings
Plate 3: Inside the public toilet
Plate 4: Household toilet
Plate 5: Open defecation site

Source: Fieldwork, 2016

Plate 1 and 2 indicate the state of the public toilet and its environs whiles plate 3 shows the inside of the toilet. Plate 4 shows a household latrine in the community. The surroundings of the public toilet in plate 2 lies a refuse dump where community members use as a toilet facility instead of the constructed building. According to the respondents, the public toilet rooms are only four which triggered long queues and hence resort to defecating openly. Plate 5 indicates the open defecation area of the communities. It was observed that the open defecation site is also just behind the toilet facility in the community. The public toilet is flanked with refuse dump and forest as depicted in plate 2 and 5. This influenced them to openly defecate than using the toilet. This indicates that the nature of the toilet precludes people from using the public toilet. It was observed that even though, the CLTS programme is aimed at shaming members from open defecation and encouraging households to build their own toilet facilities, many households have no toilet at home. This influence them to use the forest, backyard farms and refuse dumps as toilet facilities.

Factors influencing open defecation

Socio-cultural factors influencing open defecation

Majority of the respondents, especially the household heads believed that using the filthy, heat and smelly toilet facility is an abomination which demean their dignity. They expressed the view that the bad odour emanating from the toilet leaves a bad scent on their entire body which makes it difficult to mingle with other individuals. One of the respondents stated that:
‘I was at a gathering one day and I had nature’s call to attend to, when I returned to the gathering, people were asking about where I was coming from, some even asked me whether I threw myself into the faeces in the toilet when there is free range as an alternative. I was disrespected at the gathering and got very embarrassed; I decided not to use the toilet again’ (field interview, 2016).

The expression of the respondent indicates that, the toilet facility, especially the public toilet is very smelly and filthy which disgrace them by leaving a bad odour on their bodies when they visit it and that prevent them from using the toilet thereby resorting to openly defecate. The study revealed that it is culturally impermissible for squatting on someone’s faeces. To the respondents, one can incur curses on themselves when squatting on someone’s faeces, because, one may not know the person on whose faeces one squats and this gives bad luck. According to the respondents, when a person’s faeces fall on top of the other, that person would be unsuccessful in life. In addition, the respondents believed that visiting the toilet, especially the public at night endanger one’s life because, evil spirits such as the witches and wizards hide in the toilet, especially the public toilet to harm humans. Laying emphasis on this, a female respondent confirmed that:

‘I had a diarrhoea at one night and I hurriedly ran to this public toilet and I saw something very tall like human heading towards my direction from the toilet. Since that day I have vowed not to visit the toilet again, I prefer the bush to the using of the public toilet’ (field interview, 2016).

Taking this statement into cognizance, the fellow believed that, it is a witch or wizard that pursued her that night. The study further revealed that respondents believed visiting the toilet, particularly the public in the night endangers one’s life, because the sound of the frogs, fireflies and other animals believed to be witchcraft. They believe some spirits disguised themselves into such forms of animals to threatening humans. The respondents’ believed that some evil spirits turned themselves into these animals to enable them feed on the faeces. The respondents further asserted that it is not culturally right to share the same toilet facility with your in-laws. The respondents continued that sharing the same toilet facility with a rival jeopardises ones life, especially at home. The explanation by the respondents indicate that the cultural belief of the people influence their behaviour to defecate in the open. This is in consonance with the findings of O’Connell (2014) and Water Aid Report (2014) that, some socio-cultural factors influenced people to resort to open defecation.

**Economic influence of open defecation**

Understanding why community members are not using household toilets brought about many fantastic responses. The study disclosed that respondents wished to construct latrines destroyed by heavy rains but they are financially handicapped, which impels them to resort to open defecation. They were of the view that, lack of money to construct their own household’s toilet compels them to defecate in the bush and into polythene bags for which they later throw them into the bush or the field. Respondents using KVIP or the pit latrine that requires dislodgment disclosed that, they find it difficult in getting the cesspit emptier trucks to empty their toilets due to financial constraints and this impels them to abandon their household toilet facilities thereby resorting to the forest and refuse dumps.

**Agricultural influence of open defecation.**

Majority of the respondents indicated that defecating in the backyard farm fertilizes their farm products to yield in bountiful. This confirms a statement by a respondent that:

‘My children and I use the backyard farm as a toilet facility to serve as fertilizer for good yields of my crops’. Now look at the corn grown at the farm, it has yielded bountifully for which these Chinese fertilizers cannot fertilize the land this way; therefore, it is better not to waste this fertilizer on the toilet facility’ (field interview, 2016).

The statement of the respondents indicates that, defecating in the backyard farm helps to boost their crop yields which is even better than the imported compound fertilizers. Hence, there is no need to waste this fertilizer and purchase an exorbitant fertilizer from the market which is unaffordable. Additionally, majority of the respondents expressed the view that defecating in the bush helps the farmers’ crops to yield plenteously and for that matter, it is better to always defecate in the forest to fertilize the land. Respondents disclosed that defecating in the bush is another way of feeding the hungry livestock such as pigs and domestic birds. A young man stated this:

‘...faeces help the pig farmers reduce the cost of feeding on the pigs because when we are defecating in the forest, you will see these animals standing behind us and making funny noises, waiting for us to finish quickly for them to devour the faeces; to me, the fattest pigs in this community are as a result of the faeces they feed on’ (field interview, 2016).

Per this statement, the respondent was of the view that, defecating in the bush and the field is another way of helping pig farmers to feed their hungry pigs and thereby cutting down the cost of feeding the animals.

**Health factor influencing the open defecation**

Majority of the respondents explained that, the maggots at the toilet facilities, the bad odour and the heaped faeces cause them to feel nausea upon seeing things of such nature. They were emphatic that the filthy toilets cause them body itching. With this, they defecate in the forest and in the backyard farm to avoid these scenes. Others were of the view that, the bad odour and the heat that emanate from the toilet holes are unhealthy. To them, inhaling the unpleasant air, causes people, especially the asthmatic person
to suffer at the toilet. The respondents alluded that it is imperative to visit open defecation areas to eschew these unacceptable scenes. A traditional female elder expressed the view that:

‘I don’t use the toilet, because there is much heat emanating from the beneath of the toilet and this heat makes me contract candidiasis. So I prefer resorting to open defecation to the using of public toilet for which I have to seek for treatment after its use’ (field interview, 2016).

The narration above indicates that the female respondent resorted to defecate in the open for the fear of contracting candidiasis.

Implications of Open Defecation on the people in the Community

Health Implications

Majority of the respondents explained that they often experience diarrhoea as the most common disease in the communities for which it mostly affects their children. The respondents emphasised that their children experienced headaches, frequent urination including urine colour changes, and feeling nausea which makes them drink too much water. The healthcare officer also corroborated the statement of the respondents by expounding that, children mostly contract diarrhoea since they always play and crawl on the ground soiled with faeces and walk barefoot on farm infected lands. The officer reiterated that diarrhoea is among the common cases of diseases in the communities in the district. This affirms Ghana Statistical Service Report (2013) that, diarrhoea is the third most common diseases in the communities due to the continuous practice of open defecation. The study discovered that typhoid and dysentery are among the diseases troubling them in the community which affects the health wellbeing of the people. In addition, female respondents added that at times they ended up exposing their private parts to the male defecator which jeopardises their lives. A female respondent stated this:

‘My young daughter was nearly raped by some miscreants’ boys in the bush upon seeing the private part of my daughter’ (field interview, 2016).

Additionally, the respondents explained that they are always confronted with some wild reptiles such as snakes which at times bite them. Majority of the respondents disclosed that defecation in the bush sprinkles faeces on their bodies especially in the rainy season which causes body itching. Laying emphasis on this, a male respondent stated that:

‘I went to the field to ease myself and I saw maggot infested diarrhoea faeces being eaten by a fowl, my whole body itched until I visited the hospital for treatment, but I have no other option than to go to the bush since I have no toilet in my house and the public one is not a conducive place to go’ (field interview, 2016).

Implications on the community

The environmental sanitation officer disclosed that the selected communities are among the communities noted to be open defecation areas, this does not auger well for these communities. It was observed that, there are many flies in the community, especially in the morning. When one is going to the open defecation sites, there will be a myriad of flies following the person. Again, the members complain of many mosquitoes for which the environmental sanitation officer disclosed that since some members of the communities have reserved certain areas as defecation areas, they hardly weed the place for which those bushy areas breed mosquitoes to the detriment of their health.

Conclusion and Policy Implications

Good sanitation as essential commodity which brings good health is of low quality in developing countries like Ghana. Consequently, people in these countries have to ease themselves when the need arises which has escalated the sanitation situations causing harm to many individuals. It is therefore not surprising that in 2014 Ghana, Nigeria and other developing countries in Africa recorded the highest cholera and diarrhoea cases in the region, which claimed many lives, particularly children, for which it has been reported that, diarrhoea kills children under five in every 15 seconds and degrading the environment in the region. Therefore, it is very imperative for community health and environmental sanitation officers to ensure good supervision on both household and public toilets for cleanliness. The study revealed among others that open defecation in the communities is as a result of inadequate toilet facilities, both public and household toilets, filth and attitude in the communities. The causes of this canker is attributed to socio-cultural, economic, agricultural and health factors. These factors have bred diseases such as diarrhoea, typhoid, dysentery and reptile bites which at times casualty is recorded. Poverty was identified as one of the variables coercing community members to defecate openly, because those who cannot afford using the public toilet would have wished to construct their own toilet facilities but they are financially handicapped and this propels them to resort to open defecation. Therefore, it is important for the government and other philanthropists to come to the aid of the people in the communities by giving them some incentives to empower them and to enable them improve on their agricultural products in order to earn money for other developmental projects. When this is done, members would be able to get money to dislodge faeces from toilet facilities rather than abandoning them to resort to the bush. Environmental sanitation officers should endeavour to ensure proper supervision for toilets to be emptied.

Reference


Smart Highway

Nagen Kumar Sahoo

Abstract: Heavy transport is the last transport sector remains dependency over fossil fuel which makes it a leading source greenhouse emission. Due to the expected growth in demand for transport the estimate that global emission from road freight transport will grow from 1.36 to 2.4 co2 by 2050. Now world want electric vehicle to reduce pollution. So have to develop and design new technologies regarding transportation system. In this smart highway project we designed for heavy vehicle transportation system. Heavy vehicle move safely without imbalance of electric overhead lines. In this project we use special light weight design steel rail wheel as front wheel which will move on track rail and back rubber tube wheel as back wheel and electric overhead lines as energy source.

Introduction:-
In this project we use electric overhead line for electric heavy vehicle and steel rail wheel as front wheel and Rubber tube wheel as back wheel. The back wheel connect with ac motor. So a special road with track rail and overhead line and special light weight design steel rail wheel also required. The front steel wheel move on track rail and back rubber wheel move on road.

Construction and Design:--we will make a special road with overhead line electric supply, special light weight design rail wheel, parking charging system with overhead line. This design for heavy vehicle transportation. We will use steel rail wheel as front wheel and rubber tube wheel as back wheel. During move on track rail we use steel wheel as front wheel. Otherwise use rubber tube wheel as front wheel when move on plain road. During the use of front tube wheel we do not use overhead line for electricity. We use battery as energy sources. Back rubber tube wheel connected with 3 phase ac motor. Front wheels are not connected with electric supply.

Fig1: Highway with electric overheadline and electric charging parking of electric overheadline

Fig2:- During front rail wheel up and front tube wheel down position

Fig3:- During front rail wheel down and front tube wheel up position

Fig4:- During front rail on track rail

Fig5:- Different parts of vehicle

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Steps during movement on track rail
1) first the front steel wheel down on track rail and front rubber tube wheel will up.
2) Then vehicle connect with overhead lines.
3) Then starts moving.

Steps during movement on plane road
1) steel wheel will up and front tube wheel will down
2) vehicle disconnect with overhead lines
3) Use battery as energy sources.

Front wheels aren't perfect cylinders. They're beveled to make them wider on the inside. This means that when the steel rail wheel shifts left or right on the track, the diameter of the wheels can change. But because the wheels are connected by an axle, they still spin at the same rate. Effectively, this means that the wheels will travel different distances per revolution.

The wheel bevels are specifically designed so that when the steel front rail wheel goes around a corner it stays on the tracks. The wheels that have to travel a greater distance have a greater diameter, and everything stays aligned. The end result is a rail wheel stays on the tracks.

Some Parts Of Electric Heavy Vehicle:-

Battery
Heavy vehicle are provided with a battery to provide start up current and for supplying essential circuits, such as emergency lighting, when the line supply fails. The battery is usually connected across the DC control supply circuit.

Converter
Generic term for any solid state electronic system for converting alternating current to direct current or vice versa. Where an AC supply has to be converted to DC it is called a rectifier and where DC is converted to AC it is called an inverter.

Cooling Fans
To keep the electronic power systems cool, the electric vehicle equipped with an air management system, electronically controlled to keep all systems operating at the correct temperature. The fans are powered by an auxiliary inverter producing 3-phase AC at about 400 volts.

Thyristor
A type of diode with a controlling gate which allows current to pass through it when the gate is energized. The gate is closed by the current being applied to the thyristor in the reverse direction. Thyristors (also referred to as choppers) are used for traction power control in place of resistance control systems. A GTO (Gate Turn Off) thyristor is a development in which current is turned off by applying a pulse of current to the gate.

DC Link
Used on modern electronic power systems between the single phase rectifier and the 3-phase inverter. It is easier to convert the single phase AC from the overhead line to the 3-phase required for the motors by rectifying it to DC and then inverting the DC to 3-phase AC.

Rectifier
A converter consisting of thyristors and diodes which is used to convert AC to DC. A modern locomotive will usually have at least two, a "Main Rectifier" for the power circuits and one or more for the auxiliary circuits.
SEPEX
Short form of Separate Excitement of traction motors where the armature and field coils of an electric motor are fed with independently controlled current. This has been made much more useful since the introduction of thyristor control where motor control can be much more precise.

Synchronous Motor
Traction motor where the field coils are mounted on the drive shaft and the armature coils in the housing, the inverse of normal practice.

Tap Changer
Camshaft operated set of switches used on AC electric vehicle to control the voltage taken off the main transformer for traction motor power. Superseded by thyristor control.

Transformer
A set of windings with a magnetic core used to step down or step up a voltage from one level to another. The voltage differences are determined by the proportion of windings on the input side compared with the proportion on the output side. An essential requirement for electric vehicle using AC power, where the line voltage has to be stepped down before use on the vehicle.

Transistor
The original electronic solid state device capable of controlling the amount of current flowing as well as switching it on and off.

ADVANTAGES:
1) Good for environment to reduce pollution
2) Reduce transportation cost
3) Reduce maintenance cost
4) Health benefits
5) Good for our energy security

Disadvantage:
1) Truck will run only in good condition road
2) No turning is takes place during movement on track rail from track rail to direct road..

Conclusion:
This modification is very good for electric heavy transport system and track rail used for balancing the vehicle and overhead line friction.

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Achalasia Misdiagnosed As Pulmonary Tuberculosis; Case Report

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Abstract: Achalasia -a rare motility disorder characterized by obstruction of the distal part of the esophagus. Among its symptoms are dysphagia and frequent complaints of chest pain as well as weight loss. We present a 30 year old female with one year history of recurrent low grade fever, cough, difficulty in breathing, chest pain and weight loss diagnosed as achalasia. Plain radiography and endoscopy played a vital role in the diagnosis.

Index Terms: achalasia, woman, plain radiograph, endoscopy

I. INTRODUCTION
Achalasia as a rare disorder is characterized by obstruction of the distal esophagus leading to subsequently dilatation of the proximal esophagus1. Patients generally complain of gastrointestinal discomfort with progressive dysphagia, chest pain and weight loss being among the commonest symptoms2. However, in very occasional cases, the patients first complain may be related to respiratory system3. The actual cause of this disorder is unknown but it can be categorized as primary (idiopathic) and secondary (pseudoachalasia)4. The occurrence of hiatal hernia and achalasia is extremely rare, only few reports regarding this association are available5. We present this case of achalasia coexisting with hiatal hernia that presented with pulmonary symptom and was misdiagnosed as pulmonary tuberculosis.

II. CASE REPORT
HM is a 30 year old house wife who presented with one year history of recurrent low grade fever, cough, difficulty in breathing, chest pain and weight loss. No history of haemoptysis and patient denied history of dysphagia. She was initially seen in a peripheral hospital where she was placed on anti Koch’s based on clinical and chest x-ray findings. After completion of anti Koch’s regimen with no significant clinical improvement was referred the patient to our hospital, Usmanu Danfodiyo University Teaching Hospital Sokoto, (UDUTH). Physical examination showed a young woman, moderately wasted. The cardiovascular and abdominal examinations were essentially normal. The physician at the general outpatient department (GOPD) in our hospital made a provisional diagnosis of atypical pulmonary tuberculosis and requested for another chest radiograph.

In the radiology department before conducting the requested chest x-ray examination we asked the patient for previous chest radiograph which was immediately provided and the first one revealed patchy and streaky opacities in the right middle and lower lung zones Figure 1A and the second chest radiograph showed a homogenous opacity of soft tissue density in the right paracardiac region with a differential of contrast from the cardiac shadow that extend to the superior mediastinum and fading out in to the neck (Figure 1B). Also a right lateral chest radiograph showed the aforementioned lesion to be in the posterior mediastinum, and we made an impression of achalasia with possibility of aspiration pneumonitis. Subsequently we did barium swallow to confirm the diagnosis which revealed dialated, aperistaltic proximal esophagus with smooth narrowed distal esophagus (bird beak appearance), and a diagnosis of achalasia cardia? Primary type with associated aspiration pneumonitis was made and advised for upper gastrointestinal endoscopy to rule out psuedoachalasia. Subsequently the endoscopic result revealed dilated upper 2/3 of the esophagus containing food particle despite over 12 hours fasting (achalasia) with coexisting hiatal hernia. Patient was finally referred to a surgeon in the hospital where surgery was performed and finally histology reports confirmed lesion to be achalsia. A month later on follow-up, patient’s symptoms disappeared and she had started gaining weight with improved quality of life style.
Figure 1A: Plain radiograph of the chest showing homogeneous opacity (White arrow) of soft tissue density in the right paracardiac extending into the superior mediastinum. Figure 1B: Barium swallow showing dilated proximal esophagus (arrow) with smooth tapered distal end giving bird beak appearance of achalasia (arrow).

III. DISCUSSION

Achalasia is a rare motility disorder of the esophagus and lower esophageal sphincter affecting approximately 1 in 100,000 people\textsuperscript{1}. Most achalasia patients are symptomatic for many years before seeking for medical attention\textsuperscript{8}. The most common symptom is dysphagia for solid and liquid\textsuperscript{7}. About 60\% of achalasia patient may have some degree of weight loss\textsuperscript{8}. Rarely the presenting complaints are respiratory; including chronic cough, recurrent lung infection, pneumonia, atelectasis and breathing difficulty\textsuperscript{8}. In our case the patient presented with respiratory symptom which was probably from regurgitation and aspiration. Pulmonary symptoms indicate aspiration of oesophageal content, 30\% of patients reported nocturnal coughing spells and nearly 10\% had significant bronchopulmonary complications\textsuperscript{9}.

This patient was misdiagnosed as pulmonary tuberculosis due to an inadequate follow-up chest x ray during the anti Koch’s regimen and a later chest x ray that revealed a homogenous paracardiac opacity extending to the superior mediastinum that faded out into the neck was mistaken for consolidation. A chest radiograph may be abnormal in later disease, with widening of the mediastinum from grossly esophageal dilation and features of pulmonary aspiration\textsuperscript{10}. The delay in the diagnosis of this patient was probably due to atypical clinical presentation and misinterpretations of typical radiological features in the later chest radiograph.

Endoscopy is an important tool that can be use to differentiate primary achalasia from a secondary achalasia\textsuperscript{1}, it was advised after our radiological impression of achalasia which subsequently revealed hiatal hernia coexisting in this case. The histology reports confirm the diagnosis of achalasia.

Paraesophageal hiatal hernia is uncommon condition, present in 14\% of all hiatal hernia, which require urgent correction to prevent life-threatening complication\textsuperscript{11}. Sliding hiatal hernia coexist in approximately 10\% of patient with achalasia. Although coexisting achalasia and paraesophageal hiatal hernia is extremely rare\textsuperscript{12}, clinician should be aware that oesophageal disorder can coexist.

Several reports have emphasized the rarity of hiatal hernia in patient with achalasia. The frequency of hiatal hernia in general population is estimated to be approximately 5 per 1000 population\textsuperscript{13}. Factors responsible for rarity of associated hiatal hernia are not known. It is possible that the patient with achalasia do not show enough barium entry in to the stomach, therefore, may be missed on barium swallow\textsuperscript{14}. In our case there was enough barium in the stomach which revealed the distal part of the esophagus to be below the diaphragm with no features suggesting herniation of the gastric fundus or gastric mucosal wall above through the hiatus.
The radiologist should be requested to evaluate a chest radiograph whenever possible, when unexpected or unusual findings occur and the presence of coexisting disorder should always be considered as this will lead to life saving condition.

IV. CONCLUSION

We hereby present a case of achalasia coexisting with hiatal hernia that was misdiagnosed due to atypical clinical presentation. This study also highlights the importance of endoscopy in the diagnosis of coexistence of hiatal hernia.

V. REFERENCES

Farm-level Adaptation Strategies to Climate Variability: Evidence from Smallholder Farmers in Offin River basin, Ghana

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Abstract: Climate variability is a complex environmental problem facing the world with the smallholder farmers in sub-Saharan Africa and south Asia been the most vulnerable group. However, farm-level adaptation is considered an important option to mitigate the adverse effect of climate variability on the smallholder farmers. This paper examines farm-level adaptation strategies adopted by farmers in the Offin river basin. A total of Three hundred and ninety eight farmers from eight communities were randomly sampled using a multistage sampling technique. The results showed that about 78.39 % of smallholder farmers have adopted soil and crop management practices to abate the effects of climate variability. The study revealed that soil and water conservation practices, improved food crop varieties, utilization of inland valleys and wetlands, changing planting dates, crop diversification and mixed cropping were the most preferred adaptations practices adopted by the farmers. Educational attainment, farming experience, access to agricultural extension services, access to credit facilities, training on climate information and farmer-based organization were the factors found promoting the adaptations. The paper thus suggests investment in climate information and collaboration between media and research institutions in climate change and variability studies which have a great prospect in promoting adaptation among the farmers.

Keywords- Farm-level adaptation; Climate variability Smallholder farmers; Offin river basin

I INTRODUCTION
Climate variability is a complex environmental problem facing the world with smallholder farmers in Sub-Saharan Africa and south Asia been the most vulnerable group. High temperatures, erratic rainfall pattern, dry spells and droughts have been hampering crop yield vis-à-vis food production in Africa. For instance, Morton (2004) noted that the most harmful impact of climate variability will be felt by smallholder farmers in the developing countries. FAO (2008) indicated that climate variability posed severe threat to crop production particularly to the smallholder farmers in Africa continent. Stanturf et al. (2011) also observed that recurrent droughts in African countries have demonstrated the effects of climate variability on food production resources.

In Ghana, climate variability has been affecting many farmers whose livelihoods depend largely on rainfall (Fosu-Mensah et al., 2012). Farm-level adaptation strategy is an important option to climate variability. A study by Temidayo (2011) found that farm-level adaptation strategies have the potential to increase crop production and build resilience of farming systems to climate variability. According to IPCC (2001), farm-level adaptation can greatly reduce the vulnerability to climate variability by making rural communities better able to adjust to the changing climatic conditions, cope with adverse consequences and moderating potential damages.

However, farm-level conservation practices such as crop, soil health, water management and agro forestry technologies are important adaptations but adoption and implementation remains low and challenging in sub-Saharan Africa. Boko et al. (2007) indicated that adaptation to climate variability is already taking place but limited at the farm-level. Similarly, despite the importance of farm–level adaptation to climate variability, it has attracted little attention and to our knowledge no attempts have been made to identify farm-level adaptation in the Offin river basin. This paper examines farm-level adaptations strategies adopted by smallholder farmers to lessen the adverse effects of climate variability in the Offin river basin.

II MATERIALS AND METHODS
A. Study Area
The basin is located between latitude 5°30′N to 6°64′N and longitude 1°30′W to 2°15′W. A large population in the basin lives in rural communities, with crop production as their main economic activity. The basin has a bi-modal rainfall pattern with major rainy season starts from March to July. The minor rainy season begins in September and ends in November (Figure 1). The mean annual minimum temperature is 22 °C, while maximum temperature for the hottest months is 33.2 °C.

![Figure 1: Average monthly rainfall from six climatic stations within Offin river basin (1983-2012)](image)

B. Research Design
A multistage sampling technique was employed. First, four areas namely Dunkwa, Jacobu, Manso Adubia, and Nyinahin were purposively selected for the study. Sample size was estimated using

\[ n = \frac{N}{1 + N(e)^2} \]

Where, \( n \) is the sample size, \( N \) is the population size and \( e \) is the margin error. With 5 % margin of error (95% confidence level), from a total population of 68,471, the sample size was estimated as 398 farming households. Secondly, two communities were randomly selected from each area. Proportional sampling techniques was used to determine sample size (s) of each selected community. The sample size (s) was calculated as:

\[ s = \frac{Zn}{N} \]

Where \( s \) is sample size and \( Z \) is the population size. Thirdly, simple random sampling was used in the selection of 398 farming households on the field.

C. Data Collection
Climate data of 30 years period (1983-2012) from six weather stations within the basin were collected from Ghana Meteorological Department, Regional Office Kumasi for the assessment of the climate variables

A household questionnaire made up of semi-structured type was used to collect data related to farmers’ perceptions of changing climate conditions and adaptation and coping strategies. Questionnaire was administered through face-to-face interview with the help of agricultural extension officers. A follow up visit to each farm was done to validate the information given by farmers. The questionnaire was designed under the following headings:

**Farmers’ perceptions on climate variables**
Information related to farmers’ perceptions on the rainfall, dry spells, drought events and variations in temperature during the cropping seasons.

**Farmer’s adaptation strategies**
Measures adopted on the farm to responses to the impacts of climate variability
D. Data Analysis

The data collected were processed and analyzed using the SPSS version 20.0. Descriptive statistics and multinomial logit (MNL) model were used to determine the factors influencing farmers’ adaptation practices in the basin.

III RESULTS AND DISCUSSION

Farmers perceptions versus Climatic Data

The results showed that 100 %, 97.50 %, 96.00 %, and 99.20 % of smallholder farmers in the basin perceived rising temperatures pattern, high variability of rainfall, recurrent drought events and intermittent dry spells respectively within the cropping season. Comparing smallholder farmers perceptions with maximum and minimum temperatures from five weather stations (Figure 2 and 3), showed a clear evidence of increasing temperatures intensity with severe implications among the smallholder farmers.

Table 1: Farmers responses to changing climatic conditions during the growing seasons

<table>
<thead>
<tr>
<th>Variables</th>
<th>Offin basin n = 398</th>
<th>Nyinahin n = 100</th>
<th>Manso Adubia n = 88</th>
<th>Jacobu n = 84</th>
<th>Dunkwa n = 126</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing temperatures</td>
<td>398(100)</td>
<td>100(100)</td>
<td>88 (100)</td>
<td>84(100)</td>
<td>126(100)</td>
</tr>
<tr>
<td>High variability in rainfall</td>
<td>388(97.50)</td>
<td>90(99)</td>
<td>88 (100)</td>
<td>84(100)</td>
<td>126(100)</td>
</tr>
<tr>
<td>Frequent droughts</td>
<td>382(96.00)</td>
<td>96(96)</td>
<td>88(100)</td>
<td>79(94.0)</td>
<td>119(94.0)</td>
</tr>
<tr>
<td>Intermittent dry spells</td>
<td>395(99.20)</td>
<td>99(99)</td>
<td>88(100)</td>
<td>82(97.6)</td>
<td>126(100)</td>
</tr>
<tr>
<td>Low food crop production</td>
<td>318(79.90)</td>
<td>57(57)</td>
<td>78(89)</td>
<td>76(80)</td>
<td>107(84)</td>
</tr>
<tr>
<td>Adaptations measures</td>
<td>312(78.39)</td>
<td>64(64)</td>
<td>81(92)</td>
<td>79(89)</td>
<td>113(88)</td>
</tr>
</tbody>
</table>

*Values in bracket are percentage of smallholder farmers (%)

Figure 2: Maximum temperature within the cropping season from five weather stations (1983-2012)
To confirm farmers’ perceptions regarding rainfall pattern in the cropping season, the annual rainfall data from six weather stations from 1983 to 2012 did not show an apparent confirmation of increasing or decreasing rainfall (Figure 4) but there was a clear evidence of higher inter-annual variability of rainfall (Figure 5). This indicated that there is high variability of rainfall pattern rather than decreasing or increasing trend. The variability in rainfall pattern over the years in the basin has translated into intermittent dry spells and frequent drought events between and within the growing season. The results indicated a consistency between climate data and the smallholder farmers’ perception about intermittent dry spells and droughts events during cropping season. The study also indicated that about 79.90 % of smallholder farmers perceived that changing climatic conditions during the cropping season has adversely affected their food crop production and thus impacting food security systems.
Famers’ Adaptation Strategies

The results showed that 78.39% of farmers have adopted soil and water conservation technologies and crop management practices to combat the effect of climate variability (Figure 6). The study revealed that changing planting dates, soil and water conservation practices, crop diversification, improved food crop varieties, mixed cropping; small-scale irrigation and utilization of inland valleys and wetlands resources were the most adopted strategies in the basin. Studies in Kenya (Evelyn et al., 2017) and Nigeria (Ayanlade et al., 2017) have observed similar adaptation measures to minimize effect of climate variability.

Improved Food Crop Varieties

The early maturing cassava varieties (Bankye Essam, Bankye Hemma), long maturing cassava variety (Dabo), high yielding maize varieties (Obatanpa, Mamaba and Dadaba) and rice varieties (Jasmine and AGRA) were found been planted by 45% of farmers. The cultivation of early maturing and long-time maturing crop varieties found showed the tendency of smallholder farmers to take advantage of different maturing and harvesting time of crops to alleviate the effects of climate variability. These findings are in agreement with farmers in Kenya (Speranza, 2010) and Namibia (Newsham and Thomas, 2011) who plant early maturing and long-time maturing crop varieties to cope with drier conditions.

Figure 5: Variability of rainfall within the cropping season from six weather stations (1983-2012)
Crop diversification were found among 34% of farmers to guard against crop failure under climate variability. Farmers in Malawi (Coulibaly et al., 2016) and Nigeria (Babatolu and Akinnubi, 2016) also grown diverse food crops to avert the climate risks. Njeru (2013) also observed that smallholder farmers grow diverse crops to halt the effect of climate variability and enhance food security.

Changing of planting dates
About 35% of farmers were found changing planting dates during the cropping period to offset the effect of climate variability. Smallholder farmers were noted planting maize in May instead of recommended time of March/April. Studies by Iglesias et al. (2000) in Spain and Waha et al. (2012) noted that smallholder farmers are changing planting dates as mitigation measure to climate variability.

Inland valleys and wetland cultivation
Crop farmers in the Offin river basin (40%) were found utilizing inland valleys and wetlands resources as an adaptation to produce crops and as well as to ensure continuous food supply. These strategies have been reported in similar studies by Rweyemamu (2009) in Tanzania and Turyahabwe et al. (2013) in Uganda where farmers have adopted inland valleys as a coping strategy to frequent and prolonged droughts and climate variability.

Small-scale irrigation practices
Irrigation practices were found among 15% of farmers using water-pumping machine, PCV pipes, watering cans and buckets in taking water from rivers, streams and boreholes to water their crops.

Soil and Water Conservation Strategy
Smallholder farmers have adopted several soil and water conservation and management practices to retain soil moisture and promote soil health (Figure 7). The most dominant soil and water conservation practices include stone bunds, crop rotation, cover cropping, minimum tillage, agro-forestry, mulching, creation of bunds, ridging and manure application. These practices are significant in reducing negative effects of climate variability through increasing soil moisture, promoting soil health and plant growth and securing food crop yield. Zougmore et al. (2014) and Lagerkvist et al. (2015) in Kenya and Burkina Faso found that farmers have adopted soil and water conservation technologies to offset effects of climate variability.
Agro-forestry

Adoption of agro-forestry was observed among 26% of smallholder farmers to reduce the risks of cropping systems and build up resilience to climate variability. Malawi (Coulibaly et al., 2016) and Southern Africa (Syampugani et al., 2010) found that farmers used agro-forestry in building up resilience to climate variability.

Contour and terracing

Farmers (28%) were noted using earthen bunds, stone bounds, contour ridges and terraces to tap run-off during and after rainfall, promote infiltration, minimize soil erosion and increase moisture at root zone. Farmers were found building stones with height of 20-30cm from the ground on their farms to reduce surface run-off, enhance rainwater infiltration and improve moisture retention and soil-plant nutrients uptake. Studies by Syampugani et al. (2010) and Zougmore et al. (2014) found contour and bunds as soil erosion prevention and water retention structures.

It is imperative to note that stone bund practices combined with organic sources of nutrients, is a promising climate and land use adaptation responses that could increase crop productivity and securing food security while contributing to strengthen the adaptive capacity of smallholder farmers.

Mulching

Using crop residue and grasses as a soil conservation practices were found among 74% of the smallholder farmers to improve and preserve soil nutrient and to retain soil moisture in the face of climate variability.

Determinants of Adaptation Strategies

The results highlighted that educational attainment, farming experience, access to agricultural extension services, access to credit facilities, training on climate information, household size and farmer-based organization were factors found promoting changing planting dates, mixed cropping, crop diversification, soil and water conservation, utilization of inland valleys and improved crop varieties as an adaptation to climate variability in the basin.

However, age of the farmer, land use activities, farm size, soil fertility were limiting factors to adaptation measures.

Table 2: Multinomial logit (MNL) adaptation model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Improved crop varieties</th>
<th>Changing planting date</th>
<th>Mixed cropping</th>
<th>Crop Diversification</th>
<th>Soil and water conservation</th>
<th>Inland Valleys</th>
<th>Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients</td>
<td>35</td>
<td>10</td>
<td>42</td>
<td>23</td>
<td>74</td>
<td>19</td>
<td>18</td>
</tr>
</tbody>
</table>
Also communication between climate change/variability researchers and media partners need to be intensified to facilitate the exchange of climatic information among smallholder farmers. Integration of farmers' innovations of adaptation with scientific observations on soil conservation and crop management practices should be encouraged among stakeholders and research scientists particularly in the climate variability and land use change policies.

IV CONCLUSION

The paper examines farm-level adaptations among the smallholder farmers in the Offin river basin. The results demonstrated that smallholder farmers have employed various soil and water conservation technologies and crop management practices to minimize the adverse impacts of climate variability. The study concludes that the various farm-level conservational technologies or practices adapted by farmers have the propensity to promote soil health, enhance crop growth and crop productivity.

V POLICY IMPLICATIONS

Integration of farmers’ innovations of adaptation with scientific observations on soil conservation and crop management practices should be encouraged among stakeholders and research scientists particularly in the climate variability and land use change policies. Also communication between climate change/variability researchers and media partners need to be intensified to facilitate the exchange of climatic information among smallholder farmers.

ACKNOWLEDGEMENTS

We are grateful to the Directors and staff of Ghana Meteorological Department, Regional Office Kumasi and Ministry of Food and Agriculture for providing climate data and assisting us in getting the farmers.

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State of the Art Optimization Model Role of Construction Management in Improving Performance Construction Design and Design and Build in Project Building Area of Emergency Ambulans Buildings in Provincial Health DKI Jakarta

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Abstract: DKI Jakarta Provincial Government through Governor Regulation No. 144 of 2010 stipulates the Emergency Ambulance of DKI Jakarta Provincial Health Office (AGD DINKES) as a Public Service Agency must be updated in the hope of improving the performance that has been running to be more optimal and more accountable, which can ultimately improve the pre-hospital emergency care. Therefore, the Provincial Health Office of DKI Jakarta requires Construction Management Services, so it is necessary to procure Construction Management Consulting Services of Design and Build Building of AGD Building of DKI Jakarta Provincial Health Office. Required roles and performance of a measurable Construction Management consultant by analyzing schedules, daily reports, interviews with project owners, relevant journals for construction projects to be completed on time with an optimal design design in accordance with the project owner's wishes. To improve the performance of the Management Consultant in the Emergency Ambulance Building Building Project in DKI Jakarta Provincial Health Office is through the quality of education, the quality of work experience, the certification obtained and the scope of tasks undertaken.

Index Terms: model, role, construction management, performance, design and build

I. INTRODUCTION

The Emergency Ambulance Building is currently located on Jl. Sunter Permai Raya Kav. 1 Sunter Podomoro. The location is prone to flooding is an obstacle for the Emergency Room Ambulance Emergency of DKI Jakarta Provincial Health Office in providing the best service for the people of Jakarta. Therefore, a new building is needed that can facilitate the health service in the form of ambulance building so that it can run more effectively and efficiently. The construction of the Emergency Ambulance building of the new District Health Office requires good development supervision so that it can run smoothly. Therefore, the Provincial Health Office of DKI Jakarta requires Construction Management Services, so it is necessary to procure Construction Management Consultancy Services of Design and Build Development of Ambulance Emergency Building Building of DKI Jakarta Provincial Health Office.

Where the Construction Management Consultant should be able to supervise the construction planning and the implementation of physical construction simultaneously so that the implementation and financing time is well under control. As the Design and Build project procurement model is still new and all devices are unfamiliar with it, it will create many new problems that could affect performance for the Construction Service Providers including Construction Management Consultants in it.

The purpose of this research is to analyze the work of Construction Management Consultant on design and build project of Ambulance Emergency Room of DKI Jakarta Provincial Health Office. By knowing the work of Construction Management so that it can manage the implementation of integrated work of AGD building construction (Emergency Ambulance) Sub-District and Village Health Office of DKI Jakarta Province so as to get optimal result as per requirement.

II. RESEARCH PROBLEMS

Problems to be solved in this research are:

a. What is the role of Consultant MK in the process of Design and Build Integrated Construction on the project of Ambulance Emergency Room building building in DKI Jakarta Provincial Health Office?

b. What is the size of the performance of the construction process undertaken by the Consultant of the Constitutional Court on the project area of Ambulance Emergency buildings building in the DKI Jakarta Provincial Health Office?

c. What are the factors and variables of the role of Consultant of the Constitutional Court in the process of construction of Design and Build (Integrated Design and Build) on the project of Ambulance Emergency Room building building in the Health Office of DKI Jakarta Province?
III. LITERATURE REVIEW
The literature study analyzed in this research are:

3.1 The Role of Construction Management

Construction management has several roles, among others, acting as a companion of the work process starting from controlling the planning stage and controlling the implementation phase, as a Quality Control to maintain the suitability between planning and implementation, anticipating the change of uncertain field conditions and overcoming the constraints of limited implementation time, and progress of the project that has been achieved, it is done with daily (weekly and monthly), evaluation results can be made decision-making action to the problems that occur in the field, managerial role of management is a good information system to analyze the performance of the field (Wulfram, 2006). Relationship of construction planning and construction implementation in design and build in the form of diagram can be seen below:

![Diagram](image)

Figure 1. Relationship of Construction Planner and Construction Implementation on Design and Build

3.2 Construction Process

Construction work according to UUJK No.2 Year 2017 is the whole or part of a series of planning and/or implementation activities and supervision which covers the architectural, civil, mechanical, electrical, and environmental work of each and each of its equipments, to realize a building or other physical form.

3.3 Project Performance

Measures of performance can be seen in terms of cost, time, and quality where these three are furthermore said to be the dimensions of productivity (Alinaitwe, 2008). Construction project workers have a major role or task to combine inputs with specific techniques or skills through a project plan both strategic and operational planning to subsequently produce a construction project. As for the components in construction projects related to the definition of productivity are technology, human resources, performance, cost, time and quality. (Soeharto, 1995).

3.4 Project Development with Design and Build Method

Based on Attachment I of the Regulation of the Minister of Public Works and People's Housing No. 19/PRT/M / 2015 on Standards and Guidelines for Procurement of Design and Build Integrated Construction Works are all work related to the execution of building construction or other physical form, where the planning or design drawing and concurrent construction work. Design stage in Design and Build method includes two sub-stages: first, Pre-Design stage (Preliminary Design) The result of this stage is used to participate in the tender of Design and Build project. Second, Development stage Design (Design Design)/ Detail Design. Which is the development stage of the pre-approved draft is then made in more detailed calculations.

Then done Procurement Process, on Design and Build Method is after the election of Construction Management Consultant, then held the process of Procurement Contractor as executor. Usually the tender for the design and build project is the Contractor who has KSO (Cooperation of Operations) with the Planner. Entering the Construction Process is the realization of the building required by the project owner and has been designed by the Planner within the agreed cost and time limits, and with the required quality. Activities undertaken at this stage are planning, coordinating and controlling all operations in the field.

3.5 Building

The building of building according to the Law of the Republic of Indonesia Number 28 Year 2002 is a physical form of the result of construction work which is united with its place of position, partly or wholly located above and / or in the soil and / or water, which serves as a place for human to do its activities either for shelter or shelter, religious activities, business activities, social activities, culture, or special activities

Because the project under study is a building belonging to the Ministry of Health it includes a State Building that is not simple, which in its sense is a building for official purposes that becomes / will become state property such as office buildings, school buildings, hospital buildings, warehouses, and / or other legitimate acquisitions, of an office building with no prototype design, or office building with an area above 500 m2, or a multi-storey office building of more than 2 floors.
3.6 Project Control

Control by R.J. Mockler, as cited by Soeharto (1999: 228) is a systematic effort to set standards in accordance with the goals of planning, designing information systems, comparing execution with standards analyzing the possibility of deviations between implementation and standards, then taking the necessary corrective actions to effectively utilize resources and efficient in order to achieve the target. The control process runs throughout the project life cycle to achieve good performance in every stage. Planning is made as a reference for the implementation of the work. The reference material will then become the implementation standard for the project concerned, including technical specifications, schedule and budget. So to be able to do the necessary control of the planning. In the control of the project are known some tools to control the implementation of construction works, such as Project Time Control, Project Cost and Project Quality.

3.7 Portrait of Ambulance Emergency Building Building at DKI Jakarta Provincial Health Office

Provincial Government of DKI Jakarta through Governor Regulation No.144 of 2010 establishes Emergency Ambulance of DKI Jakarta Provincial Health Office (AGD DINKES) as a Public Service Board is expected to improve the performance that has been running to be optimal and more accountable, which in turn can improve pre-hospital emergency care.

AGD DINKES service is oriented to hospital pre-service, medical evacuation from the scene (traffic accidents, fire, disaster and other extraordinary events) to hospital and hospital to hospital and handling poor family patient (GAKIN) and SKTM. With the formation of AGD DINKES will provide answers to cases that occur at this time so that the impact of decreased morbidity, mortality and disability due to cases of pre-emergency hospital emergency for the community in the province of DKI Jakarta and surrounding areas.

Emergency Ambulance Building Area currently located on Jl. Sunter Permai Raya Kav. 1 Sunter Podomoro. This flood-prone location becomes an obstacle for AGD DINKES in providing the best services for the people of Jakarta. Therefore, it is needed new building location which can facilitate health service such as ambulance so that it can run more effectively and efficiently.

Development of new AGD Dinkes Building requires good development supervision so that it can run smoothly. Therefore, the Provincial Health Office of DKI Jakarta requires Construction Management Services, so it is necessary to procure Construction Management Consultancy Services of Design and Build Building of AGD Building of DKI Jakarta Provincial Health Office.

3.8. Relevant Research Results

The following are the supporting studies used in this study:

<table>
<thead>
<tr>
<th>No</th>
<th>Research Title</th>
<th>It's relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods (Darren R. Hale, PE; Pramen P. Shrestha, PE; G. Edward Gibson Jr., PE, dan Giovanni C. Migliaccio, Michael Meyer, American Society of Civil Engineering ASCE, 2009)</td>
<td>Comparing the performance of Design Build and Design-Bid-Build to see if the project's project method is superior in terms of time and cost.</td>
</tr>
<tr>
<td>2</td>
<td>Strategies for Design-build in Korea Using System Dynamics Modeling (Moonseo Park,; Sae-Hyun JI; Hyun-Soo Lee,; and Wooyoung Kim, ASCE, 2009)</td>
<td>Design-Build has become the preferred construction project of its workmanship system, outperforming other systems in terms of cost.</td>
</tr>
<tr>
<td>4</td>
<td>Determining the Appropriate Proportion of Owner-Provided Design in Design-build Contracts: Content Analysis Approach (Bo Xia; Albert Chan; Keith Molenaar,; and Martin Skitmore, ASCE 2012)</td>
<td>Statistical analysis of several design and build projects is undertaken to explore the relationship between design proportions provided by owners and supervisors as well as other project information, including project type, advertising time, project size, contractor selection methods, procurement process, and contract type.</td>
</tr>
<tr>
<td>5</td>
<td>Design management in Design-build Megaprojects: SR 99 Bored Tunnel Case Study (Umberto C. Gatti; Giovanni C. Migliaccio; and Linea Laird, ASCE, 2014)</td>
<td>Although the use of design-build is widespread, there is still little lack of information on how to plan and implement effectively the construction management procedures.</td>
</tr>
<tr>
<td>6</td>
<td>Comparing the Performance Quality of Design-Bid-Build and Design-build Delivery Methods (Tao Yu; Geoffrey Qiping Shen, Ph.D.; Qian Shi, Ph.D., American Society of Civil Engineering ASCE, 2016)</td>
<td>Use existing economic theory to develop models to test the quality of construction management performance and project advantages of both methods.</td>
</tr>
<tr>
<td>7</td>
<td>Performance of Design-build and Design-Bid-Build Projects for Public Universities (Pramen P. Shrestha, Ph.D., dan James D. Fernane, American Society of Civil Engineering ASCE, 2016)</td>
<td>Statistical tests were conducted to determine whether the metrics associated with the cost, schedule, and order changes differ significantly from each other in both types of projects. The results show that the Design and Build project significantly outperforms the Design-Bid-Build project in terms of savings schedules.</td>
</tr>
<tr>
<td>8</td>
<td>Dynamic Management of Risk Contingency in Complex Design-build Projects (Alberto De Marco,</td>
<td>With the aim of studying the dynamics and major influences involved in the contingency risk management process of a</td>
</tr>
</tbody>
</table>
Figure 2. Relevant Journals

IV. RESEARCH METHODOLOGY

4.1. Optimization of Research Framework Model

Optimization model of this research framework is done by mentukan step keangka research with the sequence as follows:

<table>
<thead>
<tr>
<th>PRIMARY DATA</th>
<th>1. Journal &amp; Reference Book 2. Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA COLLECTION</td>
<td></td>
</tr>
<tr>
<td>RESEARCH METHODOLOGY</td>
<td>Explain about the methods undertaken in the study.</td>
</tr>
<tr>
<td>DATA ANALYSIS</td>
<td>Conduct data analysis on relevant journals and project owners</td>
</tr>
<tr>
<td>DISCUSSION OF DATA ANALYSIS</td>
<td>Provided Factors and variables</td>
</tr>
<tr>
<td>CONCLUSIONS AND RECOMMENDATIONS</td>
<td>Contains conclusions and suggestions from research results</td>
</tr>
</tbody>
</table>

Figure 3. Model of Research Framework

4.2 Research Process

Research Process which is the sequence of the stage of research implementation in accordance with the problems and accurate analysis to achieve research objectives. The stages of research conducted are as follows:

Figure 4. Research Process

4.3 Research Instruments

Research instrument in research there are three that is: (a) Pimer data, source of research data obtained from interview with project owner and study from relevant journal. Finally, four (4) factors are (1) Education, which according to Carter V. Good, education is proes of the development of one's skills in the form of attitude and behavior prevailing in society. Where a person is influenced by a guided environment within the school environment so as to achieve social skills and can develop his personality. (2)
Experience, experience is also the experience used to refer to the knowledge and skills about something acquired through involvement or related to it over a certain period (wikipedia). (3) Certification. Professional certification is a determination given by a professional organization to a person to show that the person is capable to perform a specific job or task (wikipedia). (4) Scope of Task, the definition is the Limitations of tasks that must be executed (wikipedia). Of the four factors are obtained research variables are:

<table>
<thead>
<tr>
<th>No</th>
<th>Factors</th>
<th>Variables</th>
<th>Relevant Journal Resources</th>
</tr>
</thead>
</table>
| 1  | Education      | 1) Terms of Education  
  2) Formal Education Strata  
  3) The duration of graduation  
  4) IPK value  
  5) Intellectual Intelligence (IQ)  
  6) Emotional Intelligence (EQ)  
  7) Quality  
  8) Informal Education  
  9) Knowledge  
  10) Mindset | 1. Determining the Appropriate Proportion of Owner-Provided Design in Design-build Contracts: Content Analysis Approach  
  2. Performance of Design-build and Design-Bid-Build Projects for Public Universities  
  3. Impact of Design Risk on the Performance of Design-build Projects |
| 2  | Experience     | 1) Long of the work  
  2) Training  
  3) References  
  4) Ability to solve problems  
  5) Design change  
  6) The ability to use tools  
  7) Presence  
  8) The method use  
  9) The accuracy of the method used  
  10) Responsibility | 1. Impact of Design Risk on the Performance of Design-build Projects  
  2. Design management in Design-build Megaprojects: SR 99 Bored Tunnel Case Study  
  3. Identification and Analysis of Owner-Induced Problems in Design-Build Project Lifecycle |
| 3  | Certification  | 1) Profession  
  2) Institutional  
  3) Type  
  4) Levels  
  5) Term  
  6) Expertise Field  
  7) Scope of Activities  
  8) Year of Manufacture  
  9) Function/for purpose  
  10) Value | 1. Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods  
  2. Design management in Design-build Megaprojects: SR 99 Bored Tunnel Case Study  
  3. Identification and Analysis of Owner-Induced Problems in Design-Build Project Lifecycle |
| 4  | Scope of Assignment | 1) Quality Control  
  2) Time Control  
  3) Cost Control  
  4) Procurement of tender / tender  
  5) Assistance planning  
  6) Supervision of Work Preparation  
  7) Supervision of Construction Implementation Works  
  8) Maintenance Supervision  
  9) Project Administration Control  
  10) Coordination, discussion and communication | 1. Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods  
  2. Performance of Design-build and Design-Bid-Build Projects for Public Universities  
  3. Identification and Analysis of Owner-Induced Problems in Design-Build Project Lifecycle |

![Figure 5. Factor, Variable and Source Table](www.ijsrp.org)
Width of Existing Buildings :
1. Gedung A :  7.520 m²
2. Gedung B : 3.456 m²
3. Gedung C :  2.500 m²
4. Gedung D : 2.028 m²
5. Gedung E :  864 m²
Total : 16.368 m²

Figure 6. Location

Figure 7. Plan Area Situation

4.5 Respondents Research
In this study, respondents are people who are asked to provide information about a fact or opinion, namely through relevant journals and project owners. The description of the fact or opinion will be reviewed to be submitted in writing form, ie when filling in a questionnaire, or verbal, when answering the interview.

4.6 Research Methods
The research method used is quantitative research method which is one type of research that is more systematic, specific, well structured and well planned from the beginning to get a conclusion. Quantitative research emphasizes the use of numbers that make it more detailed and clearer. In addition, the use of tables, graphs, and also diagrams is very easy to read. In this quantitative method there are several supporting methods, namely descriptive method, survey, comparison, action research, exposure, and correlation.

V. ANALYSIS & DISCUSSION
5.1 Analysis
Prior to conducting the analysis in this study, data collection is drawing of construction design drawings, Daily Project reports for design planning and construction implementation, project schedule, direct interviews to project owners, and analyzing relevant journals. In addition, the analysis of the role of Construction Management consultant in the process of Design and Build Integrated Construction on the project of Ambulance Emergency Building in DKI Jakarta Provincial Health Office can be seen from the implementation schedule made by Construction Management consultant and construction design drawing, in accordance with the schedule and the results in accordance with the wishes of the project owner.
To determine the performance measures of Construction Management consultants can be seen from the schedule, project daily reports and interviews with project owners to find out the project owner's desire on the performance of Construction Management consultants. In determining the factors and variables in the role of Construction Management Consultants in addition to interviews with project owners, an analysis of the journals relevant to the research topic was conducted.

5.1 Discussion of Research Results

To be able to answer the problems that exist in this research analysis results obtained are (a) the role of Construction Management consultants in the process of Integrated Construction Design and Build on the project area of buildings Ambulance Emergency buildings in DKI Jakarta Provincial Health Office must be tailored to the wishes (b) to measure the performance of the Construction Management consultant in the Design and Build Integrated Construction process of the Ambulance Emergency Building project in the DKI Jakarta Provincial Health Office should be visible on schedules and daily reports, in which the construction project is completed on time with an optimal design design. By analyzing the relevant journals and interviews to the owner of the pot obtained factors and variables for the role of Construction Management consultants in the process of Design and Build Integrated Construction on the project area of the building of Emergency Room Ambulance at DKI Jakarta Provincial Health Office, that is:

<table>
<thead>
<tr>
<th>Factors and Variables</th>
<th>1. Education</th>
<th>2. Experience</th>
<th>3. Certification</th>
<th>4. Scope of Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Terms of Education</td>
<td>1. Long of the work</td>
<td>1. Profession</td>
<td>1. Quality Control</td>
<td></td>
</tr>
<tr>
<td>2. Formal Education Strata</td>
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<td>2. Time Control</td>
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<tr>
<td>3. The duration of graduation</td>
<td>1. References</td>
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<td>3. Cost Control</td>
<td></td>
</tr>
<tr>
<td>4. IPK value</td>
<td>1. Ability to solve problems</td>
<td>4. Levels</td>
<td>4. Procurement of tender / tender</td>
<td></td>
</tr>
<tr>
<td>5. Intellectual Intelligence (IQ)</td>
<td>1. Design change</td>
<td>5. Term</td>
<td>5. Assistance planning</td>
<td></td>
</tr>
</tbody>
</table>

VI. CONCLUSION & SUGGESTIONS

6.1 Conclusions

The conclusion of the role of Construction Management in improving the performance of integrated construction Design and Build on the project of Emergency Ambulance Building Building Building at DKI Jakarta Provincial Health Office is determined by...
the project owner's desire on the performance of the consultant through the quality of education, quality Work experience, certification obtained and the scope of the task performed. All of which is a factor to be examined through a variable that has been determined.

6.2 Suggestions

Based on the conclusions outlined above, suggestions or suggestions that can be recommended from the results of this study are the questions in the questionnaire for the respondents ie the project owner must show the synergy between the project owner's desire and the performance of the Construction Management consultant so as to facilitate the role of Construction Management consultant in conducting project supervision design and build.

VII. REFERENCES

[16] Pramen P. Shrestha, Ph.D, James D. Fernane, 2016 Performance of Design-build and Design-Bid-Build Projects for Public Universities, American Society of Civil Engineering ASCE.
[17] Tao Yu, Geoffrey Qiping Shen, Qian Shi, 2016, Comparing the Performance Quality of Design-Bid-Build and Design-build Delivery Methods, American Society of Civil Engineering (ASCE).

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www.ijsrp.org
ADOPTION OF AMMONIATED STRAW TECHNOLOGY BY FARMERS AT SUB-DISTRICT OF DONRI-DONRI, SOPPENG DISTRICT, INDONESIA

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Abstract

The low availability and quality of forage for livestock during the dry season is the main problem faced by the farmers in Indonesia. To alleviate the problems, the use of agricultural by-products that their nutritive value has been improved like ammoniated straw as animal feed is recommended. However, most farmers have poor understanding about ammonisation of straw technology. For this reason, an extension on ammonisation of straw technology was introduced to the farmers. However, after teaching on the ammonisation technology, practice of making ammoniated straw and demonstration on the superiority of using ammoniated rice straw as animal feed had been introduced to the farmers, only one of 20 farmers followed the training who adopted the technology. It is suggested that the purpose of raising the cattle is the main factor determining adoptability of the technology by the farmers.

Key-words: adoptability, ammonisation, extension, farmer, rice straw

Introduction

In Indonesia, lack of forage for ruminant animals during the dry season, both in quantity and quality is the main problem faced by most farmers. One way of alleviating the problems is through the utilization agriculture by-products or concentrates as feed to the animals. Due to high prices of concentrates, the utilization of agriculture by-products in Indonesia is more promising. During the dry season, agriculture by-products that has been used by farmers as feed to their animals is rice straw. Rice straw is the most abundant feed resources in rice producing areas like South Sulawesi that in 2015 yielded grain production of 5.47 million tons (BPS, 2016). Because the ratio of rice production and rice straw is 1 : 1 (FAO, 1989), it is estimated that rice straw production in South Sulawesi in 2015 was also 5.47 million tons. If cattle with body weight of 200 kg can consume rice straw of 2% of her body weight, such amount of rice straw can accommodate about 3.747 million of cattle annually. This figure are above the population of beef cattle and dairy cattle in South Sulawesi that in 2017 is estimated to be about 1.5 million head.

Although its high production potential, utilization of rice straw is low. After harvesting, most rice straw is wasted. The largest part is burnt in the paddy field that pollutes the air and contributes to global warming. A substantial part of rice straw in left in the field, undergoing natural decomposition that can impoverished soil because of its high C : N ratios. Although it can be used for many purposes such as livestock feed, compost materials, making paper, energy generation etc., its utilization in rural areas is low. During the dry season, a substantial amount of rice straw is used as animal feed, although it is unpalatable to cattle.

As animal feed, rice straw has low nutritive value. Its palatability is low, mighty because of its high fiber contents. Under natural conditions, cattle prefer to eat natural or improved grass rather than rice straw. Its crude protein content also low (2 – 4%), it is far under 7%, that considered a minimum value for maintaining high feed intake in ruminants.(Milford and Minson, 1968). Although it contains about 80% of substance which are potentially digestible, but actual digestibility by ruminants is only 45 to 50%. The net results is an energy intake which provides little or no surplus energy for growth, work or production (Jackson, 1978). When rice straw is used as sole diet, poor animal production has usually occurred.

One way of increasing crude protein, digestibility and intake of rice straw is through ammonisation using anhydrous ammonia or urea. According to Guo (1996), digestibility and feed intake of ammoniated straw can be increased by approximately 20% and the content of crude protein can be increased by two to three times compared to control. In rural areas of Indonesia, ammonisation of rice straw using urea may the best method to improve the nutritive value of rice straw because its price is cheap and easily found.
In rural areas of Indonesia, the increase of palatability of rice straw sometimes conducted through sprinkling with salt solution. Although this practice increases the palatability, it does not increase its protein content and digestibility. Due to its superiority, ammonisation of rice straw technique needs to be disseminated among the farmers to increase feed availability for their animals. For these reasons, an extension activity were performed with the objectives: 1. to introduce ammonisation of rice straw technology to the farmers, 2. to demonstrate how to make ammoniated rice straw and the superiority of ammoniated rice straw over non-ammoniated rice straw when fed to cattle, and 3. to determine the adoption rate of farmers to ammonisation of rice straw technology.

Materials and Method

The extension activity was performed from September to November 2017 at Kessing village, sub-district of Donri-Donri, Soppeng district, South Sulawesi Indonesia. There were three main extension activities were performed, i.e.:

1. Teaching on ammonisation of rice straw. This activity involved: the importance of providing good quality of feeds to ruminants, the superiority and limitedness of rice straw as feed for ruminants, how to overcome the low quality of rice straw, mainly through ammonisation. Ammonisation of rice straw was discussed in depth. This activity was attended by 20 farmers.
2. Practice of making ammoniated rice straw. This activity involved farmers who actively cut of long rice straw to shorter length, making urea solution, sprinkling urea solution on rice straw and sealing ammoniated rice straw with thick plastic. The method of making ammoniated rice straw followed the method proposed by Tengyun (2000). In brief, rice straw was spread over the thick plastic placed above hard soil. The rice straw (100 kg) was sprinkled with urea solution (40 litres water : 1 kg urea). The fermentation lasted for one month.
3. Demonstrating of superiority of ammoniated straw over non-ammoniated straw and superiority of supplementation of grass over non-supplementation. In this trial, we used four head of cattle weighing of about 120 kg. The grass species used as supplement to ammoniated straw were elephant grass (Pennisetum purpureum), Brachiaria mutica, and Cynodon dactylon. The cattle is kept in individual house with each drinking water and feed trough. The cattle was fed with ammoniated straw as much as 2 kg/day and supplemented with the four grasses ad libitum. The time of feeding the grass was at 8.00 AM and 16.00 PM. During the feeding trial, the farmers was asked to take grass from neighboring areas, weighing, fed them to cattle and counting its intake by cattle. This activity was lasted for one month and parameter measured was intake of fresh matter.
4. Determining adoption rate by the farmers who had followed all activities relating to rice straw ammonisation technology.

Results and Discussion

With low education levels and poor understanding about ruminant nutrition, the farmers seem hard to understand what ammonisation technology is, what’s its purpose, how this technology can increase intake and animal production, etc. There were many farmers who did not believe if urea can be used to increase the quality of rice straw, because from their experience, many death of cattle derived from feeding urea. Further there were many scientific words like crude protein, digestibility, etc. that they didn’t understand. It needed more time using easy understand local language (Bugis language) to answer what they asked.

The discussion about ammonisation technology continued until practice of ammoniating rice straw. The farmers was given opportunity to practice of making ammoniated straw. While reading manual book on ammonisation technology that had been distributed before, some of them asked why in rice straw ammonisation, urea, water and rice straw must be used in the fixed proportion ?. They also asked why urea solution should be mixed well with rice straw, why ammoniated straw must be sealed with thick plastic ?, etc. This questions were answered by us as soon as possible The activity and teaching on ammonisation of rice straw lasted about four hours.

The purpose of feeding trial was to convince the farmers to the superiority of feeding of ammoniated rice straw. Although data on intake of cattle in our work was not presented as this trial was un-replicated, intakes of cattle fed ammoniated straw and supplemented with grasses were higher than fed only rice straw. Results of our study is in agree with work of some other authors (Trach et al., 2001, Gunun et al., 2013) that ammonisation of rice straw improved intake of cattle. In the present study, it was revealed that in the first week of study, intake of rice straw and intake of rice straw supplemented with the three grasses were low, but at second and third week, intake was steadily increased and it peaked at the fourth week of study.

In the present study, cattle gain was not measured, however, it can be predicted that increasing feed intake would be followed by increasing cattle gain, as dry matter intake and gain of cattle is highly correlated (Davis et al., 1970). This indicates that in the present trial, ammonisation of rice straw is not only improved intake, but also increased the growth of cattle.
Although convincing and positive results had been obtained from feeding trial, adoption rate of farmers to rice straw ammonisation technology in quite low. Only one of twenty farmers who had followed the training will soon to feed ammoniated straw to his cattle. The other farmers are still considering to apply the technology. The farmer who adopted the technology is the man who fed the cattle and measuring their intake in the present feeding trial. He had watched well the superiority of feeding rice straw to cattle and he will soon to ammoniate wasted rice straw and feed it to his seven head of cattle that he reared on his backyard. He reared the cattle with cut and carry system and every day he take natural grasses in the field, carrying and feed these grasses to his cattle in the barn. With ammonisation technology, he feels very helpful because he can increase his feed sources. He intends to increase the number of his cattle in the near future because he feels that rearing cattle yields more profit than cultivating rice.

Different from one farmer who has adopted the ammonisation technology, most farmers in the extension area are reluctant to adopt the technology. This, partly might be related to the small amount of cattle they have. Most of these farmers have only two to four head of cattle per household. The cattle generally are left to graze on natural grasses located in road sides, lake sides, unplanted paddy field and other non-conventional areas as there are no grazing land in the area. During the dry season most cattle were losing their weight, as there were no supplement feed was given to the cattle. Sometimes in the season, the cattle entering cropping areas and causing social problems. The purpose of raising cattle for them is mostly as saving material that can be sold anytime. They didn’t care about feed quality, including quality rice straw, as their purpose to raise cattle is not to fatten the cattle. They will satisfy if their cow is pregnant and giving birth.

Besides the above factors, there are, perhaps, two additional reasons for the farmers not yet to apply the technology. First, the cost of collecting of the rice straw from the field to feeding location in the present time has been increasing. By using rice harvesting machine, distribution of rice straw in the field is more evenly. This makes collection cost of rice straw in the field become high. This is different from before when rice straw was harvested manually, in which rice straw placement in the field was more concentrated. Second, the farmers have poor understanding about ruminant nutrition and feeding. This is because no good linkages between researcher, agricultural extension worker and target farmer. When we introduce the technology to the farmers in the area, the farmers never heard and see the technology before.

**Conclusion**

Livestock production will continue to play a vital role in Indonesia, including in Soppeng regency. However its further development is hampered by problems related to low quantity and quality of forage during the dry season and the low quality of crop residues. Improved utilization of ammoniated rice straw would be a strategic solution to increase the farmer’s income derived from livestock keeping. Although encouraging results of feeding of ammoniated straw to livestock has been demonstrated, adoption rate by the farmer to the technology in extension area is low. Apparently, the purpose of raising cattle by the farmers is the dominant factor determining adoptability of the technology.

**References**


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Vibrational Analysis of Passive Suspension System for Solar Vehicle

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Abstract- Suspension system in an automobile determines the riding comfort of passengers and the amount of damage to the vehicle. In this paper, the passive suspension system, quarter car model is analyzed to improve handling and ride performance of a vehicle. Two degree and three degree of freedom with and without tire damping is analyzed by using Matlab Simulink. Comparisons between passive suspension system with tire damping and without tire damping are performed by using different damping ratios range from 0.2 to 0.4. As a results, the sprung mass displacement of two degree of freedom suspension system with and without tire damping for front suspension are 0.1503 m and 0.1509 m respectively and rear suspension are 0.1548 m and 0.1564 m. For three degree of freedom, the sprung mass displacements of front suspension for with and without tire damping are 0.1301 m and 0.1351 m respectively. Sprung mass displacement for rear suspension for with and without tire damping are 0.1331 m and 0.1393 m. Seat mass displacement of front suspension for with and without tire damping are 0.1581 m and 0.1836 m. Seat mass displacement of rear suspension for with and without tire damping are 0.1590 m and 0.1854 m. The results show that suspension system of both types with tire damping is more passenger comfortable than suspension system without tire damping. Moreover, it is observed that the greater the damping effect, the more the ride handling and ride comfort of passenger.

Index Terms- Automobile, Damping effect, Riding comfort, Solar vehicle, Suspension system

I. INTRODUCTION

A solar vehicle is an electric vehicle powered completely or significantly by direct solar energy. Usually, photovoltaic (PV) cells contained in solar panels convert the sun’s energy directly into electric energy. The term “solar vehicle” usually implies that solar energy is used to power all or part of a vehicle’s propulsion [9]. The brief study of solar car is efficient in our daily life because now day’s pollution and fuel rate is very big problem and many people having fuel cars. Solar energy is being used for car, besides the control of vehicular pollution in the city, less consumption of fuel, solar cars are effective reducing global warming and environment problem in big frame.

There are many components in a solar car such as solar panel, chassis frame, steering system, transmission system, suspension system, brake system, axle, wheel, motor, etc. A solar car works as the following principle. Firstly, solar panel converts light energy from the sun into the electrical power. Solar controller converts the energy collected from the solar array to the proper system voltage, so that the batteries and motor can use it. Then, motor controller adjusts the amount of energy that flows to the motor. Finally, the motor uses that energy to drive the transmission system.

A car suspension system is the mechanism that physically separates the car body from the wheels of the car. The performance of the suspension system has been greatly increased due to increasing vehicle capabilities. Suspension consists of the system of springs, shock absorbers and linkages that connects a vehicle to its wheels. In other meaning, suspension system is a mechanism that physically separates the car body from the car wheel. The main function of the vehicle suspension system is to minimize the vertical acceleration transmitted to the passenger which directly provides road comfort [5].

At present, three types of vehicle suspensions are used: passive, active and semi-active suspension system. The passive system is the most used type in automobile suspensions. The main reasons are the simplicity, low cost and reliability of this solution. A spring and a damper compose this suspension system, both fixed between the wheel supporting structure (unsprung mass) and the vehicle body (sprung mass). The damper is a cylinder filled with hydraulic oil or a compressed gas. Inside the cylinder there is a piston driven from the outside by a rod. Allowing the piston displacement there is a hole, which permits the fluid pass between the parts of the cylinder. This fluid flow generates a reaction force that is proportional to the relative speed between sprung and unsprung masses. The damping is achieved converting the energy of the oscillations in heat[5].

The active suspension system is also comprised of an actuator, sensors, and a control programming unit (CPU). Actually, the shock absorber is replaced by an active force actuator. The operational conditions of the vehicle are continuously controlled by sensors that measure the velocity of the sprung and un-sprung masses and lead it to the CPU that ensures correct impulses for the actuator, which creates the desired active damping forces when required. Semi-active suspension systems were first proposed in the early 1970’s. The semi-active suspension system is based on passive and active systems. The presented one contains instead a passive shock absorber,
and a variable shock absorber as an active damping force that is automatically controlled by an integrated regulator. In this type of system, the conventional spring element is retained, but the damper is replaced with a controllable damper [6].

In this work, two degrees and three degrees of freedom passive suspension system are designed. Sprung mass displacement for passive suspension system with and without tire damping are analysed by changing different damping effects. Matlab Simulink is used for analysing of the suspension system.

II. QUARTER CAR MODEL

A quarter car model consists of the wheel and its attachments, the tire, the suspension elements and quarter chassis and its rigidly connected parts. Quarter car model is very often used for suspension analysis because it is simple and can capture important characteristics of full model. The quarter car model is used extensively in studying the vehicle dynamics. Many researchers consider this model as a two degree of freedom by considering only the tire wheel assembly and the sprung mass. In this work, not only two degree of freedom but also three degree of freedom quarter model is analyzed by considering the passengers and seat. Parameters of quarter car model for front and rear suspension are shown in Table I.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Front suspension</th>
<th>Rear suspension</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger seat stiffness</td>
<td>3923.966</td>
<td>6014.868</td>
<td>N/m</td>
</tr>
<tr>
<td>Suspension spring stiffness</td>
<td>17822.932</td>
<td>36049.070</td>
<td>N/m</td>
</tr>
<tr>
<td>Tire stiffness</td>
<td>190000</td>
<td>190000</td>
<td>N/m</td>
</tr>
<tr>
<td>Tire damping coefficient</td>
<td>1150</td>
<td>1150</td>
<td>Ns/m</td>
</tr>
<tr>
<td>Road input</td>
<td>0.1</td>
<td>0.1</td>
<td>m</td>
</tr>
</tbody>
</table>

In design calculation of passive suspension system, firstly, the total sprung weight, unsprung weight and passenger seat weight are calculated. Then, sprung mass displacement of suspension system are analysed by using Matlab program. Table II shows the specification and technical data of a solar vehicle.

<table>
<thead>
<tr>
<th>Technical Category</th>
<th>Dimensions</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle gross weight</td>
<td>490</td>
<td>kg</td>
</tr>
<tr>
<td>Vehicle net weight</td>
<td>310</td>
<td>kg</td>
</tr>
<tr>
<td>Weight of solar panel</td>
<td>46</td>
<td>kg</td>
</tr>
<tr>
<td>Weight of motor</td>
<td>24</td>
<td>kg</td>
</tr>
<tr>
<td>Weight of batteries</td>
<td>168</td>
<td>kg</td>
</tr>
<tr>
<td>Seating capacity</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Weight of person</td>
<td>180</td>
<td>kg</td>
</tr>
<tr>
<td>Weight of seat</td>
<td>5</td>
<td>kg</td>
</tr>
</tbody>
</table>

The design procedure of total sprung weight involves the following steps:

A. Calculation of the unsprung weight

In today's standard size automobile, the weight of unsprung components is normally in the range of 13 to 15 percent of the vehicle net weight.

Unsprung weight = 0.15 × vehicle net weight  

(1)

B. Calculation of total unsprung weight

Total unsprung weight can be calculated as

Total unsprung weight = unsprung weight + motor weight  

(2)
C. Calculation of the sprung weight

Gross vehicle weight is the sum of unsprung weight and sprung weight. Sprung weight can be calculated as

\[ \text{Sprung weight} = \text{gross weight} - \text{unsprung weight} \]  

(3)

D. Calculation of total sprung weight

The total sprung weight of solar vehicle can be calculated as

\[ \text{Total sprung weight} = \text{sprung weight} + \text{solar weight} \]  

(4)

E. Calculation of passenger and seat weight

The passenger and seat mass of solar vehicle can be calculated as

\[ \text{Passenger and seat weight} = \text{person weight} + \text{seat weight} \]  

(5)

F. Calculation of weight on quarter car model

By using quarter car model approach, load on each suspension is one fourth of the weight on suspension.

\[ \text{Load on each suspension} = \frac{1}{4} \times \text{weight on suspension} \]  

(6)

G. Calculation of critical damping

Critical damping can be calculated as

\[ c_c = 2\sqrt{k \times m} \]  

(7)

H. Calculation of damping coefficient

Suspension damping and seat damping can be calculated as follow:

Damping ratio is 0.3 [2]

\[ c_s = \xi \times c_c \]  

(8)

The result table of weights acting on quarter car model are shown in Table III

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Results</th>
<th>units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sprung weight</td>
<td>116.375</td>
<td>kg</td>
</tr>
<tr>
<td>Total unsprung weight</td>
<td>17.625</td>
<td>kg</td>
</tr>
<tr>
<td>Seat and passenger weight</td>
<td>46.25</td>
<td>kg</td>
</tr>
<tr>
<td>Front suspension damping coefficient</td>
<td>864.113</td>
<td>N/m</td>
</tr>
<tr>
<td>Rear suspension damping coefficient</td>
<td>1228.933</td>
<td>N/m</td>
</tr>
<tr>
<td>Front seat damping coefficient</td>
<td>255.605</td>
<td>Ns/m</td>
</tr>
<tr>
<td>Rear seat damping coefficient</td>
<td>316.461</td>
<td>Ns/m</td>
</tr>
</tbody>
</table>

III. TWO DEGREE OF FREEDOM PASSIVE SUSPENSION

Sprung mass displacement is considered depend on two degree of freedom quarter car model depend on without and without tire damping in this part.

A. Two Degree of Freedom without Tire Damping

Modeling of two degree of freedom quarter car suspension without tire damping is shown in Figure 1.
where,

\[ m_s = \text{sprung mass} \]
\[ m_u = \text{unsprung mass} \]
\[ k_s = \text{suspension spring stiffness} \]
\[ k_t = \text{tire stiffness} \]
\[ c_s = \text{suspension damping coefficient} \]
\[ y = \text{road input (height of speed bump)} \]
\[ x_1 = \text{sprung mass vertical movement} \]
\[ x_2 = \text{unsprung mass vertical movement} \]

The equations of motion for sprung and unsprung mass are written as follows:

For sprung mass,
\[
\begin{align*}
  m_s \ddot{x}_1 &= -k_s(x_1 - x_2) - c_s(\dot{x}_1 - \dot{x}_2) \\

\end{align*}
\]

For unsprung mass,
\[
\begin{align*}
  m_u \ddot{x}_2 &= -k_t(x_2 - y) + k_s(x_1 - x_2) + c_s(\dot{x}_1 - \dot{x}_2) \\

\end{align*}
\]

Let
\[
Z_1 = x_1, \quad Z_2 = \dot{x}_1, \\
Z_3 = x_2, \quad Z_4 = \dot{x}_2
\]

Sprung and unsprung mass equation are become
\[
\begin{align*}
  \dot{Z}_2 &= -\frac{k_s}{m_s} Z_1 + \frac{k_s}{m_s} Z_3 - \frac{c_s}{m_s} Z_2 + \frac{c_s}{m_s} Z_4 \\
  \dot{Z}_4 &= \frac{k_s}{m_u} Z_1 - \frac{k_s}{m_u} Z_3 + \frac{c_s}{m_u} Z_2 - \frac{c_s}{m_u} Z_4 - \frac{k_t}{m_u} Z_3 + \frac{k_t}{m_u} y
\end{align*}
\]

State space model
\[
\begin{align*}
  \dot{Z} &= AZ + Bu \\
  Y &= CZ + Du
\end{align*}
\]

where,  
\[
\begin{align*}
  A &= \text{state space matrix} \\
  B &= \text{input matrix} \\
  C &= \text{output matrix} \\
  D &= \text{direct transmission matrix} \\
  u &= \text{input of system}
\end{align*}
\]

State variable are \( Z_1, Z_2, Z_3, Z_4 \)
State space vector matrix can be written as
\[
\begin{bmatrix}
\dot{Z}_1 \\
\dot{Z}_2 \\
\dot{Z}_3 \\
\dot{Z}_4
\end{bmatrix} =
\begin{bmatrix}
0 & 0 & 0 & 0 \\
-k_s & -c_s & 0 & 0 \\
0 & m_s & m_s & 0 \\
-k_m & -c_m & 0 & m_u
\end{bmatrix}
\begin{bmatrix}
Z_1 \\
Z_2 \\
Z_3 \\
Z_4
\end{bmatrix}
+ \begin{bmatrix}
0 \\
0 \\
0 \\
0
\end{bmatrix}
\begin{bmatrix}
y_0 \\
y_1 \\
y_2 \\
y_3
\end{bmatrix}
\]

Output matrix can be written as
\[
\begin{bmatrix}
x_1 \\
x_2
\end{bmatrix} =
\begin{bmatrix}
1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
Z_1 \\
Z_2 \\
Z_3 \\
Z_4
\end{bmatrix}
+ \begin{bmatrix}
0 \\
0
\end{bmatrix}
\begin{bmatrix}
y_0 \\
y_1 \\
y_2 \\
y_3
\end{bmatrix}
\]

Matlab program can be used to analyze sprung mass displacement and settling time of a two degree of freedom quarter car model.

The sprung mass displacement of front suspension without tire damping is shown in Figure 2. According from these figures, maximum overshoot is 0.1559 m and settling time occurs at 2 sec.

The sprung mass displacement of rear suspension without tire damping is shown in Figure 3.
The sprung mass displacement of rear suspension without tire damping is shown in Figure 3. According from these figures, maximum overshoot is 0.1564 m and settling time occur at 2 sec.

![Figure 4. Sprung Mass Displacement using Various Damping Ratio for Front Suspension without Tire Damping](image1)

Sprung mass displacement is also analyzed by using different damping ratios. Figure 4 show sprung mass displacement using various damping ratio for front suspension without tire damping. As a result, maximum displacement is 0.1624m and maximum settling time is 2.5s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time. Therefore, the greater the damping ratio, the more comfortable the passenger.

![Figure 5. Sprung Mass Displacement using Various Damping Ratio for Rear Suspension without Tire Damping](image2)

Sprung mass displacement using various damping ratio for rear suspension without tire damping is shown in Figure 5. As a result, maximum displacement is 0.1669m and maximum settling time is 2.5s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time. Therefore, the greater the damping ratio, the more comfortable the passenger.

**B. Two Degree of Freedom Suspension System with Tire Damping**

Modeling of two degree of freedom quarter car suspension with tire damping is shown in Figure 6.
The equations of motion for sprung and unsprung mass are written as follows:

For sprung mass,

\[ m_s \ddot{x}_1 = -k_s (x_1 - x_2) - c_s (\dot{x}_1 - \dot{x}_2) \]

For unsprung mass,

\[ m_u \ddot{x}_2 = k_t (x_1 - x_2) - k_t (x_2 - y) - c_t (\dot{x}_2 - \dot{y}) + c_s (\dot{x}_1 - \dot{x}_2) \]

Let, \( \dot{x}_1 = V_1, \quad \dot{x}_2 = V_2, \quad \Delta = (x_1 - x_2) \quad \Delta = (V_1 - V_2) \)

From sprung mass equation

\[ m_s \dot{V}_1 + k_s \Delta + c_s (V_1 - V_2) = 0 \]

\[ \dot{V}_1 = -\frac{k_s}{m_s} \Delta - \frac{c_s}{m_s} (V_1 - V_2) \tag{9} \]

From unsprung mass equation

\[ m_u \ddot{V}_2 = -k_t x_2 - c_t V_2 + k_s \Delta + c_s (V_1 - V_2) + k_t y + c_t \dot{y} \]

\[ \dot{V}_2 - \frac{c_t}{m_u} \dot{y} = -\frac{k_t}{m_u} x_2 + \frac{k_s}{m_u} \Delta + c_s (V_1 - V_2) \]

\[ + \left( \frac{c_s + c_t}{m_u} \right) V_2 + \frac{k_t}{m_u} y \tag{10} \]

Let \( T = V_2 - \frac{c_t}{m_u} \dot{y} \)

\[ T = V_2 - \frac{c_t}{m_u} y \]

\[ V_2 = T + \frac{c_t}{m_u} y \tag{11} \]

Substitute Equation (11) in Equation (10)

\[ T = \frac{k_t}{m_u} x_2 + \frac{k_s}{m_u} \Delta + \frac{c_s + c_t}{m_u} V_1 - \left( \frac{c_s + c_t}{m_u} \right) T + \left[ -\frac{c_s c_t}{m_u^2} - \frac{c_t^2}{m_u^2} + \frac{k_t}{m_u} \right] y \]

\[ \Delta = V_1 - \left[ T + \frac{c_t}{m_u} y \right] \]
From Equation (8)

\[
\begin{align*}
\dot{V}_1 &= -\frac{k_s}{m_s} \Delta - \frac{c_s}{m_s} V_1 + \frac{c_s}{m_s} \left[ T + \frac{c_t}{m_u} y \right] \\
\dot{V}_1 &= -\frac{k_s}{m_s} \Delta - \frac{c_s}{m_s} V_1 + \frac{c_s}{m_s} T + \left( \frac{c_s c_t}{m_s m_u} \right) V_1
\end{align*}
\]

State space model

\[
\dot{Z} = AZ + Bu
\]
\[Y = CZ + Du\]

State variable are \(x_2, \Delta, V_1, T\)

State space vector matrix can be written as

\[
\begin{bmatrix}
\dot{x}_2 \\
\Delta \\
\dot{V}_1 \\
T
\end{bmatrix} = 
\begin{bmatrix}
0 & 0 & 0 & 1 \\
0 & 0 & 1 & -1 \\
0 & -\frac{k_s}{m_s} & -\frac{c_s}{m_s} & \frac{c_s}{m_s} \\
-\frac{k_t}{m_u} & \frac{k_s}{m_u} & \frac{c_s}{m_u} & \left( \frac{c_s + c_t}{m_u} \right)
\end{bmatrix}
\begin{bmatrix}
x_2 \\
\Delta \\
V_1 \\
T
\end{bmatrix} + 
\begin{bmatrix}
\frac{c_t}{m_u} \\
-\frac{c_t}{m_u} \\
-\frac{c_s c_t}{m_s m_u} \\
\frac{c_t^2}{m_u} + \frac{k_t}{m_u}
\end{bmatrix}
\]

Output matrix

\[
\begin{bmatrix}
x_1 \\
V_1 \\
x_2 \\
V_2
\end{bmatrix} = 
\begin{bmatrix}
1 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 \\
1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
x_2 \\
\Delta \\
V_1 \\
T
\end{bmatrix} + 
\begin{bmatrix}
0 \\
0 \\
0 \\
\frac{c_t}{m_u}
\end{bmatrix}
\]

Matlab program can be used to analyze sprung mass displacement and settling time of a two degree of freedom quarter car model.

![Figure 7. Sprung Mass Displacement with Tire Damping for Front Suspension](image-url)

The sprung mass displacement of front suspension with tire damping is shown in Figure 7. In this figure, maximum overshoot is 0.1503 m and settling time occurs at 2 sec.
The sprung mass displacement of rear suspension with tire damping is shown in Figure 8. In this figure, maximum overshoot is 0.1548 m and settling time occurs at 2 sec.

Sprung mass displacement is also analyzed by using different damping ratios from 0.2 to 0.4. Figure 9 show sprung mass displacement using various damping ratio for front suspension with tire damping. As a result, maximum displacement is 0.1617 m and maximum settling time is 2.5 s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time. Therefore, the greater the damping ratio, the more comfortable the passenger.

Figure 8. Sprung Mass Displacement with Tire Damping for Rear Suspension

Figure 9. Sprung Mass Displacement using Various Damping Ratio for Front Suspension with Tire Damping

Figure 10. Sprung Mass Displacement using Various Damping Ratio for Rear Suspension with Tire Damping
Sprung mass displacement is also analyzed by using different damping ratios from 0.2 to 0.4. Figure 10 shows sprung mass displacement using various damping ratio for rear suspension with tire damping. As a result, maximum displacement is 0.1651 m and maximum settling time is 2.5s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time. Therefore, the greater the damping ratio, the more comfortable the passenger.

C. Comparison of Two Degree of Freedom Suspension System without and with Tire Damping

Sprung mass displacement of two DOF suspension system without tire damping is compared with suspension system with tire damping for front and rear suspension. The comparison for front suspension is shown in Table IV.

<table>
<thead>
<tr>
<th>Damping ratio $\xi$</th>
<th>Sprung mass displacement with tire damping, $X_1$, m</th>
<th>Sprung mass displacement without tire damping, $X_1$, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\xi = 0.2$</td>
<td>0.1617</td>
<td>0.1624</td>
</tr>
<tr>
<td>$\xi = 0.25$</td>
<td>0.1556</td>
<td>0.1562</td>
</tr>
<tr>
<td>$\xi = 0.3$</td>
<td>0.1503</td>
<td>0.1509</td>
</tr>
<tr>
<td>$\xi = 0.35$</td>
<td>0.1460</td>
<td>0.1464</td>
</tr>
<tr>
<td>$\xi = 0.4$</td>
<td>0.1421</td>
<td>0.1425</td>
</tr>
</tbody>
</table>

In Table IV, the sprung mass displacement is analysed by using various damping ratio range from 0.2 to 0.4. The greatest sprung mass displacement for without and with tire damping occur at damping ratio 0.2 and the smallest sprung mass displacement occurs at damping ratio 0.4. It is observed that suspension system with tire damping is more comfortable than without tire damping for all different damping ratios.

<table>
<thead>
<tr>
<th>Damping ratio $\xi$</th>
<th>Sprung mass displacement with tire damping, $X_1$, m</th>
<th>Sprung mass displacement without tire damping, $X_1$, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\xi = 0.2$</td>
<td>0.1651</td>
<td>0.1669</td>
</tr>
<tr>
<td>$\xi = 0.25$</td>
<td>0.1596</td>
<td>0.1614</td>
</tr>
<tr>
<td>$\xi = 0.3$</td>
<td>0.1548</td>
<td>0.1564</td>
</tr>
<tr>
<td>$\xi = 0.35$</td>
<td>0.1507</td>
<td>0.1523</td>
</tr>
<tr>
<td>$\xi = 0.4$</td>
<td>0.1449</td>
<td>0.1486</td>
</tr>
</tbody>
</table>

The comparison of sprung mass displacement with and without tire damping for rear suspension is shown in Table V. In Table V, the sprung mass displacement is analysed by using various damping ratio range from 0.2 to 0.4. The greatest sprung mass displacement for without and with tire damping occur at damping ratio 0.2 and the smallest sprung mass displacement occurs at damping ratio 0.4. It is observed that suspension system with tire damping is more comfortable than without tire damping for all different damping ratios.

IV. THREE DEGREE OF FREEDOM PASSIVE SUSPENSION

Seat displacement and sprung mass displacement are also considered depend on three degree of freedom quarter car model.

A. Three Degree of Freedom Suspension System without Tire Damping

Modeling of three degree of freedom, quarter car model without tire damping is shown in Figure 11.
Let \( x_1, x_2, x_3 \) be the vertical movements of the seat mass, sprung mass, and unsprung mass respectively.

![Diagram of three degree of freedom model](image)

**Figure 11. Modeling of Three Degree of Freedom without Tire Damping**

where,

- \( m_{se} \) = passenger and seat mass
- \( k_{se} \) = passenger seat stiffness
- \( k_s \) = suspension spring stiffness
- \( k_t \) = tire stiffness
- \( c_s \) = suspension damping coefficient
- \( x_1 \) = passenger seat mass vertical movement
- \( x_2 \) = sprung mass vertical movement
- \( x_3 \) = unsprung mass vertical movement

Equation of motion can be written from the free body diagram:

For seat and person mass:

\[
m_{se} \ddot{x}_{1} = -k_{se}(x_{1} - x_{2}) - c_{se}(\dot{x}_{1} - \dot{x}_{2})
\]

For sprung mass:

\[
m_s \ddot{x}_{2} = k_s(x_{1} - x_{2}) + c_s(\dot{x}_{1} - \dot{x}_{2}) - k_s(x_2 - x_3) - c_s(\dot{x}_{2} - \dot{x}_{3})
\]

For unsprung mass:

\[
m_u \ddot{x}_{3} = k_t(x_{2} - x_3) + c_t(\dot{x}_{2} - \dot{x}_{3}) - k_{t}(x_3 - y)
\]

Let \( Z_1 = x_1, Z_2 = \dot{x}_1, Z_3 = x_2, Z_4 = \dot{x}_2, Z_5 = x_3, Z_6 = \dot{x}_3 \)

From seat and person mass equation:

\[
m_{se} \dot{Z}_2 = -k_{se}(Z_1 - Z_3) - c_{se}(Z_2 - Z_4)
\]

\[
\dot{Z}_2 = -\frac{k_{se}}{m_{se}} Z_1 - \frac{c_{se}}{m_{se}} Z_2 + \frac{k_s}{m_{se}} Z_3 + \frac{c_s}{m_{se}} Z_4
\]

From sprung mass equation:

\[
m_s \dot{Z}_4 = k_{se}(Z_1 - Z_3) + c_{se}(Z_2 - Z_4) - k_s(Z_3 - Z_5) - c_s(Z_4 - Z_6)
\]

\[
\dot{Z}_4 = \frac{k_{se}}{m_s} Z_1 + \frac{c_{se}}{m_s} Z_2 - \frac{k_{se}}{m_s} Z_3 - \frac{c_{se}}{m_s} Z_4 - \frac{k_s}{m_s} Z_3 + \frac{k_s}{m_s} Z_5 - \frac{c_s}{m_s} Z_4 + \frac{c_s}{m_s} Z_6
\]
From unsprung mass equation
\[ m_u \ddot{Z}_6 = k_s (Z_3 - Z_5) + c_s (Z_4 - Z_6) - k_t (Z_5 - y) \]
\[ \ddot{Z}_6 = \frac{k_s}{m_u} Z_3 - \frac{k_s}{m_s} Z_5 + \frac{c_s}{m_u} Z_4 - \frac{c_s}{m_s} Z_6 - \frac{k_t}{m_u} Z_5 + \frac{k_t}{m_s} y \]

State space model
\[ \dot{Z} = AZ + Bu \]
\[ Y = CZ + Du \]

State variable are \( Z_1, Z_2, Z_3, Z_4, Z_5, Z_6 \)

State space vector matrix can be written as
\[
\begin{bmatrix}
\dot{Z}_1 \\
\dot{Z}_2 \\
\dot{Z}_3 \\
\dot{Z}_4 \\
\dot{Z}_5 \\
\dot{Z}_6 \\
\end{bmatrix} = \begin{bmatrix}
-\frac{k_se}{m_e} & 1 & \frac{i_se}{m_e} & 0 & 0 & 0 \\
0 & 0 & 0 & \frac{k_se}{m_e} & \frac{i_se}{m_e} & 0 \\
0 & \frac{k_se}{m_s} & \frac{i_se}{m_s} & -\left(\frac{k_se + k_s}{m_s}\right) & -\left(\frac{i_se + c_s}{m_s}\right) & \frac{k_s}{m_s} \\
0 & 0 & 0 & \frac{k_se}{m_u} & \frac{i_se}{m_u} & -\left(\frac{k_se + k_t}{m_u}\right) - \frac{c_s}{m_u} \\
0 & 0 & 0 & \frac{k_se}{m_u} & \frac{i_se}{m_u} & -\left(\frac{k_se + k_t}{m_u}\right) - \frac{c_s}{m_u} \\
0 & 0 & 0 & \frac{k_se}{m_u} & \frac{i_se}{m_u} & -\left(\frac{k_se + k_t}{m_u}\right) - \frac{c_s}{m_u} \\
\end{bmatrix}
\begin{bmatrix}
Z_1 \\
Z_2 \\
Z_3 \\
Z_4 \\
Z_5 \\
Z_6 \\
\end{bmatrix} + \begin{bmatrix}
0 \\
0 \\
0 \\
0 \\
0 \\
0 \\
\end{bmatrix}
\]

Output matrix can be written as
\[
\begin{bmatrix}
x_1 \\
x_2 \\
x_3 \\
x_4 \\
x_5 \\
x_6 \\
\end{bmatrix} = \begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 \\
\end{bmatrix}
\begin{bmatrix}
Z_1 \\
Z_2 \\
Z_3 \\
Z_4 \\
Z_5 \\
Z_6 \\
\end{bmatrix} + \begin{bmatrix}
0 \\
0 \\
0 \\
0 \\
0 \\
0 \\
\end{bmatrix}
\]

Matlab program can be used to analyze seat mass and sprung mass displacement of a three degree of freedom quarter car model.

![Figure 12. Seat Displacement of Front suspension without Tire Damping](image)

The seat mass displacement of front suspension without tire damping is shown in Figure 12. In this figure, maximum overshoot is 0.1836 m and settling time occurs at 3 sec.
Figure 13. Sprung Mass Displacement of Front suspension without Tire Damping

The sprung mass displacement of front suspension without tire damping is shown in Figure 13. In this figure, maximum overshoot is 0.1351 m and settling time occurs at 2 sec.

Figure 14. Seat Mass Displacement of Rear suspension without Tire Damping

The seat mass displacement of rear suspension without tire damping is shown in Figure 14. In this figure, maximum overshoot is 0.1854 m and settling time occurs at 3 sec.

Figure 15. Sprung Mass Displacement of Rear suspension without Tire Damping

The sprung mass displacement of rear suspension without tire damping is shown in Figure 15. In this figure, maximum overshoot is 0.1393 m and settling time occurs at 2 sec.
Seat mass and sprung mass displacement for front and rear suspension are analyzed by using different damping ratio from 0.2 to 0.4.

Figure 16. Seat Mass Displacement of Different Damping Ratio for Front Suspension without Tire Damping

Figure 16 shows seat mass displacement using various damping ratio for front suspension without tire damping. As a result, maximum displacement is 0.2039 m and maximum settling time is 4s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time. Therefore, the greater the damping ratio, the more comfortable the passenger.

Figure 17. Sprung Mass Displacement of Different Damping Ratio for Front Suspension without Tire Damping

Sprung mass displacement is also analyzed by using different damping ratios from 0.2 to 0.4. Figure 17 shows sprung mass displacement using various damping ratio for front suspension without tire damping. As a result, maximum displacement is 0.1419m and maximum settling time is 4s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time.
Figure 18. Seat Mass Displacement of Different Damping Ratio for Rear Suspension without Tire Damping

Seat mass displacement is also analyzed by using different damping ratios from 0.2 to 0.4. Figure 18 shows seat mass displacement using various damping ratio for rear suspension without tire damping. As a result, maximum displacement is 0.2049 m and maximum settling time is 4s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time.

Figure 19. Sprung Mass Displacement of Different Damping ratio for Rear Suspension without Tire Damping

Sprung mass displacement is also analyzed by using different damping ratios from 0.2 to 0.4. Figure 17 shows sprung mass displacement using various damping ratio for front suspension without tire damping. As a result, maximum displacement is 0.1466 m and maximum settling time is 4s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time.

B. Three Degree of Freedom Suspension System with Tire Damping

Seat displacement and sprung mass displacement are also considered depend on three degree of freedom quarter car model. Modeling of quarter car with tire damping is shown in Figure 18.
Let \( x_1, x_2, x_3, y \)

<table>
<thead>
<tr>
<th>x_1</th>
<th>Seat mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>k_{se}</td>
<td>m_{se}</td>
</tr>
<tr>
<td>c_{se}</td>
<td>m_{se}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>x_2</th>
<th>Sprung mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>k_s</td>
<td>m_s</td>
</tr>
<tr>
<td>c_s</td>
<td>m_s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>x_3</th>
<th>Unsprung mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>k_t</td>
<td>m_u</td>
</tr>
<tr>
<td>c_t</td>
<td>m_u</td>
</tr>
</tbody>
</table>

Figure 18. Modeling of Three Degree of Freedom with Tire Damping

Equation of motion can be written from the free body diagram:

For passenger and seat mass:

\[
m_{se} \ddot{x}_1 = -k_{se}(x_1 - x_2) - c_{se}(\dot{x}_1 - \dot{x}_2)
\]

For sprung mass:

\[
m_s \ddot{x}_2 = k_{se}(x_1 - x_2) + c_{se}(\dot{x}_1 - \dot{x}_2) - k_s(x_2 - x_3) - c_s(\dot{x}_2 - \dot{x}_3)
\]

For unsprung mass:

\[
m_u \ddot{x}_3 = k_s(x_2 - x_3) + c_s(\dot{x}_2 - \dot{x}_3) - k_t(x_3 - y) - c_t(\dot{x}_3 - \dot{y})
\]

Let \( x_1 = V_1, x_2 = V_2, x_3 = V_3 \)

\[
\Delta_1 = (x_1 - x_2), \quad \Delta_2 = (x_2 - x_3)
\]

From seat and person equation,

\[
m_{se} \dot{V}_1 = -k_{se} \Delta_1 - c_{se}(V_1 - V_2)
\]

\[
\dot{V}_1 = \frac{-k_{se}}{m_{se}} \Delta_1 - \frac{c_{se}}{m_{se}} (V_1 - V_2)
\]

For sprung mass equation

\[
m_s \dot{V}_2 = k_{se} \Delta_1 + c_{se}(V_1 - V_2) - k_s \Delta_2 - c_s(V_2 - V_3)
\]

\[
\dot{V}_2 = \frac{k_{se}}{m_s} \Delta_1 + \frac{c_{se}}{m_s} (V_1 - V_2) - \frac{k_s}{m_s} \Delta_2 - \frac{c_s}{m_s} (V_2 - V_3)
\]

For unsprung mass:

\[
m_u \dot{V}_3 = k_s \Delta_2 + c_s(V_2 - V_3) - k_t(x_3 - y) - c_t(V_3 - y)
\]

\[
\dot{V}_3 = \frac{k_s}{m_u} \Delta_2 + \frac{c_s}{m_u} V_2 - \frac{k_t}{m_u} x_3 + \frac{c_t}{m_u} y
\]

\[
\dot{V}_3 - \frac{c_t}{m_u} \dot{y} = \frac{k_s}{m_u} \Delta_2 + \frac{c_s}{m_u} V_2 - \left[\frac{c_s}{m_u} + \frac{c_t}{m_u}\right] V_3 - \frac{k_t}{m_u} x_3 + \frac{k_t}{m_u} y
\]
Let \( \dot{T} = \dot{V}_3 - \frac{c_t}{m_u} \dot{y} \)

\[
T = V_3 - \frac{c_t}{m_u} y
\]

\[
V_3 = T + \frac{c_t}{m_u} y
\] (15)

Equation (15) substitute in equation (14)

\[
\dot{T} = \frac{k_s}{m_u} \Delta_2 + \frac{c_s}{m_u} V_2 \left[ \frac{c_s}{m_u} + \frac{c_t}{m_u} \right] T + \frac{c_t}{m_u} y - \frac{k_t}{m_u} x_3 + \frac{k_t}{m_u} y
\]

\[
\dot{T} = \frac{k_s}{m_u} \Delta_2 + \frac{c_s}{m_u} V_2 \left( \frac{c_s + c_t}{m_u} \right) T + \left[ \frac{c_s c_t}{m_u^2} - \frac{c_t^2}{m_u^2} \right] y - \frac{k_t}{m_u} x_3 + \frac{k_t}{m_u} y
\] (16)

\[
\dot{\Delta}_2 = V_2 - V_3
\]

\[
\dot{\Delta}_2 = V_2 - \left[ T + \frac{c_t}{m_u} y \right]
\] (17)

Equation (15) substitute in equation (13)

\[
\dot{V}_2 = \frac{k_{se}}{m_s} \Delta_1 + \frac{c_{se}}{m_s} \left( V_1 - V_2 \right) - \frac{k_s}{m_s} \Delta_2 - \frac{c_s}{m_s} \left( V_2 - V_3 \right)
\]

\[
\dot{V}_2 = \frac{k_{se}}{m_s} \Delta_1 + \frac{c_{se}}{m_s} V_1 - \frac{k_{se}}{m_s} \Delta_2 - \frac{k_s}{m_s} \Delta_2 - \frac{c_s}{m_s} V_2 + \frac{c_s}{m_s} \left[ T + \frac{c_t}{m_u} y \right]
\]

\[
\dot{V}_2 = \frac{k_{se}}{m_s} \Delta_1 + \frac{c_{se}}{m_s} V_1 - \left[ \frac{c_{se}}{m_s} + \frac{c_t}{m_u} \right] V_2 - \frac{k_s}{m_s} \Delta_2 - \frac{c_s}{m_s} T + \frac{c_s c_t}{m_s m_u} y
\]

State variable are \( x_3, \Delta_1, \Delta_2, V_1, V_2, T \)

State space vector matrix can be written as
Output matrix is

\[
\begin{bmatrix}
    x_1 \\
    \dot{x}_1 \\
    x_2 \\
    \dot{x}_2
\end{bmatrix}
= \begin{bmatrix}
    1 & 1 & 0 & 0 & 0 \\
    1 & -1 & 1 & 0 & 0 \\
    0 & 0 & 0 & 0 & 1 \\
    0 & 0 & 0 & 1 & 1
\end{bmatrix}
\begin{bmatrix}
    x_3 \\
    \Delta_1 \\
    \Delta_2 \\
    V_1 \\
    V_2 \\
    T
\end{bmatrix}
+ \begin{bmatrix}
    0 \\
    0 \\
    0 \\
    0 \\
    0
\end{bmatrix}
\]

Matlab program can be used to analyze seat mass and sprung mass displacement of a three degree of freedom quarter car model.

Figure 19. Seat Mass Displacement of Front Suspension for with Tire Damping

The seat mass displacement of front suspension without tire damping is shown in Figure 19. In this figure, maximum overshoot is 0.1581 m and settling time occurs at 3 sec.

Figure 20. Sprung Mass Displacement of Front Suspension for with Tire Damping

The sprung mass displacement of front suspension with tire damping is shown in Figure 20. In this figure, maximum overshoot is 0.1301 m and settling time occurs at 2 sec.

The seat mass displacement of rear suspension with tire damping is shown in Figure 21. In this figure, maximum overshoot is 0.1590 m and settling time occurs at 3 sec.
The sprung mass displacement of rear suspension with tire damping is shown in Figure 22. In this figure, maximum overshoot is 0.1331 m and settling time occurs at 2 sec.

The sprung mass displacement of rear suspension with tire damping is shown in Figure 22. In this figure, maximum overshoot is 0.1331 m and settling time occurs at 2 sec.
Figure 23 shows seat mass displacement using various damping ratio for front suspension with tire damping. As a result, maximum displacement is 0.1698 m and maximum settling time is 4s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time.

![Figure 23](image)

Figure 24. Sprung Mass Displacement of Different Damping Ratio for Front suspension with Tire Damping

Figure 24 shows sprung mass displacement using various damping ratio for front suspension with tire damping. As a result, maximum displacement is 0.1375 m and maximum settling time is 4s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time.

![Figure 24](image)

Figure 25 shows seat mass displacement using various damping ratio for rear suspension with tire damping. As a result, maximum displacement is 0.1714 m and maximum settling time is 4s which occur at the smallest damping ratio. The more the damping ratio, the less the sprung mass displacement and settling time.

![Figure 25](image)

Figure 25. Seat Mass Displacement of Different Damping Ratio for Rear Suspension with Tire Damping

Sprung mass displacement using various damping ratio for rear suspension with tire damping is shown in Figure 26. According from this figure, the maximum displacement is 0.1392 m and maximum settling time is 4s which occur at the smallest damping ratio. The minimum displacement is 0.1296m and minimum settling time is 2 s which occurs at the greatest damping ratio. Therefore, the greater the damping ratio, the more comfortable the passenger.
C. Comparison of Three Degree of Suspension System without and with Tire Damping

Seat mass and sprung mass displacement of three DOF suspension system without tire damping is compared with suspension system with tire damping for front and rear suspension. The comparison of seat mass displacement for front suspension is shown in Table VI.

<table>
<thead>
<tr>
<th>Damping ratio $\xi$</th>
<th>Seat mass displacement with tire damping, $X_1$, m</th>
<th>Seat mass displacement without tire damping, $X_1$, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\xi = 0.2$</td>
<td>0.1698</td>
<td>0.2039</td>
</tr>
<tr>
<td>$\xi = 0.25$</td>
<td>0.1636</td>
<td>0.1928</td>
</tr>
<tr>
<td>$\xi = 0.3$</td>
<td>0.1581</td>
<td>0.1836</td>
</tr>
<tr>
<td>$\xi = 0.35$</td>
<td>0.1531</td>
<td>0.1758</td>
</tr>
<tr>
<td>$\xi = 0.4$</td>
<td>0.1488</td>
<td>0.1692</td>
</tr>
</tbody>
</table>

In Table VI, the seat mass displacement is analysed by using various damping ratio range from 0.2 to 0.4. The greatest seat mass displacement for without and with tire damping occur at damping ratio 0.2 and the smallest seat mass displacement occurs at damping ratio 0.4. It is observed that suspension system with tire damping is more comfortable than without tire damping for all different damping ratios.

<table>
<thead>
<tr>
<th>Damping ratio $\xi$</th>
<th>Sprung mass displacement with tire damping, $X_2$, m</th>
<th>Sprung mass displacement without tire damping, $X_2$, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\xi = 0.2$</td>
<td>0.1375</td>
<td>0.1419</td>
</tr>
<tr>
<td>$\xi = 0.25$</td>
<td>0.1335</td>
<td>0.1381</td>
</tr>
<tr>
<td>$\xi = 0.3$</td>
<td>0.1301</td>
<td>0.1351</td>
</tr>
<tr>
<td>$\xi = 0.35$</td>
<td>0.1134</td>
<td>0.1325</td>
</tr>
<tr>
<td>$\xi = 0.4$</td>
<td>0.1258</td>
<td>0.1303</td>
</tr>
</tbody>
</table>

The comparison of sprung mass displacement for front suspension is shown in Table VII. In this table, the sprung mass displacement is analysed by using various damping ratio range from 0.2 to 0.4. The greatest sprung mass displacement for without and with tire damping occur at damping ratio 0.2 and the smallest sprung mass displacement occurs at damping ratio 0.4. It is observed that suspension system with tire damping is more comfortable than without tire damping for all different damping ratios.
TABLE VIII
COMPARISON OF SEAT MASS DISPLACEMENT FOR REAR SUSPENSION

<table>
<thead>
<tr>
<th>Damping ratio $\xi$</th>
<th>Seat mass displacement with tire damping, $X_1$, m</th>
<th>Seat mass displacement without tire damping, $X_1$, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\xi = 0.2$</td>
<td>0.1714</td>
<td>0.2049</td>
</tr>
<tr>
<td>$\xi = 0.25$</td>
<td>0.1647</td>
<td>0.1943</td>
</tr>
<tr>
<td>$\xi = 0.3$</td>
<td>0.1590</td>
<td>0.1854</td>
</tr>
<tr>
<td>$\xi = 0.35$</td>
<td>0.1539</td>
<td>0.1778</td>
</tr>
<tr>
<td>$\xi = 0.4$</td>
<td>0.1494</td>
<td>0.1695</td>
</tr>
</tbody>
</table>

The comparison of seat mass displacement for rear suspension is shown in Table VIII. In this table, the seat mass displacement is analysed by using various damping ratio range from 0.2 to 0.4. The greatest seat mass displacement for without and with tire damping occur at damping ratio 0.2 and the smallest seat mass displacement occurs at damping ratio 0.4. It is observed that suspension system with tire damping is more comfortable than without tire damping for all different damping ratios.

TABLE VII
COMPARISON OF SPRUNG MASS DISPLACEMENT FOR REAR SUSPENSION

<table>
<thead>
<tr>
<th>Damping ratio $\xi$</th>
<th>Sprung mass displacement with tire damping, $X_2$, m</th>
<th>Sprung mass displacement without tire damping, $X_2$, m</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\xi = 0.2$</td>
<td>0.1392</td>
<td>0.1466</td>
</tr>
<tr>
<td>$\xi = 0.25$</td>
<td>0.1354</td>
<td>0.1426</td>
</tr>
<tr>
<td>$\xi = 0.3$</td>
<td>0.1331</td>
<td>0.1393</td>
</tr>
<tr>
<td>$\xi = 0.35$</td>
<td>0.1310</td>
<td>0.1365</td>
</tr>
<tr>
<td>$\xi = 0.4$</td>
<td>0.1296</td>
<td>0.1342</td>
</tr>
</tbody>
</table>

The comparison of sprung mass displacement for rear suspension is shown in Table VII. In this table, the sprung mass displacement is analysed by using various damping ratio range from 0.2 to 0.4. The greatest sprung mass displacement for without and with tire damping occur at damping ratio 0.2 and the smallest sprung mass displacement occurs at damping ratio 0.4. It is observed that suspension system with tire damping is more comfortable than without tire damping for all different damping ratios.

V. CONCLUSION

In the present work, vibration analysis of two degree of freedom and three degree of freedom quarter car model are performed. Sprung mass displacement and seat mass displacement of both type are analyze depend on two types of conditions such as without tire damping and with tire damping. Matlab software is used to analyze the two types of suspension system. As a results, the sprung mass displacement of two degree of freedom suspension system with and without tire damping for front suspension are 0.1503 m and 0.1509 m respectively. Two degree of freedom rear suspension with and without tire damping are 0.1548 m and 0.1564 m. For three degree of freedom, the sprung mass displacement of front suspension for with and without tire damping are 0.1301 m and 0.1351 m. Sprung mass displacement for rear suspension for with and without tire damping are 0.1313 m and 0.1393 m. Seat mass displacement of front suspension for with and without tire damping are 0.1581 m and 0.1836 m. Seat mass displacement for rear suspension for with and without tire damping are 0.1590 m and 0.1854 m. The results show that suspension system of both types with tire damping is more passenger comfortable than suspension system without tire damping. For front suspension, the sprung mass displacement of three degree of freedom suspension system with tire damping is 13% more comfortable than two degree of freedom suspension system. For rear suspension, the sprung mass displacement of three degree of freedom suspension system with tire damping is 14% more comfortable than two degree of freedom suspension system. Moreover, it is observed that the greater the damping effect, the more the ride handling and ride comfort of passenger.

ACKNOWLEDGEMENTS

The author would like to acknowledge the support and encouragement of Dr. Sint Soe, Rector of Mandalay Technological University. The author owes a debt of gratitude to her supervisor, Dr. Htay Htay Win, Professor and Head, Department of Mechanical Engineering, Mandalay Technological University, for her encouragement, patient guidance, invaluable supervision, kindly permission and suggestions throughout the course of challenging study. The author would like to express her heartfelt gratitude to all teachers for their supports, valuable suggestions and discussions during the presentation of the paper.
REFERENCES


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Investigation of Stress Analysis of Power Train Units for Light-Weight Car

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Abstract- Gears are one of the most critical components in mechanical power transmission systems. The bending and surface strength of the gear tooth are considered to be one of the main contributors for the failure of the gear in a gear set. The purpose of this research is to reduce the bending stress and contact stress happening often on gear by changing the different values of face width and three types of materials. This research investigates the characteristics of helical gear and bevel gear system mainly focused on bending and contact stresses using analytical and finite element analysis. Three-dimensional models of helical gear for different values of face width are generated by SolidWorks software and numerical solution is done by ANSYS 14.5 software. Lewis formula is used to estimate the bending stress and AGMA equation is used to determine the contact stresses between two mating gears. Helical gear and bevel gear used three types of material are analysed by ANSYS 14.5 software. Finally, the results obtained from ANSYS values are compared with theoretical values. In this analysis, the smallest face width is selected as the weight reduction and AISI 5160 OQT400 which has von-Mises stress 1114.3 MPa is the suitable material because it has lowest total deformation on gear.

Index Terms- Bending stress, Contact stress, Face width, Material, Lewis, AGMA

I. INTRODUCTION

Gearing is one of the most effective methods transmitting power and rotary motion from the source to its application with or without change of speed or direction. In automobile, highly reliable and lightweight gears are essential. Furthermore the best way to diminution of noise in engine requires the fabrication of silence gear system. Noise reduction in gear pairs is especially critical in the rapidly growing today’s technology since the working environment is badly influenced by noise. The most successful way of gear noise reduction is attained by decreasing of vibration related with them. Helical gears are currently being used increasingly as a power transmitting gear owing to their relatively smooth and silent operation, large load carrying capacity and higher operating speed. Designing highly loaded helical gears for power transmission systems that are good in strength and low level in noise necessitate suitable analysis methods [12]. There are two basic types of helical gears parallel and crossed as shown in Figure 1. Helical gears are the modified forms of spur gears, in which all the teeth are cut at a constant angle, known as helix angle. Helical gears are also employed to transmit power between two shafts parallel to the axis [6]. Sarfraz Ali N. Quadri [2] have done his research work on “Contact Stress Analysis of Involute Spur Gear under Static Loading”. In this paper, they have analysed a spur gear pair from lathe machine for contact stresses under static loading conditions using Hertz theory with the effect of various modules. The analytical method of calculating gear contact stresses are compared with calculated contact stresses using ANSYS. Finally, the higher the module, the lower the contact stress. S.K. Sureshkumar (2015) [3] investigated a research in which analysis of helical gear pairs. The author carried out an attempt to study the contact stresses among the helical gear pairs of different materials such as Steel, Cast Iron, and Aluminium under static conditions by using a 3D finite element method. J.Venkatesh [4] is analysed the helical gear based on structural analysis of high speed. In this paper, he modified the number of teeth to reduce the bending stress by using AGMA. In contact stress, the different value of helix angle is changed to minimize the contact stress. And then, two methods bending and contact stress results are compared with each other. Finally, the more the number of teeth, the more the bending stress. In contact stress, the more the helix angle, the less the stress. Puttapaka Nagaraju (2014) [6] presented a paper a suggest that, the bending stress of helical gear are analysed. In this study, bending stress were calculated with different face width by using Lewis equation and these results are compared with the results obtained in static analysis in ANSYS. The author concluded that the maximum bending stress decreases with increasing the face width of the gear. In 2014, at IJERA, Raghava Krishna Sanee.B [7] presented contact stress analysis of modified helical gear. The analytical study is based on Hertz’s equation. This paper have analysed by varying the geometrical profile of the teeth and to find the change in contact stresses between gears. Pravin M. kinge (2012) [8] presented a paper to suggest that, three modifications in the design of gear were done and after that again stress analysis of the modified gear carried out. The three design modifications were done the edges of the gear teeth were tapered by an angle of 20, making groove in the gear wheel and making holes at the roots of the gear teeth. K. Rajesh has investigated the effect of pitch angle on bending stresses of bevel gears. In this paper, the author calculated the bending stresses for straight bevel gear tooth. The author analysed the bending stress by using three different material and five pitch angles. Finally, the analysis results obtained in ANSYS and theoretical results are compared. Form the obtained results, it was concluded that the factor of safety increases up to 35 degree pitch angle and then it decreases from 40 degree
pitch angle. Cr-Ni steel was considered as the best material as compared PB102 based on factor of safety [1]. Nitin Kapoor did a research study in which design and stress strain analysis of composite differential gear box. In this paper, the author observed that Glass filled polyamide composite material is selected as best material for differential gear box and is found to suitable for different revolutions (2500rpm, 5000rpm, 750rpm) under static loading conditions. Comparisons of various stress and strain results using ANSYS-12 with Glass filled polyamide composite and metallic materials (Aluminum alloy, Alloy steel and Cast Iron) was also being performed and found to be lower for composite material. By observing these analysis results, Glass filled polyamide composite material was selected as a best material for differential gear box which in turn increases the overall mechanical efficiency of the system [5]. Gear tooth terminology is shown in Fig. 1.

II. DESIGN CALCULATION OF THE HELICAL GEAR PAIR AND BEVEL GEAR

The design calculation of the gear pair has the following steps. The material for the gear pairs are taken as AISI 5160 OQT400. The parameters considered for design a helical gear is shown in Table I.

<table>
<thead>
<tr>
<th>Design Parameters</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle gross weight</td>
<td>700</td>
<td>kg</td>
</tr>
<tr>
<td>Power (P)</td>
<td>20</td>
<td>kW</td>
</tr>
<tr>
<td>R.P.M (N_p)</td>
<td>6500</td>
<td>rpm</td>
</tr>
<tr>
<td>Helix angle (ψ)</td>
<td>23</td>
<td>degree</td>
</tr>
<tr>
<td>Pressure angle (ϕ)</td>
<td>20</td>
<td>degree</td>
</tr>
<tr>
<td>Modulus of Elasticity (E)</td>
<td>207</td>
<td>GPa</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>2220</td>
<td>MPa</td>
</tr>
<tr>
<td>Yield Strength</td>
<td>1790</td>
<td>MPa</td>
</tr>
<tr>
<td>Brinell Hardness (BHN)</td>
<td>627</td>
<td>-</td>
</tr>
<tr>
<td>Number of teeth of pinion</td>
<td>11</td>
<td>mm</td>
</tr>
<tr>
<td>Number of teeth of gear</td>
<td>34</td>
<td>mm</td>
</tr>
</tbody>
</table>

When two mating gears are to be made of the same material, the smaller gear (pinion) will be the weaker. Both pinion and gear are same material.

1. Calculation of Torque (M_t)

The torque of gears in (Nm) can be calculated as

\[
M_t = \frac{9550 \times P}{N_p}
\]
2. Calculation of pitch line velocity (V)

The pitch line velocity can be calculated by

\[ V = \frac{\pi \times D_p \times N_p}{60} \]  

(2)

3. Unknown diameter case

The actual induced stress can be calculated by using Lewis equation.

\[ S_{\text{ind}} = \frac{2M_s}{m^2 \pi^2 y_p n_p \cos \psi} \]  

(3)

\[ k = 6, \quad n_f = \frac{n}{\cos^2 \psi} \rightarrow y_p = 0.088 \quad \text{(from the table)} \]

4. Calculation of allowable stress,

Allowable stress can be calculated by

\[ S_{\text{all}} = S_0 \times \left[ \frac{5.6}{5.6 + \sqrt{V}} \right] \]  

(4)

5. Calculation of number of teeth,

The number of teeth can be calculated as

\[ n = \frac{D}{m} \]  

(5)

6. Strength Check,

Compare \( S_{\text{all}} \) and \( S_{\text{ind}} \)

If \( S_{\text{all}} > S_{\text{ind}} \), Design is satisfactory.

If not so, keeping on calculating by increasing the module until it is satisfied need to be done

7. Calculation of the face width of helical gear (b)

The face width of helical gear in (mm) can be calculated as

\[ b_{\text{min}} = k_{\text{red}} \times \pi \times m \]  

(7)

\[ b_{\text{max}} = k \times \pi \times m \]  

(8)

\[ k_{\text{red}} = k_{\text{max}} \times \frac{S_{\text{ind}}}{S_{\text{all}}} \]

8. Dynamic Check,

a. Calculation of transmitted load (F_t)

The transmitted load in (N) can be calculated as

\[ F_t = \frac{2M_t}{D_p} \]  

(9)

b. Calculation of dynamic load (F_d)

The dynamic load can be determined as
\[ F_d = F_t + \frac{21V(b\cos^2\psi + F_t)\cos\psi}{21V + \sqrt{(b\cos^2\psi + F_t)}} \]  

(10)

c. Calculation of limiting endurance load \((F_0)\)

The limiting endurance load can be determined as

\[ F_0 = S_0\pi n \cos(\psi) \]  

(11)

d. Calculation of limiting wear load \((F_w)\)

The limiting wear load can be determined as

\[ F_w = \frac{D_p \times b \times K \times Q}{\cos^2\psi} \]  

(12)

where \(S_\text{es} = (2.75\text{BHN} - 70) \text{MN/m}^2\)

\[ K = \frac{S_\text{es}^2 \times \sin\phi_n \times \left[ \frac{2}{E} \right]}{1.4} \]

\[ Q = \frac{2 \times D_g}{D_g + D_p} \]

\[ \tan\phi_n = \tan\phi \cos\psi \]

The required condition to satisfy the dynamic check is \(F_0, F_w > F_d\).

If not so, keeping on calculating by increasing the module until it is satisfied need to be done.

<table>
<thead>
<tr>
<th>NO. OF TEETH</th>
<th>SYMBOL</th>
<th>PINION</th>
<th>GEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitch circle diameter</td>
<td>D</td>
<td>28</td>
<td>85</td>
</tr>
<tr>
<td>Outside diameter</td>
<td>D₀</td>
<td>32</td>
<td>89</td>
</tr>
<tr>
<td>Root diameter</td>
<td>D₀</td>
<td>21</td>
<td>78</td>
</tr>
<tr>
<td>Face width</td>
<td>b</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Module</td>
<td>m</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Speed</td>
<td>N</td>
<td>6500</td>
<td>5000</td>
</tr>
</tbody>
</table>

The design result data for helical gear is shown in Table II. Bending stresses and contact stresses are analysed by increasing face width which are obtained from the result data.

<table>
<thead>
<tr>
<th>DESIGN PARAMETER</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
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<td>rpm</td>
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<td>MPa</td>
</tr>
<tr>
<td>Yield Strength</td>
<td>1790</td>
<td>MPa</td>
</tr>
<tr>
<td>Brinell Hardness (BHN)</td>
<td>627</td>
<td>-</td>
</tr>
<tr>
<td>Number of teeth of pinion</td>
<td>10</td>
<td>mm</td>
</tr>
<tr>
<td>Number of teeth of gear</td>
<td>16</td>
<td>mm</td>
</tr>
<tr>
<td>Transmission ratio</td>
<td>1.6</td>
<td>-</td>
</tr>
</tbody>
</table>

The parameters considered for design a bevel gear is illustrated in Table III.
1. Pitch cone angle of pinion ($\delta_1$)

Pitch cone angle of pinion can be calculated as

$$\tan \delta_1 = \frac{n_p}{n_g}$$

(13)

2. The actual induced stress can be calculated by using Lewis equation.

$$S_{ind} = \frac{2M_i}{m^2 n_p n_{pp} \pi m_p} \times \left( \frac{L_c}{L_c - b} \right)$$

(14)

3. Calculation of cone length ($L_c$)

Cone length can be calculated by

$$L_c = \frac{n_p \pi m}{2} \sqrt{1 + V^2 R^2}$$

(15)

4. Calculation of face width ($b$)

Face width can be calculated as

$$b = \frac{L_c}{3}$$

(16)

5. Strength Check,

Compare $S_{all}$ and $S_{ind}$

If $S_{all} > S_{ind}$, Design is satisfactory.

If not so, keeping on calculating by increasing the module until it is satisfied need to be done

6. Dynamic Check,

a. Calculation of dynamic load ($F_d$)

The dynamic load can be determined as

$$F_d = F_i + \frac{21V(bC + F_i)}{21V + \sqrt{(bC + F_i)}}$$

(18)

b. Calculation of limiting endurance load ($F_0$)

The limiting endurance load can be determined as

$$F_0 = S_0 \pi m \left( \frac{L_c - b}{L_c} \right)$$

(19)

c. Calculation of limiting wear load ($F_w$)

The limiting wear load can be determined as

$$F_w = \frac{0.75 \times D_p \times b \times K \times Q}{\cos^2 \psi}$$

(20)

The required condition to satisfy the dynamic check is $F_0 \times F_w > F_d$.

Allowable stress and tangential force equation have been expressed in the design of helical gear.

If not so, keeping on calculating by increasing the module until it is satisfied need to be done.
The theory results for contact stress by using AGMA equation is shown in Table IV.

### III. LEWIS AND AGMA EQUATION USED TO CALCULATE BENDING AND CONTACT STRESSES

#### A. Bending Stress Calculation by using Lewis Equation

The analysis of bending stress in gear tooth was done by Lewis equation. The tangential component ($F_t$) occurs at the tooth of the pinion.

![Fig.2 Force analysis of gear [12]](image)

The force analysis of gear is shown in Fig.2.

Bending Stress Calculation by using Lewis Equation

$$\frac{M}{I} = \frac{\sigma_b}{y}$$

where $I = \frac{bt^3}{12}$

$$F_t = \frac{\sigma_b bt^2}{6h}$$

$$\sigma_b = F_t \times P_c = \sigma_b by_P$$

(B. Contact Stress Calculation by using AGMA Equation)

$$\sigma_c = C_p \sqrt{\frac{F_t \cos \psi}{0.95CR}} K_x K_0 (0.93K_m)$$

where,

$I = \frac{\sin \phi \cos \phi \times i}{2} \times \frac{i}{i+1}$

$C_p = \sqrt{\frac{1}{\pi \left(1 - \frac{v_1^2}{E_1} + \frac{v_2^2}{E_2} \right)}}$

<table>
<thead>
<tr>
<th>Description</th>
<th>Nomenclature</th>
<th>Dimensions</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pitch cone angle</strong></td>
<td>Pinion $\delta_1$</td>
<td>32.01°</td>
<td>degree</td>
</tr>
<tr>
<td></td>
<td>Gear $\delta_2$</td>
<td>57.99°</td>
<td>degree</td>
</tr>
<tr>
<td><strong>Tip circle diameter</strong></td>
<td>Pinion $d_{a1}$</td>
<td>46.7836 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gear $d_{a2}$</td>
<td>68.2405 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Pitch circle diameter</strong></td>
<td>Pinion $D_p$</td>
<td>40 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gear $D_g$</td>
<td>64 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Gearing Arrangement</strong></td>
<td>$\Sigma$</td>
<td>90°</td>
<td>degree</td>
</tr>
<tr>
<td><strong>Module</strong></td>
<td>$m$</td>
<td>4</td>
<td>mm</td>
</tr>
<tr>
<td><strong>Cone distance</strong></td>
<td>$L$</td>
<td>37.7311 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Face width for pinion and gear</strong></td>
<td>$b$</td>
<td>13</td>
<td>mm</td>
</tr>
</tbody>
</table>
\[ CR = \left( \sqrt{(r_1 + a)^2 - r_1^2} + \sqrt{(r_2 + a)^2 - r_2^2} + (r_1 + r_2) \sin \phi \right) / \pi m \cos \phi \]

C. Calculation of von-Mises Stress

Shear stress \( \tau_{xy} \),

\[ \tau_{xy} = \frac{T \times R}{J} \]

\[ = \frac{37.054 \times 28}{(\pi/32) \times 28^4} = 0.0085 \text{ MPa} \]

\[ \sigma_{1,2} = \frac{1}{2} (\sigma_x + \sigma_y) \pm \frac{1}{2} \left[ (\sigma_x - \sigma_y)^2 + 4\tau_{xy}^2 \right]^{1/2} \]

By using von-Mises Criterion equation,

\[ \sigma = \frac{1}{\sqrt{2}} \left[ (\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2 \right]^{1/2} \]

<table>
<thead>
<tr>
<th>Face Width (mm)</th>
<th>von-Mises stress for Lewis (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>182.35</td>
</tr>
<tr>
<td>22</td>
<td>174.06</td>
</tr>
<tr>
<td>23</td>
<td>166.49</td>
</tr>
<tr>
<td>24</td>
<td>159.55</td>
</tr>
<tr>
<td>25</td>
<td>153.17</td>
</tr>
<tr>
<td>26</td>
<td>147.28</td>
</tr>
<tr>
<td>27</td>
<td>141.83</td>
</tr>
<tr>
<td>28</td>
<td>136.76</td>
</tr>
</tbody>
</table>

The theoretical results of von-Mises stresses is shown in Table V.

<table>
<thead>
<tr>
<th>Face Width (mm)</th>
<th>von-Mises stress for AGMA (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>1043.97</td>
</tr>
<tr>
<td>22</td>
<td>1019.97</td>
</tr>
<tr>
<td>23</td>
<td>997.55</td>
</tr>
<tr>
<td>24</td>
<td>976.55</td>
</tr>
<tr>
<td>25</td>
<td>956.82</td>
</tr>
<tr>
<td>26</td>
<td>938.24</td>
</tr>
<tr>
<td>27</td>
<td>920.70</td>
</tr>
<tr>
<td>28</td>
<td>904.11</td>
</tr>
</tbody>
</table>

The theoretical results of von-Mises stresses is shown in Table VI.
IV. MODELLING OF GEAR

This gears are modelled by the results obtained from theory in SolidWorks software. The material for the gear is AISI 5160 OQT400. The gears are modelled with the combination of the all above mentioned parameter, other gear set are modelled in same way. The helical gear and bevel gear were generated by using SolidWorks software.

![Solid model of helical gear](image1)

The solid model of helical gear is shown in Fig. 4.

![Solid model of helical gear pair](image2)

The solid model of helical gear pair is shown in Fig. 5.

![Solid model of bevel gear pair](image3)

The solid model of bevel gear pair is shown in Fig. 6.
A. FEM Analysis

The structural analysis of helical gear and bevel tooth model are carried out in SolidWorks and imported in ANSYS software. The fixed support is given at the inner rim of the pinion. The tangential load 2646.7142 N is applied at the tooth of the helical gear. Torque is applied to the helical pinion in clockwise direction.

Fig.7 Boundary condition of helical gear

The boundary condition of helical gear is shown in Fig. 7.

The fixed support is given at the inner rim of the pinion and torque which the value is 37.054Nm is applied to the helical pinion in clockwise direction. The frictionless support is given at the inner rim of the pinion.

Fig.8 Boundary condition of helical gear pair

The boundary condition of helical gear pair is shown in Fig. 8.

The fixed support is given at the inner rim of the bevel gear and torque which the value is 37.054Nm is applied to the bevel pinion in counter clockwise direction. The frictionless support is given at the inner rim of the bevel pinion.

Fig.9 Boundary condition of bevel gear pair

The boundary condition of bevel gear pair is shown in Fig. 9.
The generated mesh of helical gear pair and bevel gear pair are shown in Fig. 10 and Fig. 11. The generated mesh is done by fine position to obtain the good quality of mesh.

V. FEM EQUATION USED TO CALCULATE BENDING STRESS AND CONTACT STRESS

The model were analysed by using ANSYS software. The different value of face width are used to find out the bending stress and contact stress for helical gear.

A. Bending Stress for Different Values of Face Width

The von-Mises stress of 21 mm face width modelled gear is shown in Fig. 12. The magnitude of maximum stress is 220.6 MPa which occur at the root of the teeth.

The von-Mises stress of 22 mm face width modelled gear is shown in Fig. 13. The magnitude of maximum stress is 215.56 MPa which occur at the root of the teeth.
The von-Mises stress of 23 mm face width modelled gear is shown in Fig. 14. The magnitude of maximum stress is 207.14 MPa which occur at the root of the teeth.

The von-Mises stress of 24 mm face width modelled gear is shown in Fig. 15. The magnitude of maximum stress is 195.1 MPa which occur at the root of the teeth.

The von-Mises stress of 25 mm face width modelled gear is shown in Fig. 16. The magnitude of maximum stress is 187.79 MPa which occur at the root of the teeth.
The von-Mises stress of 26 mm face width modelled gear is shown in Fig. 17. The magnitude of maximum stress is 177.13 MPa which occur at the root of the teeth.

The von-Mises stress of 27 mm face width modelled gear is shown in Fig. 18. The magnitude of maximum stress is 169.6 MPa which occur at the root of the teeth.

The von-Mises stress of 28 mm face width modelled gear is shown in Fig. 19. The magnitude of maximum stress is 159.51 MPa which occur at the root of the teeth.
B. Contact Stress for Different Values of Face Width

Fig. 20 von-Mises stress of 21 mm face width modelled gear

The von-Mises stress of 21 mm face width modelled gear is shown in Fig. 20. The magnitude of maximum stress is 1114.3 MPa which occur at the contact point.

Fig. 21 von-Mises stress of 22 mm face width modelled gear

The von-Mises stress of 22 mm face width modelled gear is shown in Fig. 21. The magnitude of maximum stress is 1043.8 MPa which occur at the contact point.

Fig. 22 von-Mises stress of 23 mm face width modelled gear

The von-Mises stress of 23 mm face width modelled gear is shown in Fig. 22. The magnitude of maximum stress is 1027.8 MPa which occur at the contact point.
The von-Mises stress of 24 mm face width modelled gear is shown in Figure 23. The magnitude of maximum stress is 1010.4 MPa which occur at the contact point.

The von-Mises stress of 25 mm face width modelled gear is shown in Fig. 24. The magnitude of maximum stress is 1003.00 MPa which occur at the contact point.

The von-Mises stress of 26 mm face width modelled gear is shown in Fig. 25. The magnitude of maximum stress is 979.31 MPa which occur at the contact point.
The von-Mises stress of 27 mm face width modelled gear is shown in Fig. 26. The magnitude of maximum stress is 952.61 MPa which occur at the contact point.

The von-Mises stress of 28 mm face width modelled gear is shown in Fig. 27. The magnitude of maximum stress is 923.79 MPa which occur at the root of the teeth which contact between pinion and gear.

C. Contact Stress for Different Three Types of Materials
The following figures show von-Mises stress for different properties of materials which obtained from analysis (FEA) result. The different properties of materials are AISI 5160 OQT 400, AISI 4150 OQT 400 and AISI 1030.

The von-Mises stress of AISI 4150 OQT 400 modelled gear is shown in Fig. 28. The magnitude of maximum stress is 1117.5 MPa which occur at the root of the teeth which contact between pinion and gear.
Total deformation of AISI 4150 OQT 400 modelled gear is shown in Fig. 29.

The von-Mises stress of AISI 1030 modelled gear is shown in Fig. 30. The magnitude of maximum stress is 1114.3 MPa which occur at the root of the teeth which contact between pinion and gear.

Total deformation of AISI 1030 modelled gear is illustrated in Fig.31.
D. Contact Stress for Different Three Types of Material for Bevel Gear

The von-Mises stress of AISI 5160 OQT 400 modelled gear is shown in Fig. 32. The magnitude of maximum stress is 1422.8 MPa which occur at the root of the teeth which contact between bevel pinion and bevel gear.

Total deformation of AISI 5160 OQT 400 modelled gear is shown in Fig. 33.

The von-Mises stress of AISI 4150 OQT 400 modelled gear is shown in Fig. 34. The magnitude of maximum stress is 1443 MPa which occur at the root of the teeth which contact between pinion and gear.
Total deformation of AISI 4150 OQT 400 modelled gear is expressed in Fig. 35.

The von-Mises stress of AISI 1030 modelled gear is shown in Fig. 36. The magnitude of maximum stress is 1402.0 MPa which occur at the root of the teeth which contact between pinion and gear.

Total deformation of AISI 1030 modelled gear is illustrated in Fig.37.
VI. RESULTS AND DISCUSSIONS

TABLE VII
COMPARISON OF LEWIS THEORY AND FEM FOR HELICAL GEAR

<table>
<thead>
<tr>
<th>Face Width (mm)</th>
<th>Theoretical Stress (MPa)</th>
<th>Simulation Results (MPa)</th>
<th>Yield Strength (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>182.35</td>
<td>220.62</td>
<td>1790</td>
</tr>
<tr>
<td>22</td>
<td>174.06</td>
<td>215.56</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>166.49</td>
<td>207.14</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>159.55</td>
<td>195.1</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>153.17</td>
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<td></td>
</tr>
<tr>
<td>26</td>
<td>147.28</td>
<td>177.13</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>141.83</td>
<td>169.63</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>136.76</td>
<td>158.93</td>
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</tr>
</tbody>
</table>

The result data for theory and FEM is shown Table VII.

TABLE VIII
COMPARISON OF AGMA THEORY AND FEM FOR HELICAL GEAR PAIRS

<table>
<thead>
<tr>
<th>Face Width (mm)</th>
<th>Theoretical Stress (MPa)</th>
<th>Simulation Results (MPa)</th>
<th>Yield Strength (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>1043.97</td>
<td>1114.30</td>
<td>1790</td>
</tr>
<tr>
<td>22</td>
<td>1019.97</td>
<td>1043.80</td>
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<tr>
<td>23</td>
<td>997.55</td>
<td>1027.80</td>
<td></td>
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<tr>
<td>24</td>
<td>976.55</td>
<td>1010.40</td>
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</tr>
<tr>
<td>25</td>
<td>956.82</td>
<td>1003.00</td>
<td></td>
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<tr>
<td>26</td>
<td>938.24</td>
<td>979.30</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>920.70</td>
<td>952.60</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>904.11</td>
<td>923.70</td>
<td></td>
</tr>
</tbody>
</table>

The result data for theory and FEM is shown Table VIII.

The above table show that the von-Mises stresses are inversely proportional to the face width of the helical gear, as the face width increases the bending stresses and contact stresses decreases. The effect of face width on bending stress and contact stress is studied by varying the face width. It can be observed that the variation in the magnitude of stress to face width. When comparing, Lewis and AGMA values are a little lower than the ANSYS values.

TABLE IX
TOTAL DEFORMATION AND VON-MISES STRESS OF BEVEL GEAR PAIRS FOR THREE TYPES OF MATERIAL

<table>
<thead>
<tr>
<th>Materials</th>
<th>AISI 5160 OQT400</th>
<th>AISI 4150 OQT 400</th>
<th>AISI 1030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total deformation (displacement) (m)</td>
<td>0.0497</td>
<td>0.0514</td>
<td>0.0515</td>
</tr>
<tr>
<td>von-Mises stress (MPa)</td>
<td>1422.8</td>
<td>1443</td>
<td>1422.8</td>
</tr>
</tbody>
</table>

The result data for different properties of material is shown in Table IX shows.

From the obtained results, three types of material have nearly the same total deformation. The suitable material is AISI 5160 OQT 400 because it has lowest von-Mises stress on gears.
Simulation results of von-Mises stress and effective strain for different three types of material are shown in Fig. 38 and Fig. 39. According to the results, the values of AISI 4150 OQT 400 is the largest in the figure of von-Mises stress. In the figure of effective strain, AISI 5160 OQT 400 has the smallest value. That is why AISI 5160 OQT 400 is preferred.

<table>
<thead>
<tr>
<th>Theoretical and simulation results of von-Mises stress and effective strain for bevel gear (AISI 5160 OQT 400)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical Result</td>
</tr>
<tr>
<td>von-Mises stress (MPa)</td>
</tr>
<tr>
<td>Effective Strain</td>
</tr>
</tbody>
</table>

Theoretical and simulation results of von-Mises stress and effective strain for straight bevel gear (AISI 5160 OQT400) are shown in Table X.

<table>
<thead>
<tr>
<th>Weight of helical gear pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face Width (mm)</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>21</td>
</tr>
<tr>
<td>22</td>
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<tr>
<td>23</td>
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<td>24</td>
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<td>25</td>
</tr>
<tr>
<td>26</td>
</tr>
<tr>
<td>27</td>
</tr>
<tr>
<td>28</td>
</tr>
</tbody>
</table>

The weight of helical gear pairs is shown in Table XI. Weight reduction is very important criterion in automobile. Therefore, face width 21 mm is selected for reducing the weight of car.

VII. CONCLUSIONS

Face width is an important geometrical parameters in determining the state of stresses during the design of gears. The effect of face width on von-Mises stress is studied by varying the face width which are from 21mm to 28mm calculated from theory. Both Lewis and AGMA theory of stresses as well as FEM method of stresses give almost identical results with a mere percentage difference. The results are indicated that as the face width increases the bending stress and contact stress decreases. By observing the analysis results, the stress values obtained are less than the yield strength (1790 MPa). So, it can conclude that the design is safe under working condition. And then, weight reduction is a very important criterion in the helical gears. So, face width 21mm is preferred. And then, Comparative study on static structure analysis has been carried out the helical and bevel gear made of different materials. From the obtained results, it is clear that the suitable material is AISI5160 OQT 400 because three types of gear material have nearly the same von-Mises stress on gear but AISI 5160 OQT 400 has lowest total deformation on gears. Therefore, AISI 5160 OQT 400 is suitable for helical gear and bevel gear.
ACKNOWLEDGEMENTS

Special appreciation is intended to her supervisor Dr. Htay Htay Win, Professor and Head of Department of Mechanical Engineering, Mandalay Technological University, under whose guidance, constant encouragement, patient and trust, I have been worked on this paper. A special thanks is offered to Dr. Myit Thein, Associate Professor, Department of Mechanical Engineering, Mandalay Technological University, for his encouragement, constructive guidance and kindly advice throughout the preparation of this paper.

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Abstract- The productivity of distilled water is directly proportional to water temperature in solar still. In this work, a single basin single slope solar still is integrated with a salt gradient solar pond (SGSP) to increase the productivity of solar still. The performance of the single basin single slope solar still integrated with and without salt gradient solar pond has been analyzed theoretically, numerically and experimentally. The energy balance equations have been written for different temperature elements of the solar still and solar pond. Here, a two-phase three-dimensional model was made for evaporation as well as condensation process in solar still by using ANSYS CFX method to simulate the present model. The experiments with single basin solar still have been carried out from June to October 2017. The highest temperature of thermal storage zone reached 312 K. On September 21st 2017, the storage zone temperature is occurred 310.3 K, 310.16 K and 309.5 K according to the numerical simulation, theory calculation and experimental measurements of SGSP. The water temperature in single basin solar still integrated with salt gradient solar pond is 343.4 K, 343.3 K, 343 K and without solar pond is 312 K, 312 K, 311.9 K according to the simulation, theory, and experiment at 12 pm of September 21st 2017. Distilled water productivity of solar still integrated with SGSP is 0.000050 kg/s, 0.000049 kg/s, 0.0000487 kg/s and without solar pond is 0.000042 kg/s, 0.000041 kg/s, 0.00004 kg/s. The average productivity of single basin solar still with salt gradient solar pond is 40.78 % higher than solar still without solar pond. The maximum daily efficiency of the solar still coupled with and without solar pond was found to be 8.00 % and 5.04 %. Simulation and theoretical results of single basin solar still also show a good agreement with experimental results.

Index Terms- desalination, distilled water productivity, salt gradient solar pond, single basin solar still, solar energy

I. INTRODUCTION

Water is one of the most abundant resources on earth, covering three-fourths of the planet's surface. About 97% of the earth's water is salt water in the oceans; 3% of all fresh water is in ground water, lakes and rivers, which supply most of human and animal needs. Most water resources contain salt, bacteria and pollutants. Apart from this, water is being polluted by human activities, urbanization and industrialization. The lack of safe and unreliable drinking water constitutes the health problems for human life. Most of the human diseases are due to polluted or non-purified water resources. Desalination of salt water and impure water is suitable solution that can help reduce current and future water scarcity [1].

Energy is an important factor for every country all over the world. There are many different types of desalination processes for desalting water systems using energy. The use of fossil fuels in energy provision should not continue for everyday life because they can be exhausted and polluted to water resources and environment. Solar energy is one of the effective solutions to environment pollution, the largest source of renewable energy, and abundantly available in all parts of the earth. It has some benefits in the remote areas, where there is no access to electricity or difficult to reach fossil fuels. The cost of utilizing solar energy to produce fresh water is reasonable and there is also no remained pollutant from the process. Water treatment process utilizing the solar energy for desalination technology enables human beings to acquire clean water supply with the simplest and economical way possible. Solar desalination has only recently emerged as a promising renewable energy-powered technology for producing fresh water. Solar desalination can improve health standards, because solar distilled water is chemically pure. Therefore, solar desalination is one of the simplest applications for water purification system [3].

Solar still is widely used in the solar desalination process. Purifying water through distillation is a simple yet effective means of providing drinking water in a reliable and cost-effective manner. Solar distillation could offer a real and effective solution for families in remote arid areas to clean their water supplies on-site. Solar still has been proven to be the best solution to solve water problem in these locations. It is a very simple solar device used for converting the available brackish or waste water into the potable water. This device can be fabricated easily with available materials. Solar still production is a function of solar energy (insolation) and ambient temperature. Solar stills effectively eliminate all water borne pathogens, salts, and heavy metals, and produce ultrapure water that is proven to be superior to most commercial bottled water sources [5]. The maintenance is also cheap and no skilled labour is required to
make it. But the productivity of it is very low. To increase the productivity of solar still, solar still can be integrated with flat plate collector, evacuated tube collector, parabolic trough collector, etc.

In this work, salt gradient solar pond (SGSP) is selected to supply an extra thermal energy to the basin of solar still because it is a new technique for thermal desalination and can store the solar thermal energy for a long time. Comparison is made between the solar still coupled with salt gradient solar pond as well as passive solar still.

II. LITERATURE SURVEY

Many techniques have been developed for purification of water. Among these water purification systems, solar desalination proves to be economical and eco-friendly technique. Fedali Saida, Bougriou Cherif (2010), presents the thermal analysis of passive solar still. Mathematical equations for water, absorber, glass and insulator temperatures yield and efficiency of single slope basin have been derived. The analysis is based on the basic energy balance for the solar still. A computer model has been developed to predict the performance of the solar still. The calculations indicated that the wind speed has an influence on the glass cover temperature. It was noted that in sunshine duration, temperature of various components of the distiller follows the evolution of solar radiation [4]. Eric Spooner and Lisa Van Bladilen discussed Solar Distillation in Rajasthan, India (2013). This paper aims to guarantee that the solar still can be easily adopted and employed. The materials used to build the still are available at local markets in the city of Jodhpur and are relatively inexpensive. The solar still that they designed and built produced roughly one to two liters of water per square meter of glass surface per day [13].

A number of efforts have been made to develop and improve the performance of solar desalination systems particularly solar stills. The efficiency of the still is directly proportional to the inlet water temperature to still. To increase the temperature of the water inside the still, some researchers suggested coupling the still to solar collectors such as flat plate collector, evacuated tube collector, parabolic trough collector, solar pond, etc. Solar ponds have been studied by many researchers in the US, Israel, Australia and several other countries because of their excellent heat collection and storage performances. Experimental works basically concentrate on design, application and experimental thermal measurements in solar ponds to investigate the thermal behaviour of various types of solar ponds in different dimensions [20]. The mathematical formulation of the behaviour of solar ponds was first given by Weinberger. Theoretical studies are particularly focused on modelling of solar ponds for their performance analysis and predicting temperature variations in the ponds. Solar energy is absorbed by a solar pond from its surrounding during the day and stored in the form of heat energy in it. During the nights, due to non-existence of solar energy, no contribution is made to the pond’s thermal energy [11]. The use of numerical methods for studying the solar pond was first suggested by Tabor; however, Hull first used the finite difference method to investigate solar pond performance [12].

Theoretical modeling of solar pond and integration with desalination was studied by Ibrahim Alenezi (2012). Time-dependent steady state model has been developed to predict the behavior of solar pond temperatures. Coupling a solar pond with a desalination unit could assist providing fresh potable water to the inhabitants [11]. K. Shamugasundaram (2014) presented experimental analysis of double slope single basin solar still coupled with shallow solar pond. The performance of the double slope solar still coupled with and without shallow solar pond has been analyzed experimentally. The distilled water output and efficiency of solar still when coupled with shallow solar pond is found to be higher than solar still without coupled solar pond [18]. A. M. Dalave (2016) discussed about the experimental investigation for performance enhancement of solar still using solar pond. Solar still is the best option for the domestic purpose to get the distilled water. The productivity can be enhanced by integrating solar still with solar pond [21]. Yunes Mogheir (2017) presented about the treatment of desalination brine using an experimental solar pond. The brine characteristics were studied by using shallow solar pond SSP. Evaporation rate increases with decreasing the mirror’s angle that makes with horizontal. The best performance of the pond can be achieved when the mirrors are employed as reflectors [23].

Single basin solar still was tested at our laboratory, Mechanical Engineering Department in Mandalay Technological University. Phyoe., P, P. have also designed temperature dependent correlations for internal heat transfer coefficients between water and glass cover of solar still. The inclination of single basin solar still was selected by theoretical and numerical result. According to the results, the optimum inclination angle is 20° [22]. However, any studies about solar pond technology and experiment have not been carried out locally. This research work aims to build an experimental, numerical and theoretical model for active solar still to test the thermal performance behavior. The single basin solar still integrated with salt gradient solar pond is proposed to improve its productivity. All the results are compared together to reach to the best operating conditions that can be used in future for solar still augmentation for the production of drinking water. In this paper, a three-dimensional two-phase model was developed for condensation and evaporation process in single slope solar still and three-dimensional model of SGSP with in-pond heat exchanger was also developed using ANSYS CFX software. The simulation results are compared with the theoretical and experimental data.

III. THEORETICAL ANALYSIS

Theoretical analysis is being made to find out the solar radiation behavior and temperature of solution in solar pond and solar still at every instant.
A. Solar Radiation Behavior

The amount of solar radiation is a function of many factors like position of sun, time of day, location, distance travelled by light, and wavelength range of solar spectrum. The total solar radiation incident on a tilted surface was considered to include three components: beam, isotropic diffuse, and solar radiation diffusely reflected from the ground. It can be calculated as

\[ I_1 = I_b \cos \theta_i + I_d \left( \frac{1+ \cos \beta}{2} \right) + I_{p_{\text{ground}}} \left( \frac{1- \cos \beta}{2} \right) \]  

(1)

The total solar radiation incident on a horizontal surface, often referred to as global radiation on the surface can be calculated as

\[ I_h = I_b \cos \theta_z + I_d \]  

(2)

The absorbed radiation in the body of water can be converted into useful thermal energy. The solar radiation intensity at depth x, in the solution is given by Beer's law as

\[ I(x) = (1 - \alpha)(1 - \beta) I_0 e^{-\mu x} \]  

(3)

The beam radiation under clear sky conditions on the horizontal surface can be calculated as

\[ I_b = I_{0,\text{eff}} \left[ a_0 + a_1 \exp \left( \frac{-k}{\cos \theta_z} \right) \right] \]  

(4)

The clear sky diffuse radiation on the horizontal surface can be calculated as

\[ I_d = \left[ 0.271 I_{0,\text{eff}} - 0.294 I_b \right] \cos \theta_z \]  

(5)

Effective solar constant varies with the time of year according to the formula,

\[ I_{0,\text{eff}} = I_0 \left( 1 + 0.033 \cos \frac{360 \pi n}{365} \right) \]  

(6)

The incidence angle for the horizontal surface is the zenith angle of the sun. Solar Zenith (\(\theta_z\)) is the angle between the vertical and the line to the sun. The solar zenith angle \(\theta_z\) is of the form,

\[ \cos \theta_z = \cos \phi \cos \delta \cos \omega + \sin \phi \sin \delta \]  

(7)

The incidence angle of the sloped surface due northern hemisphere is

\[ \cos \theta_i = \cos(\phi - \beta) \cos \delta \cos \omega + \sin(\phi - \beta) \sin \delta \]  

(8)

B. Single Basin Single Slope Solar Still

The performance of a solar still can be predicted by writing energy balance equations on various components of the still. The heat transfer in solar still can be classified as internal and external heat transfer. The heat transfer from water surface to inner surface of glass cover taken place within the solar still is called internal heat transfer which is mainly due to convection, radiation and evaporation. The external heat transfer is mainly governed by conduction, convection and radiation processes, which are independent of each other, these are, the heat lost from the glass cover to outside atmosphere and the heat lost from basin water to outside atmosphere through the bottom and sides insulation. The details of various heat transfers in solar still are shown in Figure 1.
Energy received by the water in the still from sun is equal to the summation of energy lost by convective heat transfer between water and glass, radiative heat transfer between water and glass, evaporative transfer between water and glass, conductive heat loss from water basin, and energy gained by the water. An energy balance on the water in the basin can be written as,

\[ q_{in} - q_{loss} = q_u \]  \hspace{1cm} (9)

\[ I \alpha_w - (q_{r,w-g} + q_{c,w-g} + q_{e,w-g} + q_{k,b} + q_{k,s}) = m_w c_{p,w} \left( \frac{dT_w}{dt} \right) \]  \hspace{1cm} (10)

\[ T_{w}^{t+\Delta t} = T_{w}^{t} + \frac{\Delta t}{m_w c_{p,w}} \left( I \alpha_w - q_{r,w-g} - q_{c,w-g} - q_{e,w-g} - q_{k,b} - q_{k,s} \right) \]  \hspace{1cm} (11)

Energy gained by the glass cover (from sun and convective, radiative and evaporative transfer from water to glass) is equal to the summation of energy lost by convective heat transfer between glass and atmosphere, radiative heat transfer between glass and atmosphere, and energy gained by the glass. An energy balance on the cover can be written as,

\[ \left( I \alpha_g + q_{r,w-g} + q_{c,w-g} + q_{e,w-g} \right) - \left( q_{r,g,a} + q_{c,g,a} \right) = m_g c_{p,g} \left( \frac{dT_g}{dt} \right) \]  \hspace{1cm} (12)

\[ T_{g}^{t+\Delta t} = T_{g}^{t} + \frac{\Delta t}{m_g c_{p,g}} \left( I \alpha_g + q_{r,w-g} + q_{c,w-g} + q_{e,w-g} - q_{r,g,a} - q_{c,g,a} \right) \]  \hspace{1cm} (13)

The radiative heat transfer between water and glass is given by,

\[ q_{r,w-g} = h_{r,w-g} (T_w - T_g) \]  \hspace{1cm} (14)

The radiative heat transfer coefficient between water and glass is given by,

\[ h_{r,w-g} = 0.9 \sigma (T_w^4 - T_g^4) \]  \hspace{1cm} (15)

The convective heat transfer between water and glass is given by,

\[ q_{c,w-g} = h_{c,w-g} (T_w - T_g) \]  \hspace{1cm} (16)

The convective heat transfer coefficient between water and glass is given by,

\[ h_{c,w-g} = 0.884 \left[ (T_w - T_g) + \left( \frac{P_w - P_g}{268.9 \times 10^3} \right) T_w \right]^{3/2} \]  \hspace{1cm} (17)

\[ P_w = \exp \left( 25.317 - \frac{5144}{T_w} \right) \]  \hspace{1cm} (18)

\[ P_g = \exp \left( 25.317 - \frac{5144}{T_g} \right) \]  \hspace{1cm} (19)

The evaporative heat transfer between water and glass is given by,

\[ q_{e,w-g} = h_{e,w-g} (T_w - T_g) \]  \hspace{1cm} (20)

The evaporative heat transfer coefficient between water and glass is given by,

\[ h_{e,w-g} = \frac{16.27 \times 10^3}{T_w - T_g} h_{c,w-g} (P_w - P_g) \]  \hspace{1cm} (21)

The conduction heat loss from basin water to outside atmosphere through the bottom can be computed as follow;

\[ q_{k,b} = U_b (T_w - T_a) \]  \hspace{1cm} (22)

\[ U_b = \frac{k A_b}{R_b} = \frac{k A_b}{t_b} \]  \hspace{1cm} (23)

The conduction heat loss from basin water to outside atmosphere through the sides insulation can be computed from the following simple relation:

\[ q_{k,s} = U_s (T_w - T_a) \]  \hspace{1cm} (24)

\[ U_s = \frac{U_s A_s}{A_b}, \quad (U_s \approx 0 \text{ as } A_s \approx A_b) \]  \hspace{1cm} (25)
The radiative heat transfer between glass and ambient is given by,
\[ q_{r,g-a} = \varepsilon \sigma (T_g^4 - T_{sky}^4) \]  
(26)

The convective heat transfer between glass and ambient is given by,
\[ q_{c,g-a} = h_{c,g-a} (T_g - T_a) \]  
(27)

The convective heat transfer coefficient between glass and ambient is given by,
\[ h_{c,g-a} = 2.8 + 3.8v \]  
(28)

By analogy between heat and mass transfer, the mass transfer rate can be written as,
\[ m_D = \frac{q_{e,w-g} \times A}{h_{lg}} \]  
(29)

\[ h_{lg} = 2.4935 \times 10^6 \times (1 - 9.4779 \times 10^{-4} T_v + 1.3132 \times 10^{-7} T_v^2 - 4.7974 \times 10^{-9} T_v^3) \]  
(30)

Where, \( T_v = \frac{T_w + T_g}{2} \)

The objective of still design is to maximize \( q_{e,w-g} \), the transport of absorbed solar radiation to the cover-condenser by water vapor, as this is directly proportional to still productivity \( m_D \). The still output is measured by the evaporation-condensation transfer from water basin to cover.

Daily efficiency is obtained by the output of the single basin solar still and divided by the input of the solar basin still.

Daily Efficiency = \[ \left( \frac{Output}{Input} \right) \times 100 \]  
(31)

Increase in efficiency of solar still is defined as the difference between the output of single basin solar still with and without modifications divided by output of single basin solar still without modification.

Increasing Efficiency = \[ \left( \frac{Output_{With SP} - Output_{Without SP}}{Output_{Without SP}} \right) \times 100 \]  
(32)

C. Salt Gradient Solar Pond

The performance of a solar pond depends substantially on the amount of solar energy that is inputted into the solar pond and the amount of heat loss from the pond. A solar pond is a non-homogeneous system in which various heat transfer processes occur. The input and output heat values passing through the upper zone of a solar pond can be briefly described as in Figure 2. The net heat in the surface layer is thermally fed by the solar irradiation and the conducted heat from the lower zones but part of this heat may be mainly lost by the mentioned four processes. The upper convective zone is assumed to have a uniform temperature \( T_u \).

![Figure 2. Energy balance for UCZ](https://example.com/figure2.png)

The energy balance equation can be written as:
\[ q_{in} - q_{loss} = q_{store} \]  
(33)

\[ (I_0 + q_{ub}) - (I_u + q_{Loss}) = \rho C_p x_{ucz} \frac{\partial T_u}{\partial t} \]  
(34)

The heat balance of UCZ in non-differential form can be written as
\[ k \left[ \frac{\partial T(x,t)}{\partial t} \right]_{x = x_{ucz}} + I_0 - I_u - q_{Loss} = \frac{\rho C_p x_{ucz}}{\Delta t} (T_u^{t+\Delta t} - T_u^t) \]  
(35)
The temperature distribution for UCZ is given as

$$T_{u}^{t+\Delta t} = T_{u}^{t} + \Delta t \frac{\Delta t}{\rho c_p x_{uz}} \left[ I_0 - I_{u} - q_{\text{Loss}} + k \left( \frac{I_{u}^{t} - T_{u}^{t}}{\Delta x} \right) \right]$$  \hspace{1cm} (36)

The total heat loss from pond’s surface can be calculated as follows:

$$q_{\text{Loss}} = q_{uc} + q_{ur} + q_{ue} + q_{uw}$$  \hspace{1cm} (37)

Convection heat transfer from the upper layer to the atmosphere depends mainly on the wind speed and the temperature difference between the atmosphere and the water surface; this can be expressed as in the following equation:

$$q_{uc} = h_c (T_{u} - T_a)$$  \hspace{1cm} (38)

The heat transfer between the upper zone and the sky is a function of the ambient and water surface temperatures. Thus, the radiation heat loss equation may be written as the following:

$$q_{ur} = \sigma e_w \left[ T_{u}^{4} - T_{k}^{4} \right]$$  \hspace{1cm} (39)

$$T_{k} = T_a \cdot \left( 0.55 + 0.061 \sqrt{P_a} \right)^{0.25}$$  \hspace{1cm} (40)

The evaporation heat loss includes the wind heat transfer coefficient and the vapour and partial pressure of water.

$$q_{ue} = \left( \frac{\lambda h_c}{1.6 C_a P_{\text{atm}}} \right) (P_u - P_a)$$  \hspace{1cm} (41)

$$P_u = \exp \left( 18.403 - \frac{3885}{T_u + 230} \right)$$  \hspace{1cm} (42)

$$P_a = (\text{RH}) \exp \left( 18.403 - \frac{3885}{T_a + 230} \right)$$  \hspace{1cm} (43)

The rate of heat loss through the upper layer wall of pond can be calculated as:

$$q_{uw} = \frac{U \Delta \theta}{A}$$  \hspace{1cm} (44)

The NCZ layer on the energy balance equation is solved by dividing the equal sub-layer. In this layer heat coming from i+1 layer and leaving to i-1 layer both by conduction. The input and output heat values passing through the middle zone of a solar pond can be briefly described as in Figure 3.

Figure 3. Energy balance for NCZ

The energy balance of this zone can be written as:

$$\left( I_{i+1}^{t} + q_{\text{cond3}} \right) - \left( I_{i+1}^{t} + q_{\text{cond2}} + q_{\text{lw}} \right) = \rho c_p \frac{\partial T_{i}}{\partial t}$$  \hspace{1cm} (45)

The heat balance of NCZ in non-differential form can be written as

$$k \frac{\partial T(x, t)}{\partial t} \bigg|_{x = i+1} - k \frac{\partial T(x, t)}{\partial t} \bigg|_{x = i-1} + \left. I_{i+1}^{t} - I_{i-1}^{t} \right|_{t} = \frac{\rho c_p \Delta x}{\Delta t} \left( T_{i+1}^{t+\Delta t} - T_{i}^{t} \right)$$  \hspace{1cm} (46)
The temperature distribution for NCZ is given as
\[
T_{i+1}^{t+\Delta t} = T_i^t + \frac{\Delta t}{\rho C_p \Delta x} \left[ I_{x=i-1} - I_{x=i+1} + k \frac{T_{i+1}^t - T_i^t}{\Delta x} - k \frac{T_i^t - T_{i-1}^t}{\Delta x} \right]
\]  
(47)

The input and output heat values passing through the lower zone of a solar pond can be briefly described as in Figure 4. The lower convective zone is assumed to have a uniform temperature \( T_L \).

\[
\begin{align*}
q_{lw} & = \rho C_p x_{LCZ} \frac{\partial T_L}{\partial t} \\
q_{le} & = -k \frac{\partial T(x, t)}{\partial x} \bigg|_{x=x_{LCZ}} + I_{Xucz+Xncz} \\
q_{lb} & = \rho C_p x_{LCZ} \frac{\Delta t}{\rho C_p x_{LCZ}} \left[ I_{Xucz+Xncz} - k \frac{\Delta t}{\Delta x} \right]
\end{align*}
\]
(48)

The heat balance of LCZ in non-differential form can be written as
\[
-k \frac{\partial T(x, t)}{\partial x} \bigg|_{x=x_{LCZ}} + I_{Xucz+Xncz} = \rho C_p x_{LCZ} \frac{\Delta t}{\rho C_p x_{LCZ}} \left( T_L^{t+\Delta t} - T_L^t \right)
\]
(49)

The temperature distribution for LCZ is given as
\[
T_L^{t+\Delta t} = T_L^t + \frac{\Delta t}{\rho C_p x_{LCZ}} \left[ I_{Xucz+Xncz} - k \frac{\Delta t}{\Delta x} \right]
\]
(50)

IV. NUMERICAL ANALYSIS

Computational Fluid Dynamics (CFD) approach was used to study the temperature distribution in the single basin solar still. Geometric model of solar still is created using ANSYS CAD module and this geometric model is imported to the ANSYS meshing module to generate the meshing. The geometry has six faces which are considered as impermeable wall. The vertical higher and lower heights of the unit are 0.46 m and 0.13 m which results in a top surface slope of 20°. The width and length of the unit are 0.86 m and 1.22 m. In the mesh generation 6144 nodes, 4991 elements are generated. Figure 5 shows a three-dimensional (3D) model of single slope solar still based on data available in experimental set up of solar still and Figure 6 shows the meshing structure of single basin solar still.

The mesh files of solar still are imported to the ANSYS CFX 15 which solves the equations of continuity, momentum and energy. To simulate the condensation and evaporation process in solar still appropriate boundary conditions must be specified at each boundary. In CFX Pre, physics and boundary conditions are applied on the domain to solve the mass and momentum equation. The recorded experimental data are for eight hours, starts from 9 am to 5 pm. Here ANSYS CFX run time of 8 hours that is required for modeling of solar still which is in an unsteady state process. Hence, to overcome this problem, it assumes that steady state condition is reached after time period of 1 hour and received water; glass temperatures inside basin are constant.

A two-phase domain is created in VOF frame work for liquid water and mixture of water vapor and air. Evaporation process is modeled as laminar, accounting for thermal energy heat transfer while considering the effects of buoyancy. Due to distinct interface between liquid and vapor phase, both phases are assumed to be continuous. Two resistance models are taken to transfer heat, zero resistance model for gas phase and heat transfer coefficient for water phase. It was assumed that bottom temperature is equal to water temperature. The bottom and top surfaces are at fixed temperatures and the remaining side walls are assumed adiabatic so there is no heat loss to surrounding. No slip boundary condition is specified for liquid phase and free slip boundary condition is specified for
vapor phase. For producing droplets on the condensing cover plates, it assumes that adhesion forces are taken into account in simulation. The water and gas mixture volume fraction are taken as 0.21 and 0.79 respectively.

![Three-dimensional model of Single Basin Solar Still](image1)

**Figure 5.** Three-dimensional model of Single Basin Solar Still

![Mesh Generation of Single Basin Solar Still](image2)

**Figure 6.** Mesh Generation of Single Basin Solar Still

The commercial software ANSYS was used for the CFD numerical simulation of temperature distribution in a salt gradient solar pond. Firstly, three-dimensional geometry models for solar pond are drawn in ANSYS Workbench which allows for the use of CAD geometries or to build the geometry using a number of geometry tools. The cylindrical domain of consideration is that of the existing pond dimensions with 1.04 m diameter and 1.2 m height. The pond has been divided in three zones. The bottom zone (LCZ) has 0.48 m depth. The middle zone (NCZ) has 0.6 m depth and five equally divided sub-layers, each 0.12 m depth. The top zone (UCZ) has 0.12 m depth. Therefore, the physical domain consists of seven layers. And then, the 3D geometric model of in-pond heat exchanger is created using Auto-CAD software and this geometric model is imported to the middle of SGSP in ANSYS Workbench. After that, meshing is done in the ANSYS meshing approach. The number of mesh nodes is 207500 and elements 1086200. Figure 7 shows a three-dimensional model of SGSP with in-pond heat exchanger and Figure 8 shows the meshing structure of this model.
Figure 7. Three-dimensional model of SGSP with in-pond heat exchanger

Figure 8. Mesh Generation of SGSP with in-pond heat exchanger

The mesh files are imported to ANSYS CFX-15 software. In ANSYS CFX-Pre, the properties of the domains are defined along with their interface properties. The gravitational acceleration was set as 9.81 m/s². The fluid motion was considered as laminar flow, since water velocity didn’t achieve greater magnitudes. Bottom and vertical walls of the pond are set to be impermeable and thermally insulated. Also, the top surface is taken to be at ambient temperature according to local meteorological data. Modelling of the physics included creating interfaces for flow zones, assigning boundary conditions, assigning initial conditions, applying governing equations with appropriate models and choosing the flow materials. The solution control and declaration of variables were also done in the ANSYS CFX-Pre. The problem presented in this simulation consists in solving the combined equations of Navier-Stokes and energy equation for compressible fluid and subjected to density and concentration variation with temperature. After solving the governing equations in solver, the results of CFD simulation are showed in CFD-Post.

Three-dimensional CFD simulation is performed for temperature distribution in a salt gradient solar pond by using ANSYS CFX software. A complete workflow for CFD simulation is presented in Figure 7.
V. EXPERIMENTAL SETUP

The experiment mainly consists of two parts namely, single basin single slope solar still and salt gradient solar pond. The experimental setup of single basin single slope solar still is shown in Figure 8. The single basin single slope solar still is made up of mild steel sheet. The still basin is painted with matt black color to increase solar absorption. It is placed inside the plywood box which is made of plywood sheet at front and back heights of 0.2 m and 0.53 m, and size of 1.22 m × 0.86 m. The space between box and basin is filled with polystyrene foam sheet as an insulation purpose to reduce the heat losses from the bottom and the side walls of the solar still. A 5-mm thick glass is used as roof as well as the condensing surface in the still. The glass has been mounted at an angle of 20° equal to the latitude of Mandalay, to ensure maximum transmission of solar radiation into the still. The edges of the glass are sealed so that the entire basin becomes airtight. A collection trough is made in the still to collect the distilled water. The collection tray is used to drain the fresh water to an external beaker. An inlet PVC hose is fixed at the rear wall of the still for feeding raw water and hot water from solar pond. Two thermocouples were installed to measure the glass inside temperature and water temperature. The four-legged wood stand is appropriate to construct the solar still (height 1.2 m and size 1.2 m × 0.82 m). Four robust casters should be fixed at the end of each leg to facilitate moving and orientation of solar still.

The above said solar still is integrated with a SGSP. The experimental setup of salt gradient solar pond is shown in Figure 9. The main solar pond body is made up of cylindrical shape polyethylene water tank of 1000 L volume, 1.04 m diameter, 1.29 m height and 10 mm thick. The inner and outer surfaces of it are painted with matt black color to increase the absorption of incident solar radiation. It is enclosed in an iron box which is made of iron sheet at a height of 1.65 m and size of 1.32 m × 1.32 m. The inner and outer surfaces of box are painted with red oxide to avoid corrosion. The tank’s wall was insulated with polystyrene foam sheets of 0.14 m thickness. The bottom of solar pond was supported by an iron stand insulated with polystyrene foam sheets of 0.3 m thickness. Plywood is used to cover the insulation and covered with black plastic. The copper tube of 16 mm diameter is used as a straight and coil heat exchanger and stainless steel solid rod is used to stand the heat exchanger in the middle of pond. To measure the temperature...
distributions in each layer, the ten digital thermometers are used. The PVC pipes and lips of 12 mm diameter are used to insert the temperature sensors for each layer. The PVC pipe of 76 mm diameter is used to make the salt charger. The solution from the pond is piped to measure the salt concentration of each layer. If the salt lost from the bottom zone, the require amount of salt can add to the salt charger without destroying the various layers. All temperature sensors, salt charger and pipes are fixed to the inside wall of the pond. The secondary plastic tank of 200 L capacity is used to supply the fresh/salt water to the main solar pond. The four-legged iron stands are appropriate to construct the main solar pond (height 1.52 m and size 1.32 m × 1.32 m) and secondary tank (height 3.66 m and size 0.61m × 0.61 m) stands. The eight concrete stands are used to make the strong based frames and then installed with iron stands. The top of solar pond is covered by 8 mm thick transparent glass with aluminum frame. The iron ladder is used to observe the temperature distribution of solar pond. A diffuser can be made of plastic pipe in circular form and several holes along them led the higher density brine out. It is an essential role for filling process. Pure sodium chloride salt (NaCl ≥ 98.5 %) is used to establish the salt gradient layer. The flow of water from plastic tank to pond can be controlled by flexible hose and valve. Single-phase submersible pump of 35 m head, 6 m³/h flows and 2860 rpm speed are used to supply the solution to the secondary tank. There are three zones in the SGSP. The top zone is the Upper Convection Zone (UCZ) and consists of the fresh water. The middle zone is the Non-Convection Zone (NCZ) and consists of five sub-layers in which each sub-layer is heavier and hotter than the ones above it. This density gradient prevents the heat loss from the lower zone to the upper zone. The bottom zone is the Lower Convection Zone (LCZ) and consists of highest salt concentration. This zone acts as the heat storage zone and thermal energy can be extracted from this zone. The SGSP is connected with solar still by a pipe through a flow control valve.
The experimental procedure is as follows. The schematic diagram and photographic view of solar still is integrated with solar pond as shown in Figure 10 and 11. When the solar radiation falls on the surface of the SGSP, the heat penetrates through UCZ and NCZ to be stored at the LCZ. Water from top layer of solar pond (UCZ) is allowed to pass through NCZ and LCZ by a copper tube. While passing through LCZ, the water absorbs the heat from LCZ and gets heated. This preheated water is sent to solar still through a flow control valve. The depth of water in solar still is taken as 20 mm. The incident solar radiation is transmitted through the glass cover of solar still and absorbed by the water in the basin. Thus, the basin water gets heated up and evaporates. The evaporated water particles condense in the inside layer of the glass cover. This condensed water flows down the cover due to the slope provided and reaches the channels, where it is collected by the collection jar leaving behind the salts, minerals, and most other impurities, including germs. The evaporated water in the solar still is compensated by the hot water from the solar pond. The decrease in water level in the solar pond is also compensated by gently adding (without disturbing the three zones) fresh water on the top side of the solar pond.
Figure 10. Schematic Diagram of Solar Still Integrated with Solar Pond

Figure 11. Photographic View of Solar Still Integrated with Solar Pond
A measurement system had been installed for recording the experimental data. The digital thermometers with stainless steel sensor probe were used to measure the temperature of the various zones in the solar pond, basin water and glass cover in the solar still. Solar radiation is measured with solar power meter. Wind velocity is measured by a digital anemometer. Infrared thermometer is used to measure the glass outside temperature. Thermometer is used to measure the ambient temperature. The amount of produced potable water is measured by a collection tank of one-liter capacity and 250 ml measuring cylinder. Salt meter and hydrometer are used manually to measure the salt concentration and density of the liquids samples. Readings are taken for every one hour between 8:00 am and 5:00 pm. Figure 12 shows the measuring instruments.

![Image of measuring instruments](image)

Figure 12. Measuring Instruments (a) Digital Thermometer, (b) Solar Power Meter, (c) Digital Anemometer, (d) Thermometer, (e) Infrared Thermometer, (f) 250 ml Measuring Cylinder, (g) Salt Meter, (h) Hydrometer

VI. RESULTS AND DISCUSSION

The performance of the single basin single slope solar still integrated with and without salt gradient solar pond has been analyzed theoretically, numerically and experimentally. Energy balance equations have been solved analytically for the temperature elements of the solar still and solar pond. ANSYS CFX software is used for numerical analysis. A number of experimental tests are performed to predict the still performance at Mechanical Engineering Department in Mandalay Technological University, Myanmar. The following results were obtained.
Computational Fluid Dynamics approach was used to study the temperature distribution in the single basin solar still. Model geometry and meshing were done using ANSYS Workbench 15. Attention is made to concentrate on the temperature distribution of still basin. Simulation was carried out for one hour with all initial conditions. The temperature distribution of water and gas mixture, superficial velocity and mass fraction of gas mixture of single basin solar still integrated with and without salt gradient solar pond are shown in Figure 13 to 20.

![Figure 13. Water temperature distribution of Solar Still with SGSP (21.9.2017)](image1)

![Figure 14. Water temperature distribution of Solar Still without SGSP (21.9.2017)](image2)

![Figure 15. Gas Mixture temperature distribution of Solar Still with SGSP (21.9.2017)](image3)
Figure 16. Gas Mixture temperature distribution of Solar Still without SGSP (21.9.2017)

Figure 17. Gas Mixture Superficial Velocity of Solar Still with SGSP (21.9.2017)

Figure 18. Gas Mixture Superficial Velocity of Solar Still without SGSP (21.9.2017)

Figure 19. Gas Mixture Mass Fraction of Solar Still with SGSP (21.9.2017)
After the post-processing of simulation results, the temperature distribution of SGSP is obtained and presented in the Figure 21. In three dimensional simulation, the total depth of solar pond is analyzed. It is already possible to visualize the thermal stratification in a solar pond. The different colours defined the value of temperature in each zone of solar pond. It can be seen that temperature in UCZ remains approximately the same with ambient temperature. Temperature distribution in NCZ increases with depth similar to the density gradient. The highest temperature is reached in LCZ and this heat can store in the bottom of SGSP.

The experiment of the salt gradient solar pond was carried out using solar energy without using auxiliary heater from January to October 2017. After performing the filling process, the temperature distribution inside the pond was measured manually with ten digital thermometers distributed vertically with a gap around 6 cm. Daily data was observed once an hour from 8 am until 5 pm. According to the experimental result, SGSP has been able to operate properly by the increase of temperature at 5 pm on every day, although there is still a decreasing in temperatures that occurs in the next morning due to heat loss from the sides and bottom of the tank at night. Therefore, the data for average temperature at the bottom (LCZ) layer of SGSP at 5 pm is shown in Figure 22. There are variances in the figure, the stored temperature started at the time due to pond filling preparations, and salt concentration arrangements, which last several days, collecting and storing solar energy as heating energy mode, which increased storage region temperatures. The temperature differences increased with time to reach its maximum value. Solar pond heats up slowly but store heat in a longer period of time. It can be seen that the maximum storage temperature reaches 312 K.
The variation of water temperature from heat exchanger tube immersed in SGSP has been depicted in Figure 23. The extraction of heat from the SGSP by water through the heat exchanger tube is moderate and it gradually increases. The maximum water temperature is found to be 50 °C and heat energy extracted from pond water is given as input to the still throughout the working hours of the day to enhance the evaporation rate in the still.

The temperature variations depend on the solar energy that reaches on the surface, the climate conditions of the place and time. The hourly variations of solar radiation on the pond and still with respect to time are shown in Figure 24 and 25. From these figures, it is observed that the solar radiation intensity is gradually increased and reaches maximum during 12 pm to 1 pm and then decreased gradually. The maximum value of the solar radiation is 1258 W/m².
Figure 25. Variations of the solar radiation intensity on Single Basin Solar Still with time

Figure 26 shows the variation of ambient temperature with respect to time. It can be observed that the maximum ambient temperature (36°C) is obtained during the period from 11 a.m. to 3 p.m.

Figure 26. Variations of the ambient temperature and time

The productivity of the solar still can be augmented by preheating the inlet water. This can be done by a solar pond. A salt gradient solar pond is connected with the solar still by a flow control valve. The effect of SGSP coupled with solar still is compared with simple solar still and the results are shown in Figure 27 and 28. It shows that, the productivity of the salt gradient solar still is much higher than the solar still alone throughout the day. The additional heat energy supplied from SGSP increases the basin water temperature in the still. This leads to higher productivity in the salt gradient solar still. It is found that, the productivity of the salt gradient solar still is 40.78% higher than the simple solar still.

Figure 27. Comparisons of distilled water output of the still with and without SGSP
Figure 28. Comparisons of distilled water output of the still with and without SGSP

Figure 29 shows the comparison of PH level of solar still with and without SGSP. It shows that, the PH level of the salt gradient solar still is much higher than the solar still alone.

Figure 29. Comparisons of PH level of distilled water output of the still with and without SGSP

Figure 30 shows the productivity of distilled water from the single basin single slope solar still with and without salt gradient solar pond on September 21st 2017 as determined by experimental measurements, theory calculation and numerical simulation model. It is found that the theoretical and numerical results are in good agreement with the experimental results.

Figure 30. Theoretical and experimental values of distilled water output with coupled SGSP
VII. CONCLUSIONS

The solar still can be used as a water purifier for domestic purposes by using solar energy. Solar-pond technology is the renewable and efficient technology for pre-heating the inlet water to solar still. A salt gradient solar pond was used to store the solar thermal energy and the heat energy stored by the solar pond was used for preheating water in single basin solar still. Experiments of single basin solar still were carried out with and without solar pond. The experiment is performed from 9 am to 5 pm at Mechanical Engineering Department, Mandalay Technological University. Here we have focused on the use of salt gradient solar pond to increase the daily productivity of single basin single slope solar still. In this work, solar evaporation of water is simulated using ANSYS CFX. CFD prediction results become insignificantly closer to the theoretical and experimental work. The maximum pH level is 7.4 with integration and 7 without integration and the minimum pH level is 7 with integration and 6.6 without integration. The maximum water temperature is obtained about 95ºC and 72ºC with and without integration. The maximum yield of the still is about 1.5 liters and 1.1 liters with and without integration. The productivity of solar still with solar pond was 40.78 % more than solar still alone. The performance of the solar still integrated with the salt gradient solar pond provides better performance compared with the still without integration.

ACKNOWLEDGEMENTS

The author would like to acknowledge the support and encouragement of Dr. Sint Soe, Rector of Mandalay Technological University. The author is very thankful to Dr. Htay Htay Win, Professor and Head of Department of Mechanical Engineering, M.T.U, for her invaluable help, and indispensable guidance in the preparation of this paper. The author wishes to express her deepest special thanks to her supervisor, Dr. Myat Myat Soe, Professor, Department of Mechanical Engineering, M.T.U, for her enthusiastic instruction, invaluable input into the present research as well as for her understanding and moral support throughout the course of this challenging study. The author is thankful to Japan International Cooperation Agency (JICA), Project for Enhancement of Engineering Higher Education (EEHE) for supporting the experimental facilities. The author would like to thank all teachers from Mechanical Engineering Department, Mandalay Technological University for their kindness, graceful, attitude and permission to do this paper. The author wishes to express her heartfelt thanks to her parents for their guidance and encouragements to attain her destination without any trouble.

NOMENCLATURE

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Radiative heat transfer between glass and ambient W/m²
Convective heat transfer between glass and ambient W/m²
Conduction heat loss to the bottom W/m²
Conduction heat loss to the sides W/m²
Useful energy stored in the pond W/m²
Heat gained from bottom in upper zone W/m²
Heat loss from the bottom of pond W/m²
Heat loss from the top W/m²
Heat loss by heat extraction W/m²
Heat loss from the sidewalls in UCZ W/m²
Heat loss from the sidewalls in NCZ W/m²
Heat loss from the sidewalls in LCZ W/m²
Ambient temperature ºC
Upper layer temperature ºC
Gradient layer temperature ºC
Lower layer temperature ºC
Sky temperature ºC
Water temperature ºC
Operating time hr
Reflectance of radiation at surface -
Collector’s tilt angle degree
Emissivity of water -
Solar declination angle degree
Solar zenith angle degree
Solar incidence angle degree
Attenuation or extinction coefficient -
Latitude of the location -
Stefan – Boltzman constant -
Density kg/m³

References


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Design, Simulation and Performance on the Effect of Modification on Impeller Tip for Pump as Turbine (PAT)

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Abstract - Pump as Turbine (PAT) is typically used as electromechanical components in microhydro systems, especially by rural communities in developing countries to reduce initial capital cost. The technology is readily available and easily accessible compared to commercially available turbines. This paper presents experimental design, the results of an experimental test and performance of a centrifugal pump working as turbine (PAT). An end suction centrifugal pump was tested in turbine mode at PAT experimental rig installed in the Mechanical Engineering Laboratory of Mandalay Technology University. The experiment showed that a centrifugal pump can satisfactorily be operated as turbine without any mechanical problems. As compared to pump operation, the pump was found to operate at higher heads and discharge values in turbine mode. Centrifugal volute-pumps are potential alternative solution to be using as hydroturbine, by flowing water in the reverse direction through in the pumps. Since the overall efficiency of these machines is lower than the conventional turbines, their application in larger hydro sites is not economical. Therefore, the efficiency improvement of reverse pumps is essential. In this study, by focusing on a pump impeller, the shape of blades was redesigned to reach a higher efficiency in turbine mode. The aim of this research is to compare the performance of a small centrifugal volute-pump as turbine at the different head of the pump before and after modification on impeller tips of the pump at various capacities. Modification is performed by grinding the inlet ends of the impeller tips of the pump to a sharp-edge, round and bullet nose shape to preclude excessive turbulence for efficiency consideration. After modification, a new impeller was tested in the test rig. Then, testing is carried out by operating the pump as turbine at the maximum head of the pump, 13.5 meter, and at various capacities. The results show that the output-power and efficiency of the modified impeller tips the centrifugal volute-pump as turbine slightly better than before modified one.

Index Terms - Experimental tests, Design, Pump as Turbine, Modification Impeller, Performance

I. INTRODUCTION

Small hydroelectric power stations became attractive for generating electrical energy after the oil crisis of the seventies. However cost per kW energy produced by these stations is higher than the hydroelectric power plants with large capacity. Numerous publications in recent years emphasize the importance of using simple turbine in order to reduce the cost of produced electrical energy. We considered the idea of using pumps as hydraulic turbines an attractive and important alternative. Pumps are relatively simple machine, are easy to maintain and are readily available in most developing countries. From the economical point of view, it is often stated that pumps working as turbines in the range of 1 to 500 kW allow capital payback periods of two years or less which is considerably less than that of a conventional turbine. Small hydropower plants are very attractive for producing energy from water in these days. The main problem for developing such units is the high price of installation as well as the time needed for their construction and maintenance. One solution of this problem is the extensive use of pumps that can operate in the reverse mode as turbines. They are easily found on the market at much lower price compared to a standard turbine. The maintenance of the pump is very low and the pumps can be operated by non-highly trained people. Pumps operated in the reverse mode are usually of the single stage type with low or medium delivery head and the description of flow inside. It is possible of course to use also the multistage pump in the turbine regime in the case when sufficiently high head is available, nevertheless there is lack of information about applications of the multistage pumps in the reverse mode, especially about the flow phenomena occurring inside these pumps when operating as turbines.

Rural electrification plays a significant role in enhancing the quality of life for rural communities by promoting access to modern energy services. This leads to increased economic strength and improves productivity, consequently reducing inequality. The traditional way to supply electricity to rural areas is to extend the national grid into these areas; however, after taking into account financial viability, this approach is usually found to be uneconomical. Using microhydro technologies for off-grid electricity generation
is the most suitable method whenever there is an accessible potential site. The use of appropriate technologies to suit local conditions is one of the critical factors affecting the success of an off-grid microhydro electrification system [1, 2]. Economic feasibility is one of the main considerations associated with microhydro systems. Hence, the application of low-cost equipment for the microhydro system has always been the central focus for rural electrification.

The use of Pump as Turbine (PAT) in place of commercial electromechanical components has proven to be a feasible, low-cost solution. Some successful microhydro projects have been reported for rural area sites, especially in developing countries [3-5]. There has been growing interest on utilising the PAT as a substitute for the commercial microhydro turbine, in particular for generating power between the ranges of 10 kW to 25 kW. Even though the PAT has lower efficiency than commercial turbines, its availability covers a wide variety of flows and heads, which makes microhydro projects more economical and practical. Also, the PAT offers benefits such as simple construction, easily-attainable spare parts, readily-available maintenance services, and installation that can be carried out by local laymen. These desirable characteristics of the PAT are indeed important, as they reduce dependence on third-party professional services, which can be very expensive. Even though there are many ways to predict the behaviour of PATs, such as simulation analysis, theoretical frameworks and prediction models, the best approach is to test the pump at a predefined operation range of flow rate and pressure. Each PAT is unique to its application; thus, it needs to be tested in its working environment. There are many prediction and simulation models; however, they are limited to certain applications and cannot definitively predict the actual performance. Therefore, the experimental results will give specific indicators of its operational performance. The outcome of the experimental work will accurately present real operational conditions from the perspective of microhydro applications [6].

Pump manufactures do not normally provide the characteristic curves of their pumps in reverse operation. Therefore, establishing a correlation enabling the passage from the “pump” characteristics to the “turbine” characteristics is the main challenge in using a pump as a turbine. The hydraulic behavior of a pump when rotates as a turbine will be changed. In general a pump will operate in turbine mode with higher head and discharge in the same rotational speed. Many researchers have presented some theoretical and empirical relations for predicting the PAT characteristics in the best efficiency point (BEP). A good literature review has been done by Nautiyal and Anoop Kumar [7]. But the results predicted by these methods are not reliable for all pumps with different specific speeds and capacities. Most recent attempts to predict performance of PAT, have made using CFD [8]. However, without verifying the CFD results by experimental data, they are not reliable. Besides, also all of these simulations included only hydraulic losses.

II. THEORETICAL DESIGN

The design of centrifugal pumps involves a large number of interdependent variables so there are several possible designs for the same duty. One of the most difficult design problems is to predict the impeller head slip, i.e. the difference between the theoretical head for a number of impeller vanes and the theoretical head deduced from the net horsepower given to the fluid passing through the impeller. Before pump design or selection can be got, specifications need to be established which express several requirements.

A. Specific Speed of Pump

Selection of the specific speed value at the best efficiency point is the first step in the design of centrifugal pumps. This involves a selection of the rotation speed and whether the required head should be produced in one or more stages. Another distinction in impellers is the liquid traverses and leaves the impeller blades. This is called the specific speed. It is another index used by pump designers to describe the geometry of the impeller and to classify impellers according to their design type and application. The equation for specific speed of pump is;

$$n_{sp} = \frac{N_p \sqrt{Q_p}}{H_p^{\frac{1}{2}}}$$

(1)

B. Capacity

This is the volume of liquid per unit time delivered by the pump. The capacity of a pump is the amount of water pumped per unit time and it is also known traditionally as volume flow rate. Capacity means the flow rate which liquid is moved or pushed by the pump to the desired point in the process. It is expressed in English units gallons per minute. In metric units, it is expressed as liters per minute (L/min) or cubic meters per second (m³/sec). As liquid is essentially incompressible, the capacity is directly related with the velocity of flow in the suction pipe.

This relationship is as follows:

$$Q = AV$$

(2)
C. Overall Efficiency

The overall efficiency of the turbine is the ratio of useful power available at the turbine shaft to the power supplied by the water turbine at the entrance.

\[ \eta_o = \frac{\text{power available at the shaft}}{\rho_w g Q H} \]  

(3)

\[ \eta_o = \eta_h \times \eta_m \times \eta_v \]  

(4)

The hydraulic turbines are directly coupled to electric generators to produce electric power. There is loss of power in transmission. Coupling and the generators also have some losses. Therefore, the power output at the generator shaft is a bit less than the power available at the runner outlet.

D. Dimensions of Impeller Diameters

Before the impeller diameters, the rotational speed, design flow rate and the pump head must be known. Electric motor drive prescribes standard motor speeds. So, the maximum size of the impeller diameter is limited. The value of the impeller inlet diameter \( D_1 \) is usually selected to minimize the inlet relative velocity. The impeller diameter is one of the principal determinants of the power and head of the pump. So, the inlet and outlet diameter of impeller is calculated by the following equation.

The inlet diameter of impeller is carried out from stepanoff chart,

\[ D_1 = \frac{D_1}{D_2} \times D_2 \]  

(5)

The outlet diameter of impeller is calculated by using equation,

\[ D_2 = \frac{U_2 \times 60}{\pi N_p} \]  

(6)

\[ U_2 = K_u \sqrt{2 \times g H_p} \]  

(7)

E. Inlet and Outlet Width of Impeller

The width of the blades at inlet and outlet of the impeller are calculated from the continuity equation. The inlet width of impeller, \( b_1 \) is calculated by:

\[ b_1 = \frac{Q_s'}{\pi D_1 V_{ml}} \]  

(8)

The volumetric efficiency for pump can be calculated by

\[ \eta_v = \frac{1}{1 + \left( \frac{1.124}{(n_{sp})^3} \right)^2} \]  

(9)

\[ Q_s' = \frac{Q_p}{\eta_v} \]  

(10)
\[ V_{n1} = K_{n1} \sqrt{2 \times gH_p} \]  

(11)

The outlet width of impeller, \(b_2\) is calculated by:

\[ b_2 = \frac{Q_s'}{\pi D_2 V_{n2}} \]  

(12)

\[ V_{n2} = K_{n2} \sqrt{2 \times gH_p} \]  

(13)

III. SIMULATION

The Computational Fluid Dynamics (or CFD) programs are gaining in importance for the design and analysis of fluid turbomachinery. The CFD analysis of the PAT was carried out inside the premises of ANSYS Workbench 17.0. In this study, all the simulations have been performed in turbine mode and the setups were done for the same condition.

A. Modelling of the Geometry

Modeling of the geometry of a centrifugal pump running in turbine mode involves defining the impeller and volute components. Geometric modeling of draft tube is also considered since it is one of the major components in PAT system. The volute, impeller and draft tube are generated using Solidworks software.

B. Mesh Generation

The entire geometry consisting of casing, impeller, and draft tube is modelled for numerical analysis using an unstructured tetrahedral mesh as shown in the following figures. The geometry and the mesh of a six bladed pump impeller domain is generated using ANSYS Workbench 17.0. An unstructured mesh with tetrahedral cells is also used for the zones of impeller and volute.

![Figure 1. Meshed Model of the Impeller with (a) Flat Tip (b) Round Tip (c) Sharp Tip and (d) Bullet Tip](image-url)
C. Boundary Conditions

Centrifugal pump impeller domain is considered as rotating frame of reference with a rotational speed of 1655 rpm. The working fluid through the pump is water at 25°C. k-ε turbulence model with turbulence intensity of 5% is considered. The inlet and outlet boundary condition were set by imposing total pressure on the casing inlet surface and variable mass flow rate on the impeller outlet surface respectively.

D. CFX-Pre

CFX-Pre is a mode allowing to set up fluid flow simulations such as compressors or turbines. Each components of a machine can be simply defined by selecting a mesh file and some basic parameters and then add the boundary conditions and interfaces between the components. The meshed model are imported to CFX-Pre to analyze the velocity and pressure distribution on the PAT due to the fluid flow.

E. Simulation Results

The pressure contours show a continuous pressure decrease from leading edge to trailing edge of the impeller. It is observed that total pressure on pressure side of the blade is more than that of suction side. The difference of pressure from the pressure side to the suction side of the impeller blade is decreasing from leading edge to trailing edge of the blade. The minimum value of the static pressure inside the impeller is located at the leading edge of the blades on the suction side.

The velocity streamlines and pressure distributions with the above setup is shown in Figure.4. From the runner, the water flows towards the draft tube with high velocity. This velocity head is converted into the pressure head generating more power and efficiency. The diverging passage of the draft tube allows for the decrease in the velocity at the outlet from the equation of continuity.

Figure 2. Meshed Model of Volute Casing

Figure 3. Meshed Model of Draft Tube

Figure 4(a). Pressure and Velocity Distribution for the Impeller with Flat Tip
Figure 4(b). Pressure and Velocity Distribution for the Impeller with Sharp Tip

Figure 4(c). Pressure and Velocity Distribution for the Impeller with Round Tip Modification

Figure 4(d). Pressure and Velocity Distribution for the Impeller Bullet Tip Modification
The total pressure patterns are varying along the span of the impeller. Low total pressures are observed near hub of the impeller. A low total pressure and high velocity is observed near the trailing edge on suction side of the blade because of the vane thickness. At leading edge of the blade total pressure loss is observed for all span wise locations due to the wake formation at trailing edge of the blade. At trailing edge, pressure drop on both pressure and suction side are observed due to the acceleration of the flow in to the impeller. By seeing the simulation result, the pressure side along the blade after modification is more increased than before modification.

![Comparison of Pressure Difference between Before and After Modification](image)

Figure.5. Comparison of Pressure Difference between Before and After Modification

IV. METHODOLOGY

Figure.6 shows the schematic of the hydraulic test rig that was adopted for the PAT test. The main components consist of a feed pump, PAT, test bed, Pressure gauges, PVC piping network and control valves. Bends and tees were used as the pipe connectors and fittings. All the pipes and fittings were fitted with flanged joints and connected with bolts and nuts.

![Schematic view of the hydraulic test rig](image)

Figure .6. Schematic view of the hydraulic test rig

Two pressure gauges were positioned at each end of the PAT to measure pressure difference across the device. The driving force behind the flow of water across the PAT was recorded as a pressure drop at the corresponding flow rate. The hydraulic test rig was an open-loop system. The inlet and outlet piping systems were joined to water tank that acted as a reservoir. The open-loop system allowed a continuous water supply to the piping system. The inlet of the feed pump was positioned at the lower water tank line to ensure sufficient
suction pressure. This served to prevent flow separation and reduce air suction to the feedpump. The pressurised water flowed through the piping network to the PAT before being returned to the water tank.

### A. Test Rig Main Components and Measuring Instruments

The hydraulic test rig consists of six main components and measuring instruments as describe below.

**Feed pump:** The feed pump that was used to supply pressurised water to the PAT was a monoblock pump with a power rating of 2.2 kW and 2900 rpm maximum speed. The pump used an induction generator with a single-phase power input. The feed pump was mounted on a large fixed frame bed and secured by a bolt connection. This kept the pump attached and stabilized thus reducing the vibration generated during the experiment. This pump will produce a maximum water pressure of 22.2 m at a flow rate of 600 l/min. The additional pressure at the pump inlet will be added to the total pressure generated at the pump outlet.

**Pump as Turbine:** The centrifugal pump used as Pump as Turbine was a low specific speed pump that delivered high pressure at a low flow rate. The impeller had a diameter of 127 mm, and the flange diameter was 50.0 mm at the inlet and 54.5 mm at the outlet. The pump’s power rating was 200 W, and the rotational speed was 1650 rpm. The best efficient point was at 65.0% with a corresponding pressure and flow rate of 9.05 m and 240 l/min, respectively.

**Piping system:** The pipes were made from polyvinyl chloride, PVC. The wall thickness was recorded at 3.0 mm, with the permissible working pressure of 12 bars at 20° Celsius. Reducers and expanders were used to connect the pipes to the pump that had a different diameter. The PVC pipe was fitted with a set of connectors and fittings including tees, bends, and a valve with flange ends. PVC pipe with diameter of 50 mm was used for the experimental test rig. A bypass pipe was connected from the main pipe to regulate excess flow and pressure.

**Water tank:** The water was re-circulated within the polythene tank having capacity of 80 gallons. The water tank was connected by a pipe at the side wall of the tank. Two control valves were used to adjust water flow to the PAT and to regulate excess flow. The water level was kept at a defined height to generate sufficient suction pressure at the feed pump inlet. The iron pallet held the tank foundation with a iron frame for support.

**Control valve:** The feed pump did not have a control mechanism to regulate the flow and pressure generated at the pump outlet. Two control valves controlled the flow rate. The flow rate was adjusted by manipulating the opening of the control valve and diverting a portion of the flowing water from the piping system to the water tank, by passing the PAT.

**Bulbs:** Three pieces of bulbs, 100W each were used as ballast load for the generated power. On/off toggle switches were used to increase the ballast load by switching on the 100W bulbs.

**Pressure gauge:** The pressure gauges with a measuring range of 0 psi to 30 psi were placed at the outlet of the feed pump and at the inlet and outlet of the PAT to measure the head. The pressure difference between the two points gave the pressure difference across the PAT.

**Clamp meter:** One of the most basic measurements of a clamp meter is current. Another common function for a clamp meter is measuring voltage.

**Tachometer:** The speed of the generator can also be measured by using the tachometer. Figure .8. is the tachometer to measure the speed.
B. General Assembly and Operation Procedure

Figure 11. shows the completed hydraulic test rig that was used to test the PAT. The arrangement of rig components was adapted to suit the existing hydraulic lab facilities. The rig was designed to have modular components, which would allow for a simple system that could be upgraded for future research. The hydraulic test rig was fabricated and installed in the Mechanical Laboratory of Mandalay Technological University. The feed pump supplied a continuous flow to the piping system. The water was contained in the reservoir and was open to atmospheric pressure. Two control valves were used for flow rate control between the PAT and feed pump. The flow was adjusted by regulating the opening of the two valves by hand.

As the water entered the PAT, the impeller rotated and produced rotational power. The impeller shaft was coupled to the generator. The desired rotational speed was measured by applying the tachometer. Meanwhile, the corresponding pressure across the PAT was recorded with a pressure gauge positioned at the inlet and outlet of the PAT. Each experimental process gave a set of data consisting of flow rate Q, pressure P, current I, voltage V and rotational speed N. The purpose of the experimental work on the PAT was to determine the efficiency, flow rate and power over the operation rotational speed.

Firstly, the water is pumped to the inlet pipe from the open tank. The flow rate to the turbine is controlled by gate valve which has twelve cycles (fully open). The valve was marked at opening one cycle. In this test, the flow was controlled by opening gate valve starting from one cycles to twelve cycles (fully open). In the event of an overflow, there is a by-pass pipe line by opening by-pass valve to the tank. The pressure is measured by the pressure gauge on the suction and discharge pipe of PAT. The runner rotational speed is measured by tachometer. The voltage and current are measured by clamp meter.

C. Manufacturing Impeller with the 3D Printer

All the parts created using a 3D printer need to be designed using some kind of CAD software. This type of production depends mostly on the quality of the CAD design and also the precision of the printer. There are many types of CAD software available. The model to be manufactured is built up a layer at a time. A layer of powder is automatically deposited in the model tray. The print head then applies resin in the shape of the model. The layer dries solid almost immediately.

In case of impeller manufacturing using RP, the initial phase of this procedure is exactly the same as CAD/CAM method. Scanned data prepared and transferred to the software, after analyzing and refining the data it transferred to 3D printing machine and 3D impeller is produced. After data analyze, and drawing 3D shape of impeller it is ready to transfer to RP machine, machine receive the data and produce initial model of impeller layer by layer. The model tray then moves down the distance of a layer and another layer of power is deposited in position, in the model tray. The print head again applies resin in the shape of the model, binding it to the first layer. This sequence occurs one layer at a time until the model is complete.
The materials used for printing the impeller are Acrylonitrile Butadiene Styrene (ABS) and Polylactic Acid (PLA). ABS is made of oil-based resources and has a higher melting-point, it is stronger and harder than PLA plastic. PLA is made of plant-based resources (corn starch or sugar cane) and it is biodegradable. Both ABS and PLA have advantages and limitations, and choosing a printer depending on the used material could be a good idea, as they have different properties: ABS as a longer lifespan and has a higher melting point, while PLA is more malleable, easier to use, looks better and is suitable for creating artistic 3D objects.

D. Impeller manufacturing using conventional sand casting process

In conventional method, manufacturer use casting procedure to produce impeller. It will be taking less cost compare to other methods but it has some other limitation, which compel manufacturer to select and try other methods depending the case, which they want to produce. Such like other casting operation it need to main section such as die, core and core box. That is the traditional core box making method. In this way, the wooden or plastic core box produced by hand via professional model maker. These initial blades are used to making sand core. In this regard, aluminum core box will be casted via this wooden core box and prepared to make main core.
to use for final casting of impeller. Mentioned method is old and traditional method in reverse engineering of impeller and it is to keeping being not more used method. Because most of the work is done by hand and actually, the mistake of labor transferred to work piece so it wouldn’t be so accurate and dependable. But as advantage of this method the cost issue is so lower than compare to another method and it has also done in some traditional workshops. The finished blades joint to shroud part of impeller and finally are used as core box to make sand core.

![Figure 14. Pattern Making Process](image1.png)

![Figure 15. Metal Casting process](image2.png)

![Figure 16. Making Sand Mold](image3.png)

![Figure 17. Making Sand Mold](image4.png)

![Figure 18. Lathe Machining Process](image5.png)

![Figure 19. Bronze Casting Process](image6.png)

Casting technology has been observed and evaluated in order to produce model and core box for our case study. After the aluminum core box has been prepared and also, dimensional control has checked, now, it is ready to produce the sand core of impeller by foundry experts. Special sand is mixed properly with particular glue and poured inside of core box then CO2 gas is injected to inside of Die for solidification purposes.

**E. Modification on the Geometry**

The main difference in the pump and turbine design is that, conventional turbines having flow control mechanism to increase its part load efficiency but the standard pumps are not having any flow control mechanism to increase its part load efficiency. Pumps are generally operated with constant speed, head and flow. A pump is therefore designed for one particular of operation for maximum efficiency and it not required any regulating flow control device. Turbine operates under variable head and flow condition. In various seasonal variations of the available water so to adjust the power output and consumer requirement regulate the flow regulator are required. Also in the reverse operation of pump it may be less efficient because the direction of flow is reverse and hydraulic and frictional losses increase sharply. When fluid enters in to impeller because of round edges of impeller at the end flow separation occurs at inlet of PAT due to that separation losses occurs.

Modification is performed by grinding the inlet ends of the impeller tips of the PAT in various shape to preclude excessive turbulence for efficiency consideration. Then, testing is carried out by operating the pump as turbine at the maximum head and at various capacities. The sharp tip, round tip and bullet-nose tip impeller that used in experimental test are shown in Figure 20, 21 and 22.
V. EXPERIMENTAL RESULTS

The experiments are carried out on the PAT to find out the performance at various flow rate with impeller in modified and non-modified condition. From the measurements and calculation that have been done in the experiment as presented in Table.1.

Table.1: Result Data of Current and Voltage for Different Types of Impeller Tips

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Table.2: Result Data of Flow Rate, Head, Speed, Power and Efficiency for Different Types of Impeller Tips

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<td>184.59</td>
<td>34.3</td>
<td>36.39</td>
<td>37.00</td>
<td>41.5</td>
</tr>
</tbody>
</table>

VI. PERFORMANCE CHARACTERISTIC

Performance analysis with different type of impeller tips are shown in the following figures. The graph shows that the head extracted from the turbine is increasing if the flow of water capacity is increased both on before and after modification of pump impeller tips. In addition, the speed, the power and efficiency of the pump as turbine after modification is slightly higher than before modification.

Figure.23. Flow rate verses Head with Different Type of Impeller Tip
Figure 24. Flow rate versus Speed with Different Type of Impeller Tip

Figure 25. Flow rate versus Power Output with Different Type of Impeller Tip

Figure 26. Flow rate versus Efficiency with Different Type of Impeller Tip
**VII. NOMENCLATURE**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n_s)</td>
<td>Specific speed of pump</td>
<td>-</td>
</tr>
<tr>
<td>(N_p)</td>
<td>Speed of pump</td>
<td>rpm</td>
</tr>
<tr>
<td>(H)</td>
<td>Design head</td>
<td>m</td>
</tr>
<tr>
<td>(P_{out})</td>
<td>Output power</td>
<td>watts</td>
</tr>
<tr>
<td>(Q)</td>
<td>Capacity or volume flow rate,</td>
<td>m³/sec</td>
</tr>
<tr>
<td>(A)</td>
<td>Area of pipe</td>
<td>m²</td>
</tr>
<tr>
<td>(v)</td>
<td>Velocity of flow</td>
<td>m/s</td>
</tr>
<tr>
<td>(\rho_w)</td>
<td>Density of water</td>
<td>kg/m³</td>
</tr>
<tr>
<td>(g)</td>
<td>Acceleration due to gravity</td>
<td>m/s²</td>
</tr>
<tr>
<td>(\eta_o)</td>
<td>Overall efficiency</td>
<td>(%)</td>
</tr>
<tr>
<td>(\eta_h)</td>
<td>Hydraulic efficiency</td>
<td>(%)</td>
</tr>
<tr>
<td>(\eta_m)</td>
<td>Mechanical efficiency</td>
<td>(%)</td>
</tr>
<tr>
<td>(\eta_v)</td>
<td>Volumetric efficiency</td>
<td>(%)</td>
</tr>
<tr>
<td>(D_1)</td>
<td>Inlet diameter of impeller</td>
<td>(m)</td>
</tr>
<tr>
<td>(D_2)</td>
<td>Outlet diameter of impeller</td>
<td>(m)</td>
</tr>
<tr>
<td>(U_2)</td>
<td>Absolute tangential velocity of the impeller outlet</td>
<td>(m³/s)</td>
</tr>
<tr>
<td>(K)</td>
<td>Constant coefficient</td>
<td>-</td>
</tr>
<tr>
<td>(b_1)</td>
<td>Inlet width of impeller</td>
<td>(m)</td>
</tr>
<tr>
<td>(Q_s)</td>
<td>Leakage flow rate through an impeller</td>
<td>(m³/s)</td>
</tr>
<tr>
<td>(V_{ml})</td>
<td>Inlet flow velocity</td>
<td>(m/s)</td>
</tr>
<tr>
<td>(K_{ml})</td>
<td>Constant parameter</td>
<td>-</td>
</tr>
<tr>
<td>$P_f$</td>
<td>output power for flat tip impeller</td>
<td>W</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>$P_s$</td>
<td>output power for sharp tip impeller</td>
<td>W</td>
</tr>
<tr>
<td>$P_r$</td>
<td>output power for round tip impeller</td>
<td>W</td>
</tr>
<tr>
<td>$P_b$</td>
<td>output power for bullet tip impeller</td>
<td>W</td>
</tr>
<tr>
<td>$\eta_f$</td>
<td>turbine efficiency for flat tip impeller</td>
<td>%</td>
</tr>
<tr>
<td>$\eta_s$</td>
<td>turbine efficiency for sharp tip impeller</td>
<td>%</td>
</tr>
<tr>
<td>$\eta_r$</td>
<td>turbine efficiency for round tip impeller</td>
<td>%</td>
</tr>
<tr>
<td>$\eta_b$</td>
<td>turbine efficiency for bullet tip impeller</td>
<td>%</td>
</tr>
<tr>
<td>$I_f$</td>
<td>Current for flat tip impeller</td>
<td>A</td>
</tr>
<tr>
<td>$I_s$</td>
<td>Current for sharp tip impeller</td>
<td>A</td>
</tr>
<tr>
<td>$I_r$</td>
<td>Current for round tip impeller</td>
<td>A</td>
</tr>
<tr>
<td>$I_b$</td>
<td>Current for bullet tip impeller</td>
<td>A</td>
</tr>
<tr>
<td>$V_f$</td>
<td>Voltage for flat tip impeller</td>
<td>V</td>
</tr>
<tr>
<td>$V_s$</td>
<td>Voltage for sharp tip impeller</td>
<td>V</td>
</tr>
<tr>
<td>$V_r$</td>
<td>Voltage for round tip impeller</td>
<td>V</td>
</tr>
<tr>
<td>$V_b$</td>
<td>Voltage for bullet tip impeller</td>
<td>V</td>
</tr>
</tbody>
</table>

**VIII. CONCLUSION**

This paper outlined the experimental testing of PAT performance using a hydraulic test rig. The corresponding pressure, current, voltage and flow rate of the PAT system were measured using measuring instruments. From the experimental results, it can be concluded that the centrifugal pump could run in turbine mode with satisfactory operational performance. The ideal flow rate for the pump in turbine mode was higher than in pump mode; however, due to the constraints of the hydraulic test rig, the control parameters were limited to the designed test rig setup. For future research, it is recommended that some of the system components, such as feed pump capacity and diameter of the pipe, are upgraded. This will allow a higher flow rate and greater pressure to be transferred to the pump; consequently, a higher rotational speed that matches the synchronous speed of the induction generator could be achieved, allowing full performance characteristics to be acquired. Efficiency of the volute-pump operating as turbine after modification its impeller tips is slightly better than before modification. Furthermore, both pumps as turbines before and after modification generate high shaft-revolution that is about 1,600 rpm at their maximum efficiency; therefore, it can be coupled directly to the load, a generator for example, without reduction gear. The maximum efficiencies of the pump as turbine both on before and after modification are performed between the rated flow capacity of the pump at its maximum efficiency and the maximum flow capacity of the pump.

**ACKNOWLEDGEMENTS**

The authors would like to express gratitude to JICA project for providing financial support. The author would like to acknowledge the support and encouragement of Dr. Sint Soe, Rector of Mandalay Technological University. Great thanks to Dr. Htay Htay Win, Professor and Head of Mechanical Engineering Department, Mandalay Technological University. The author owes a debt of gratitude to her supervisor, Dr. Myat Myat Soe, Professor, Department of Mechanical Engineering, M.T.U, for her enthusiastic instruction, invaluable input into the present research as well as for her understanding and moral support throughout the course of this challenging study. The author would like to express her heartfelt gratitude to all teachers for their supports, valuable suggestions and discussions during the presentation of the paper. Finally, the author wishes to express her heartfelt thanks to her family. Thanks are also extended to Mechanical Engineering Department, who provided her great assistance and supports.
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Design and Analysis of Steering Gear and Intermediate Shaft for Manual Rack and Pinion Steering System

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* Department of Mechanical Engineering, Mandalay Technological University
** Department of Mechanical Engineering, Mandalay Technological University
*** Department of Mechanical Engineering, Mandalay Technological University

Abstract - Manual rack and pinion steering systems are commonly used due to their simplicity in construction and compactness. The main purpose of this paper is to design and analyze the rack and pinion steering system. In this paper analyzed the two components of the steering system. Firstly, this paper investigates the characteristics of a rack and pinion gear system mainly focused on bending and contact stresses of the pinion gear and rack bending stress using analytical and finite element analysis. To estimate the contact stress, the-dimensional solid models for different materials are generated by SolidWorks software and the numerical solution is done by ANSYS, which is a finite element analysis package. The analytical investigation is based on Lewis stress formula. This paper also considers the study of contact stresses induced between two gears. Present method of calculating gear contact stress uses AGMA equation. To determine the contact stresses between two mating gears the analysis is carried out on the equivalent contacting cylinders. The results obtained from ANSYS are presented and compared with theoretical values. This paper also deals with the stress analysis of the rack. By using FEM a stress analysis has been carry out. Steering rack deflection and bending stresses are found. This stresses are compared with analytical result. Secondly, Fatigue analysis of intermediate steering shaft is done to find the life of the intermediate steering shaft in cycles and determined the factor of safety of the shaft. The Software results, mathematical and logical calculation implementation in a research will increase the performance and efficiency of a design.

Index Terms - Rack and Pinion Steering Gear, Contact Stress, Rack Bending Stress, Steering Intermediate Shaft, Life Cycle, Safety Factor, ANSYS Software.

I. INTRODUCTION

Two main types of steering systems are used on modern cars and light trucks: the rack-and-pinion system and the conventional, or parallelogram linkage, steering system. On automobiles, the conventional system was the only type used until the 1970s. It has been almost completely replaced by rack-and-pinion steering.

Rack-and-pinion steering is a simple system that directly converts the rotation of the steering wheel to straight line movement at the wheels. The steering gear consists of the rack, pinion, and related housings and support bearings. Turning the steering wheel causes the pinion to rotate. Since the pinion teeth are in mesh with the rack teeth, turning the pinion causes the rack to move to one side. The rack is attached to the steering knuckles through linkage, so moving the rack causes the wheels to turn. All steering systems contain several common parts. Every steering system, no matter what type, will have a steering wheel, a steering shaft and column, universal joints, steering tie rod, and steering arm.
II. THEORETICAL CALCULATION OF STEERING SYSTEM COMPONENTS

A. Theoretical calculation of Steering Gear Design

Table I shows the parameters considered for design a rack and pinion gear.

<table>
<thead>
<tr>
<th>Design Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Force</td>
<td>2610N</td>
</tr>
<tr>
<td>Pinion Speed ( N_p )</td>
<td>15-8 rpm</td>
</tr>
<tr>
<td>Helix angle (( \psi ))</td>
<td>23°</td>
</tr>
<tr>
<td>Pressure angle ( \phi )</td>
<td>20°</td>
</tr>
<tr>
<td>Modulus of Elasticity (E)</td>
<td>207 GPa</td>
</tr>
<tr>
<td>Ultimate Strength ( S_u )</td>
<td>1950 MPa</td>
</tr>
<tr>
<td>Yield Strength ( S_y )</td>
<td>1570 MPa</td>
</tr>
<tr>
<td>Brinell Hardness (BHN)</td>
<td>555</td>
</tr>
<tr>
<td>Number of teeth of pinion ( n_p )</td>
<td>6</td>
</tr>
<tr>
<td>Number of teeth of rack ( n_R )</td>
<td>28</td>
</tr>
</tbody>
</table>

Pinion and rack are same material and so pinion is weaker. So based design on pinion.

Unknown diameter case

1. Calculation of Diameter of teeth,
   Module selected from the standard module series.
   \[ D_p = n_p \times m_n \]  

2. Calculation of Torque \( M_t \)
   \[ M_t = F_t \times D_p \]  

3. Calculation of pitch line velocity \( V \)
   The pitch line velocity can be calculated by
   \[ V = \frac{\pi \times D_p \times N_p}{60} \]  

4. Calculation of allowable stress, \( S_{all} \)
   Allowable stress can be calculated by
   \[ S_{all} = S_p \times \left[ \frac{3}{3 + V} \right], \text{ for } V < 10 \text{m/sec} \]  

5. Calculation of endurance stress, \( S_o \)
   \[ S_o = \frac{S_u}{3} \]  

6. The actual induced stress can be calculated by using Lewis equation.
   \[ S_{ind} = \frac{2M_t}{m^3 \times n_p \times \cos \psi} \]  

7. Strength Check,
   Compare \( S_{all} \) and \( S_{ind} \)
   If \( S_{all} > S_{ind} \), Design is satisfied.
   If not so, keeping on calculating by increasing the module until it is satisfied need to be done.

8. Calculation of the face width of helical gear, \( b \)
   The face width of helical gear can be calculated as
   \[ b_{min} = k_{red} \times \pi \times m_n \]
\[ b_{\text{max}} = k \pi \times m_n \]  
(9)

\[ k_{\text{red}} = k_{\text{max}} \times \frac{S_{\text{ind}}}{S_{\text{all}}} \]  
(10)

After determining the design from strength point of view, it is necessary to check the dynamic effect.

9. Dynamic Check,

The transmitted load in (N) can be calculated as

\[ F_t = \frac{2M_t}{D_p} \]  
(11)

10. Calculation of dynamic load, \( F_d \)

\[ F_d = F_t + \frac{21V(bC\cos^2 \psi + F_s)\cos \psi}{21V + (bC\cos^2 \psi + F_s)} \]  
(12)

11. Calculation of limiting endurance load, \( F_o \)

\[ F_o = S_0b_n\pi m\cos(\psi) \]  
(13)

12. Calculation of limiting wear load, \( F_w \)

\[ F_w = \frac{D_p \times b \times K \times Q}{\cos^2 \psi} \]  
(14)

\[ K = \frac{S_{\text{es}}^2 \times \sin \phi}{1.4} \times \left[ \frac{2}{E} \right] \]

The required condition to satisfy the dynamic check is \( F_o, F_w > F_d \).

If not so, keeping on calculating by increasing the module until it is satisfied need to be done.

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Symbol</th>
<th>Formula</th>
<th>Result</th>
<th>Pinion</th>
<th>Rack</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Module</td>
<td>( m_n )</td>
<td>( h_1 = 0.8m_n )</td>
<td>6.0</td>
<td>2.5</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Pressure angle</td>
<td>( \alpha )</td>
<td></td>
<td>20(^\circ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Number of teeth</td>
<td>( n )</td>
<td></td>
<td>6</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Height of Pitch Line</td>
<td>( H )</td>
<td></td>
<td>1</td>
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<td></td>
</tr>
<tr>
<td>5</td>
<td>Addendum</td>
<td>( h_a )</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Pitch Diameter</td>
<td>( D )</td>
<td>( D_p = n_p \times m_n )</td>
<td>15</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Diametral Pitch</td>
<td>( P_d )</td>
<td>( P_d = n_p / D_p )</td>
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<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Tooth Thickness</td>
<td>( t )</td>
<td>( t = 1.5708/P )</td>
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<td>-</td>
</tr>
<tr>
<td>9</td>
<td>whole Depth</td>
<td>( h_w )</td>
<td>( h_w = 1.8m_n )</td>
<td>4.5</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Clearance</td>
<td>( C )</td>
<td>( C = 0.2m )</td>
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<td>-</td>
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<tr>
<td>11</td>
<td>Outside Diameter</td>
<td>( D_0 )</td>
<td>( D_0 = D_p + 2h_a )</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Dedendum</td>
<td>( h_d )</td>
<td>( h_d = 1m_n )</td>
<td>2.5</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>Root Diameter</td>
<td>( D_R )</td>
<td>( D_R = D_p - 2h_d )</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Center Distance</td>
<td>( a )</td>
<td>( a = D_p/2 + H )</td>
<td>30.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The design results for pinion gear are shown in Table II.

The result data of tooth dimension for rack and pinion are shown in Table III.
B. Contact Stress Analysis of Steering Gear by Using AGMA Equation

One of the main gear tooth failure is pitting which is a surface fatigue failure due to repetition of high contact stresses occurring on the gear tooth surface while a pair of teeth is transmitting power [14Bab].

1. The contact stress equation is given as

$$\sigma_c = C_p \left[ \frac{F_1}{b dl} \left( \frac{\cos \psi}{0.95CR} \right) K_v K_F \right]$$

(15)

2. The elastic coefficient factor equation is given as

$$C_p = 0.564 \left[ \frac{1}{\left( 1 - \nu_1^2 \right) + \frac{1 - \nu_2^2}{E_1 + E_2}} \right]$$

(16)

3. The geometry factor $I$ is given by

$$I = \frac{\sin \phi \cos \phi}{2 \left( i + 1 \right)}$$

(17)

4. The speed ratio is given by

$$i = \frac{n_1}{n_2} = \frac{d_2}{d_1}$$

5. The contact ratio equation is given as

$$CR = \frac{\sqrt{h_w - h_r} + \frac{h_w - h_r \sin \phi}{\sin \phi}}{\pi m_c \cos \phi}$$

(18)

In the principle stress theory failure will occur when the principle stress in the complex system reaches the value of the maximum stress at the elastic limit in simple tension.

6. The principal stresses are determined by the following equation.

$$\sigma_1, \sigma_2 = \frac{\sigma_x + \sigma_y}{2} \pm \frac{1}{2} \sqrt{\left(\sigma_x - \sigma_y \right)^2 + 4 \tau_{xy}^2}$$

(19)

With either yield criterion, it is useful to define an effective stress denoted as $\sigma_v$ which is a function of the applied stresses. If the magnitude of $\sigma_v$ reaches a critical value, then the applied stress state will cause yielding, in essence, it has reached an effective level. The von-Mises stress is calculated by the following equation:

7. The von-Mises stress is,

$$\sigma_v = \frac{1}{\sqrt{2}} \sqrt{\left[ (\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2 \right]}$$

(20)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Von Mises Stress (max)</td>
<td>944.31 MPa</td>
</tr>
<tr>
<td>Strain (max)</td>
<td>4.04×10^{-3}</td>
</tr>
</tbody>
</table>

The stress and strain value for gear pair is shown in Table IV.
C. Theoretical Calculations of Rack Bending Stress And Deflection

Rack is subject to not only the axial load but also the vertical loading. The vertical load causes the bending stress and if the load is higher than critical load then it will be lead to breakage. Consider the vehicle load front axle weight of 740N. The rack vehicle load (W) come on rack end is calculated. The assembly is considered as cantilever beam. Pinion is fixed and then vertical load is applied the rack end. Refer Figure 2 for the rack assembly and loading conditions.

Figure 2. Rack Assembly and Loading Condition

Figure 3 shows the rack cross section view. The shows the minimum cross section of rack. The sector area is removed for making tooth on rack.

Figure 3. Rack Cross Section View

1. To find the center of gravity of sector area, \( y \)

\[
y = \frac{4r}{3} \left( \frac{\sin \theta}{2} - \frac{\theta}{2} - \sin \theta \right)
\]  

(21)

2. To find the moment of inertia, \( I \)

\[
I = \frac{r^4}{8} \left( \theta - \sin \theta + 2 \sin \theta \sin^2 \frac{\theta}{2} \right)
\]  

(22)
Table V shows specification data of rack and rack housing assembly.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rack Diameter</td>
<td>( D_r )</td>
<td>23</td>
<td>mm</td>
</tr>
<tr>
<td>Center of Gravity of Sector Area</td>
<td>( y )</td>
<td>8.289</td>
<td>mm</td>
</tr>
<tr>
<td>Moment of Inertia</td>
<td>( I )</td>
<td>5299.80</td>
<td>mm(^4)</td>
</tr>
<tr>
<td>Rack Tip Max. Bend Load</td>
<td>( W )</td>
<td>294.35</td>
<td>N</td>
</tr>
<tr>
<td>Rack Length</td>
<td>( L_r )</td>
<td>210</td>
<td>mm</td>
</tr>
<tr>
<td>Young’s Modulus</td>
<td>( E )</td>
<td>207</td>
<td>GPa</td>
</tr>
</tbody>
</table>

3. To find the Rack Plane coefficient, \( Z \)
   
   \[ Z = \frac{I}{y} \]  

4. To find the Rack Stress, \( \sigma \)
   
   \[ \sigma = \frac{W \cdot L}{Z} \]  

5. To find the Deflection, \( \delta \)
   
   \[ \delta = \frac{W \cdot L^3}{3EI} \]  

The stress and deformation value for rack in Table VI.

D. Design and Fatigue Analysis of Intermediate Steering Shaft

There are three steps in the design and fatigue analysis of rear axle shaft. They are (i) design calculation of intermediate steering shaft, (ii) stress analysis of intermediate steering shaft, and (iii) fatigue analysis of intermediate steering shaft.

Table VII shows the parameters considered for Intermediate Shaft.

<table>
<thead>
<tr>
<th>Design Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>ASTM A36</td>
</tr>
<tr>
<td>Ultimate Strength (( S_u ))</td>
<td>400</td>
</tr>
<tr>
<td>Yield Strength (( S_y ))</td>
<td>250</td>
</tr>
<tr>
<td>Modulus of Elasticity (( E ))</td>
<td>207 GPa</td>
</tr>
<tr>
<td>Speed of Shaft (( N ))</td>
<td>15-8 rpm</td>
</tr>
<tr>
<td>Outside Diameter of Shaft (( D_o ))</td>
<td>19 mm</td>
</tr>
<tr>
<td>Torque (( T ))</td>
<td>6 Nm</td>
</tr>
</tbody>
</table>

(i) Design calculation of Intermediate Steering Shaft

The axle shaft is a rotating member, in general, has a circular cross-section and is used to transmit power. The shaft is generally acted upon by torsion.

The torque can be computed from the known power transmitted and the rotational speed.

1. Maximum power, \( p = \frac{T \times N_{\text{max}}}{9550} \)  

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2. Maximum Torque, \( T_{\text{max}} = \frac{60P}{2\pi N_{\text{min}}} \) 

(27)

3. Minimum Torque, \( T_{\text{min}} = \frac{60P}{2\pi N_{\text{max}}} \) 

(28)

4. Mean Torque, \( T_m = \frac{T_{\text{max}} + T_{\text{min}}}{2} \) 

(29)

5. Alternative Torque, \( T_a = \frac{T_{\text{max}} - T_{\text{min}}}{2} \) 

(30)

6. Maximum Shear Stress, \( \tau_{\text{max}} = \frac{S}{SF} \) 

(31)

\( SF = 15 \) (Maximum Safety Factor)

7. Inside Diameter of Intermediate Shaft, \( \tau_{\text{max}} = \frac{16T_{\text{max}}}{\pi(D_0^3 - D_i^3)} \) 

(32)

(ii) Stress analysis of Intermediate Steering Shaft

1. Mean torsional shear stress; \( \tau_m = \frac{16T_m}{\pi(D_0^3 - D_i^3)} \) 

(33)

2. Alternating torsional shear stress; \( \tau_a = \frac{16T_a}{\pi(D_0^3 - D_i^3)} \) 

(34)

If \( \tau_m \) and \( \tau_a < \tau_{\text{max}} \), Design is satisfied.

3. The principal stresses are determined by the following equation.

\[ \sigma_1, \sigma_2 = \frac{\sigma_x + \sigma_y}{2} \pm \frac{1}{2} \sqrt{(\sigma_x - \sigma_y)^2 + 4\tau_{xy}^2} \] 

(35)

4. The von-Mises stress is,

\[ \sigma_v = \sqrt{\frac{1}{2}[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2]} \] 

(36)

(iii) Fatigue Analysis of Intermediate Steering Shaft

1. Estimating the Theoretical Endurance Limit

\( S_{\text{e}} = 0.504S_u \) for \( S_u \leq 1400\text{MPa} \) 

(37)

2. The equation can be written to give corrected endurance limit (fatigue strength), \( S_e \) as follows:

\[ S_e = k_a \times k_b \times k_c \times k_d \times k_e \times k_f \times S' \] 

(38)

The coefficients are detailed below,

3. Surface Factor (\( k_a \))

\[ k_a = aS_0^b \] 

(39)

Where, \( a \) and \( b \) are constants, they are to be found in Table.

4. Size Factor (\( k_b \))

\[ k_b = \left( \frac{d}{7.62} \right)^{-0.1133} \] 

(40)

2.79mm \( \leq d \leq 51\text{mm} \)

5. Loading Factor (\( k_c \))

\[ k_c = \begin{cases} 
1 & \text{bending} \\
0.85 & \text{axial} \\
0.59 & \text{torsion}
\end{cases} \] 

(41)
6. Temperature Factor \( K_d \)

\[
k_d = \frac{S_T}{S_{RT}}
\]  
(42)

7. Reliability Factor \( k_e \)

Assume reliability factor is 99.99%, \( k_e = 1 \)  
(43)

8. Miscellaneous-effects Factor \( k_f \)

\[
k_f = 1
\]
(44)

9. Calculation of Number of Cycles to Failure

\[
S_f = \frac{\sigma'}{1 - \frac{\sigma_m}{S_u}}
\]
(45)

Number of cycles to failure \( N \) can be expressed by using the fatigue strength of material; \( f \) is the fatigue strength fraction as shown in Table A-3 [2].

\[
N = \left( \frac{S_f}{a} \right)^b
\]
(46)

\[
a = \left( \frac{f S_u}{S_e} \right)^2
\]
(47)

\[
b = \frac{1}{3} \log \left( \frac{f S_u}{S_e} \right)
\]
(48)

10. Fatigue factor of safety \( n_f \)

Fatigue factor of safety \( n_f \) can be calculated by using Modified Goodman Method

\[
n_f = \frac{S_e S_u}{\sigma'_f S_u + \sigma'_m S_e}
\]
(49)

### Table VIII

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Von Mises Stress (max)</td>
<td>39.092 MPa</td>
</tr>
<tr>
<td>Fatigue Safety Factor</td>
<td>3.706</td>
</tr>
</tbody>
</table>

Table VIII shows the theoretical results for von-Mises stress and fatigue safety factor value.

### III. Analysis of the Steering System Components

Analysis is process of analyzing the components by applying external factors such as loads, temperature, pressure etc. and obtaining the values such as stresses (bending, tangential and normal), deformations etc. in order to determine the safety of the components when implemented in practical use. It gives optimum result of the safety of components and very easy to understand various factors applicable in the process. These Analyses gives optimum result of safety of components and minimize the chances of failure. There are various packages in market to carry out these simulations on computer such as ANSYS, SolidWorks, HYPERWORKS, and FLOTRAN etc. In this project we have used ANSYS as the software to analyze the safety of our components under various loading conditions.

Two major analyses carried out in this project are:

1) Deformation analysis
2) Stress analysis

Various components analyzed in this project are:

1) Steering Gear
2) Steering Rack
3) Intermediate Steering Shaft
Process for performing the analysis:
1) Making or importing the geometry to software interface (GUI).
2) Defining the field.
3) Applying the material properties.
4) Meshing the components with appropriate element size.
5) Applying the actions such as load, pressure etc. on the body.
6) Applying the boundary conditions such as fixed supports (constraints).
7) Solving using the solver.
8) Obtaining required reactions such as stresses, deformations etc.

A. Gear Tooth Strength Analysis of Steering Pinion Gear
The material properties of AISI 5160 OQT 400 is given in the Table IX.

### TABLE IX
MATERIAL PROPERTIES OF AISI 5160 OQT 400

<table>
<thead>
<tr>
<th>Material Properties</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young modulus</td>
<td>207 GPa</td>
</tr>
<tr>
<td>Poisson ratio</td>
<td>0.3</td>
</tr>
<tr>
<td>Density</td>
<td>7850 kg/m3</td>
</tr>
<tr>
<td>Coefficient of Thermal Expansion</td>
<td>1.15e-05°C^-1</td>
</tr>
<tr>
<td>Tensile Yield Strength</td>
<td>1570 MPa</td>
</tr>
<tr>
<td>Tensile Ultimate Strength</td>
<td>1950 MPa</td>
</tr>
</tbody>
</table>

(i) Simulation Result (Boundary Condition)

![Fixed and forced Condition of Pinion Gear](image)

Figure 4. Fixed and forced Condition of Pinion Gear

Figure 4 shows the fixed and forced conditions for structural analysis of pinion gear. There are three boundary conditions for structural; fixed support, moment and force.

(ii) Simulation Result (Von- Mises Stress and Strain)

Stress analysis is used to determine equivalent stress and strain of the pinion gear. The numerical results of stress analysis are carried out by using ANSYS 14.5 software.
Figure 5 shows minimum and maximum von-Mises stress. The values are 0.58921 N/mm$^2$ (MPa) and 132.26 N/mm$^2$ (MPa). Comparing Yield strength value 1570N/mm$^2$ (MPa), the maximum value is less than yield strength. So the design is satisfied. The steering pinion will work safely at this stress.

Figure 6 shows the equivalent strain values. The minimum value is $4.7338 \times 10^{-5}$ and the maximum value is 0.00057657.

B. Stress Analysis of Steering Shaft for Pinion Gear

Stress analysis was analyzed by ANSYS software and material properties of AISI 4340 OQT 400 is given in the Table IX.

<table>
<thead>
<tr>
<th>Material Properties</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young modulus</td>
<td>207 GPa</td>
</tr>
<tr>
<td>Poisson ratio</td>
<td>0.3</td>
</tr>
<tr>
<td>Density</td>
<td>7850 kg/m$^3$</td>
</tr>
<tr>
<td>Tensile Yield Strength</td>
<td>1570MPa</td>
</tr>
<tr>
<td>Tensile Ultimate Strength</td>
<td>1950MPa</td>
</tr>
</tbody>
</table>
Table XI shows specification data of steering shaft for pinion gear.

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque (Nm)</td>
<td>T</td>
<td>6</td>
</tr>
<tr>
<td>Tangential Force (N)</td>
<td>F_t</td>
<td>2610</td>
</tr>
<tr>
<td>Axial Force (N)</td>
<td>F_a</td>
<td>1108</td>
</tr>
<tr>
<td>Radial Force (N)</td>
<td>F_r</td>
<td>950</td>
</tr>
<tr>
<td>Diameter of Shaft (mm)</td>
<td>D</td>
<td>8</td>
</tr>
<tr>
<td>Length of Shaft (mm)</td>
<td>L</td>
<td>105</td>
</tr>
</tbody>
</table>

(i) Simulation Result (Boundary Condition)

Figure 7. Fixed and forced Condition of steering shaft for pinion gear

Figure 7 shows the fixed and forced conditions for structural analysis of shaft. There are four boundary conditions for structural; fixed support, cylindrical support, moment and force.

(ii) Simulation Result (Von- Mises Stress and Strain)

Figure 8. Equivalent (von-Mises) Stress Analysis of Shaft
Figure 8 shows minimum and maximum von-Mises stress. The values are 0.051691 N/mm$^2$ (MPa) and 105.61 N/mm$^2$ (MPa), the maximum value is less than yield strength. So, shaft design is satisfied for pinion gear of steering system.

![Image](image1)

**Figure 9. Equivalent Strain of Shaft**

Figure 9 shows the equivalent strain values. The minimum value is $4.3546 	imes 10^{-7}$ and the maximum value is 0.00050723.

C. Stress Analysis of Steering Shaft and Pinion Gear Assembly

Structural analysis of shaft and gear assembly was analyzed by ANSYS software.

(i) Simulation Result (Boundary Condition)

![Image](image2)

**Figure 10. Fixed and forced Condition of Shaft and Pinion Gear Assembly**

Figure 10 shows the fixed and forced conditions for structural analysis of shaft and pinion gear assembly. There are three boundary conditions for structural; fixed support, moment and force.

(ii) Simulation Result (Von- Mises Stress and Strain)

![Image](image3)

**Figure 11 shows minimum and maximum von-Mises stress. The values are 4.4846x10^9 N/mm$^2$ (MPa) and 392.61 N/mm$^2$ (MPa). Comparing Yield strength value 1570 N/mm$^2$ (MPa), the maximum value is less than yield strength. So the design is satisfied.**
Figure 11. von-Mises Stress of Pinion Gear and Shaft Assembly

Figure 12. Equivalent Strain of Pinion Gear and Shaft Assembly

Figure 12 shows the equivalent strain values. The minimum value is \(7.8777 \times 10^{-14}\) and the maximum value is 0.0017582.

D. Contact Stress Analysis of Steering Rack and Pinion Gear

(ii) Simulation Result (Boundary Condition)

Figure 13. Fixed and forced Condition of Rack and Pinion Gear Assembly
(ii) Simulation Result (Contact Stress)

Stress analysis is used to determine equivalent stress and the strain of the rack and pinion gear assembly contact point. The numerical results of stress analysis are carried out by using ANSYS 14.5 software. The numerical results of von-Mises stress and strain are compared with different materials of rack and pinion gear (AISI 4340 steel, aluminum alloy and gray cast iron).

Figure 14. Equivalent (von-Mises) Stress on Rack and Pinion Gear Assembly using AISI 4340 Steel

Figure 14 shows the equivalent (von-Mises) stress on rack and pinion gear assembly using AISI 4340 steel. The maximum equivalent (von-Mises) stress on contact point is 1027.3 MPa and location of maximum stress is at the meshing area of the rack and pinion while the yield strength of the structural steel is 1570 MPa. The steering gear will work safely at this stress.

Figure 15. Equivalent Strain of Rack and Pinion Gear Assembly using AISI 4340 steel

The equivalent strain on rack and pinion gear pair using AISI 4340 steel is 0.0046578 and occurs at meshing area of the rack and pinion as shown in Figure 15.

Figure 16. Equivalent (von-Mises) Stress on Rack and Pinion Gear Assembly using Aluminum Alloy

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Figure 16 shows the equivalent (von-Mises) stress on rack and pinion gear assembly using Aluminum. The maximum equivalent (von-Mises) stress on contact point is 1021.4 MPa and location of maximum stress is at the meshing area of the rack and pinion while the yield strength of the structural steel is 225 MPa. The steering gear will not work safely at this stress.

![Equivalent Strain of Rack and Pinion Gear Assembly using Aluminum Alloy](image)

Figure 17. Equivalent Strain of Rack and Pinion Gear Assembly using Aluminum Alloy

The equivalent strain on rack and pinion gear pair using Aluminum is 0.014995 and occurs at meshing area of the rack and pinion as shown in Figure 17.

Figure 18 shows the equivalent (von-Mises) stress on rack and pinion gear assembly using Gray Cast Iron. The maximum equivalent (von-Mises) stress on contact point is 1030.6 MPa and location of maximum stress is at the meshing area of the rack and pinion while the yield strength of the structural steel is 170 MPa. The steering gear will not work safely at this stress.

![Equivalent (von-Mises) Stress on Rack and Pinion Gear Assembly using Gray Cast Iron](image)

Figure 18. Equivalent (von-Mises) Stress on Rack and Pinion Gear Assembly using Gray Cast Iron

![Equivalent Strain of Rack and Pinion Gear Assembly using Gray Cast Iron](image)

Figure 19. Equivalent Strain of Rack and Pinion Gear Assembly using Gray Cast Iron
The equivalent strain on rack and pinion gear pair using Gray Cast Iron is 0.0097802 and occurs at meshing area of the rack and pinion as shown in Figure 19.

Table XII shows the comparison of theoretical and simulation results for von-Mises stress and strain value of the gear pair.

(iii) Comparison of Von-Mises Stress and Strain on the Rack and Pinion Gear Assembly with Three Types of Materials

Comparative study on contact stress analysis has been carried out on the rack and pinion gear assembly made of different materials namely AISI 4340, Aluminum Alloy and Gray Cast Iron which are suitable for rack and pinion gear pair.

![Figure 20](image-url)

**Figure 20.** Comparison of Numerical Result for Equivalent (von-Mises) Stress

Figure 20 show von-Mises stress on rack and pinion gear assembly with three types of materials by using ANSYS 14.5.

![Figure 21](image-url)

**Figure 21.** Comparison of Numerical Result for Equivalent (von-Mises) Strain
Figure 21 show von-Mises strain on rack and pinion gear assembly with three types of materials by using ANSYS 14.5. The resulted data for static structural analysis with three types of materials are compared with von-Mises stress and strain. Static analysis reveals that maximum stress on rack and pinion gear pair are 1027.3 MPa, 1021.4 MPa and 1030.6 MPa respectively and maximum strain on rack and pinion gear pair are 0.0046 mm, 0.014 mm and 0.0097 mm. The maximum von-Mises stresses on rack and pinion gear pair are occurred at the meshing area of the rack and pinion gear. From the structural contours of ANSYS, it can be observed that the maximum strains are also occurred at the meshing area of the rack and pinion gear. The von-Mises stresses on gear pair using different materials are nearly the same. The analysis shows that the strain has minimum with AISI 4340 steel. Therefore, AISI 4340 steel is suitable material in this designed steering gear pair.

E. Stress Analysis of Steering Rack and Rack Housing

Stress analysis of steering rack and rack housing assembly was analyzed by ANSYS software. Rack material is used as height tensile steel, as standard material AISI 4340 steel. Mechanical properties of all the materials are in Table XIII.

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Material</th>
<th>Young’s Modulus (GPa)</th>
<th>Poisson’s Ratio</th>
<th>Tensile Strength (MPa)</th>
<th>Yield Strength (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinion</td>
<td>Steel AISI 4340</td>
<td>207</td>
<td>0.3</td>
<td>1950</td>
<td>1570</td>
</tr>
<tr>
<td>Rack</td>
<td>Steel AISI 4340</td>
<td>207</td>
<td>0.3</td>
<td>1950</td>
<td>1570</td>
</tr>
<tr>
<td>Housing</td>
<td>Aluminum Alloy</td>
<td>71</td>
<td>0.33</td>
<td>273</td>
<td>225</td>
</tr>
</tbody>
</table>

(i) Simulation Result (Boundary Condition)

Figure 22. Fixed and Forced Condition of Rack and Rack Housing Assembly

Figure 22 shows the fixed and forced conditions for structural analysis of rack and rack housing assembly. There are two boundary conditions for structural; fixed support and force.

(ii) Simulation Result

Stress analysis is used to determine equivalent stress and the total deformation of the rack. The numerical results of stress analysis are carried out by using ANSYS 14.5 software.
Figure 23 shows the equivalent (von-Mises) stress on rack and rack housing assembly. The maximum equivalent (von-Mises) stress is 108.53 MPa while the yield strength of the structural steel is 1570 MPa. The steering rack will work safely at this stress.

(iii) Deformation Result

Figure 24 shows the deformation values. The minimum value is 0 and the maximum value is 0.84859 mm.

Table XIV

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Theoretical calculation</th>
<th>Simulation</th>
<th>% Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Von - Mises Stress (MPa)</td>
<td>96.782</td>
<td>108.53</td>
<td>10.8%</td>
</tr>
<tr>
<td>Deformation (mm)</td>
<td>0.828</td>
<td>0.849</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

Table XIV shows the comparison of theoretical and simulation results for von-Mises stress and deformation value of the rack.

F. Stress Analysis and Fatigue Analysis of Intermediate Steering Shaft

Stress analysis of intermediate steering shaft was analyzed by ANSYS software. Intermediate steering shaft material is used as steel, as standard material ASTM A36 steel. Mechanical properties of the materials are in Table XV.
Table XV
MECHANICAL PROPERTIES FOR INTERMEDIATE SHAFT

<table>
<thead>
<tr>
<th>Properties</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>ASTM A36 steel</td>
</tr>
<tr>
<td>Model Type</td>
<td>Linear Isotropic</td>
</tr>
<tr>
<td>Default Failure Criterion</td>
<td>Max Von Mises Stress</td>
</tr>
<tr>
<td>Yield Strength</td>
<td>250MPa</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>400MPa</td>
</tr>
<tr>
<td>Elastic Modulus</td>
<td>200GPa</td>
</tr>
<tr>
<td>Poisson’s Ratio</td>
<td>0.3</td>
</tr>
<tr>
<td>Mass Density</td>
<td>7850kg/m³</td>
</tr>
</tbody>
</table>

The static structural shaft SolidWorks model was added to the geometry in ANSYS Workbench. This geometry model was meshed with high smoothing. This meshed model was imported to static structural for static structural analysis of the intermediate steering shaft. Firstly, give the input conditions to the model, which applied the torque 6000 N-mm at end of steering intermediate shaft. Then, supports are fixed at another end as shown in Figure 25. The engineering data for type of material uses the structural steel for testing material.

![Figure 25. Loading Condition of Intermediate Steering Shaft](image)

After finishing set up the boundary conditions on intermediate steering shaft, run the solution and get equivalent (von-Mises) stress and deformation.

![Figure 26. Equivalent (von-Mises) Stress of Intermediate Steering Shaft](image)

Figure 26 shows the equivalent (von-Mises) stress on intermediate steering shaft. The maximum equivalent (von-Mises) stress is 41.099 MPa while the yield strength of the structural steel is 250 MPa. The steering shaft will work safely at this stress.
Figure 27. Total Deformation of Intermediate Steering Shaft

Figure 27 shows the deformation values. The minimum value is 0 and the maximum value is 0.18912 mm.

Figure 28. Life Cycle of Intermediate Steering Shaft

In the fatigue tool bar, the life cycles of intermediate steering shaft can be solved. Figure 28 shows the results of life cycles structural steel intermediate steering shaft.

Figure 29. Factor of Safety on Intermediate Steering Shaft
Then, the factor of safety on steering intermediate steering shaft is also shown in Figure 29. The maximum and minimum factor of safety is 15 and 3.8631.

### Table XVI

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Theoretical calculation</th>
<th>Simulation</th>
<th>% Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>von-Mises Stress (MPa)</td>
<td>39.092</td>
<td>41.099</td>
<td>4.8%</td>
</tr>
<tr>
<td>Fatigue Safety Factor</td>
<td>3.706</td>
<td>3.863</td>
<td>4.1%</td>
</tr>
</tbody>
</table>

Table XVI shows the comparison of theoretical and simulation results for von-Mises stress and fatigue safety factor of the steering intermediate shaft.

### IV. CONCLUSION

Manual rack and pinion steering system is suitable for solar car. In steering gear design, the diameter of pinion 15mm and face width 47mm and module 2.5mm was satisfied. The von Mises stress and strain of steering shaft and pinion gear have been compared with theoretical and simulation result. The contact stress of steering rack and pinion gear pair have been compared in theoretical and simulation result with different materials. From analysis of rack and pinion gear pair, the von-Mises stress for steel was 1027.3 MPa, aluminum alloy was 1021.4 MPa and gray cast iron was 1030.6 MPa. From analysis of rack and pinion steering gear pair, strain results for steel were 0.0046, aluminum alloy was 0.014 and gray cast iron was 0.0097. In structural analysis, steel rack and pinion steering gear pair is having least strain value. Hence steel rack and pinion steering gear pair was safe for design.

This research also analyzed the stress of the steering rack. By using Finite Element method, a stress analysis has been carried out. Steering Rack Deflection and Bending stresses are found. These stresses are compared with analytical results. Modeling has been done by SolidWorks and Analysis has been done by ANSYS software. From analysis of rack, the von-Mises stress was 108.53MPa and a deformation result was 0.849mm. From analytical result, the von-Mises stress was 96.782MPa and a deformation result was 0.828mm. Error Percent was 10.8% for von-Mises stress and 2.5% for deformation.

This research has been studied the stress and fatigue analysis for intermediate steering shafts. This research focused on the stress analysis. It is caused by torsion. The models of intermediate steering shafts are also drawn by SolidWorks software. In the numerical analysis, stress and fatigue analysis of intermediate steering shafts are considered base on ANSYS software. Fatigue analysis of intermediate steering shaft is done to find the life of the intermediate steering shaft in cycles and determined the factor of safety of the shaft. From analysis of intermediate shaft, the von-Mises stress was 41.099 MPa and a safety factor was 3.863. Maximum stress occurs at the corner points of the circular hole. From analytical result, the von-Mises stress was 39.092MPa and a safety factor was 3.706. Error Percent was 4.8% for von-Mises stress and 4.1% for deformation.

### ACKNOWLEDGMENT

The author wishes to express her deepest gratitude to her Excellency, Union Minister Dr. Myo Thein Gyi, Ministry of Education in Myanmar.

The author is deeply gratitude to Dr. Sint Soe, Rector, Mandalay Technological University, for his kindness, help, permission, guidance and advice of this paper.

The author would like to thank to Dr. Htay Htay Win, Professor, Head of Department of Mechanical Engineering, Mandalay Technological University, for her valuable suggestion and giving useful comments.

The author owes a debt of gratitude to her supervisor, Dr. Myint Thein, Associate Professor of the Department of Mechanical Engineering, Mandalay Technological University, for her enthusiastic instruction, invaluable help, and indispensable guidance in the preparation of this paper.

Finally, the author wishes to express her heartfelt thanks to her family, especially her parents and all other persons for their supports and encouragements to attain her destination without any trouble.

### REFERENCES


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The Long-Run Relationship between Stock Market and Macroeconomic Behavior in Postwar Economy of Sri Lanka

DHD Nadeesha

Abstract- The study investigates the dynamic relations between macroeconomics behaviour and all share price index (ASPI) performance in post war economy of Sri Lanka for the period 2009-2016, using monthly series of the corresponding variables. The study considers Average Weighted Prime Lending Rate (AWPR) and Average Weighted Deposit Rate (AWDR), money supply as measure for country’s interest rates which supervise the behaviour of money market, Colombo Consumer price index as measure of inflation and exchange rates as the measure of external sector in economy of Sri Lanka. The objective was achieved by identifying the influence of macroeconomic variables on ASPI by using the statistical techniques of unit root test in order to fulfill the objective of stationary for all the macroeconomic variables and ASPI. The Johansen co-integration test was used to investigate whether the variables are co-integrated of the same order taking into account the trace statistics and the maximum Eigen-value tests. The variables were found to be co-integrated with at least one co-integrating vector. Finally, Vector Error Correction Model (VECM) was developed to forecast the long term behaviour. The results reveal that the change in average prime Deposit rate(AWDR), inflation rate (INF), exchange rate of Britain Pounds (GBP) and Japanese Yen (JPY), Special Drawing Right (SDR) affect All Share Price Index(ASPI) while money supply and average prime lending rate (AWPR) does not influence on ASPI. Moreover, all the macroeconomic variables and ASPI shows significant change and huge depreciation of currency in post war economy in Sri Lanka. From the results, it was inferred that the movement of ASPI reflect the macroeconomic condition of the country and can therefore be used to predict the future path of ASPI behaviour. Rapid growth in ASPI and decline in inflation and interest rates is observed in post war economy. The policy makers of the country should establish proper policies to control depreciation of the currency against USD, GBP, JPY and SDR in post war economy.

Keywords: Average Weighted Deposit Rate, All Share Price Index, Average Weighted Prime Lending Rate, Macro economy

I. INTRODUCTION

The dynamic relationship between macroeconomic variables and stock market returns is well-documented in the literature (Bilson et al, 2001 ; Gunasekarage et al, 2004; Husam et al, 2009). However, absence in the past literature related to examine the co-integration between macroeconomic variables and stock market’s sector indices returns in Sri Lanka. In Sri Lanka, Colombo Stock Exchange (CSE) consists of twenty sector wise price indices and macroeconomic variables may affect sector wise price indices differently. Also, these macroeconomic variables affect investment decisions and financing decisions in corporate sector.

The stock exchange acts as the most important market for capital and companies get the ability to find sources of finance from the capital market. A well-developed capital market is essential to promote economic development in a country. The Sri Lankan government has been offering a number of incentives to enhance the share market. Specially, foreign investors are granted substantial incentives to invest in Sri Lankan company shares in budget 2016 (Ministry of Finance, 2016). Furthermore, companies listed in the CSE are already involved in the development of infrastructure in the country of the areas of Power and energy sector, Information technology sector and Telecommunication sector. Furthermore, banking and finance sector covers whole financial infrastructure in the country.

Many researchers believe that investment influence on economic growth and economic development (Aydemir and Demirhan, 2009). Country’s business investment environment reflects by the stock exchange market which helps in distributing nation’s wealth by enabling wide ownership of public company stocks. Investors get an ability to buy shares of publicly listed companies which enable them to be the owners of the businesses and earn dividends according to their invested capital. Stock market performance is highly volatile to countries economic and political conditions. Theoretically, the interest rate has a negative impact on stock market performance because an increase of interest rate would evade investors making high risk stock market investments compare to low risk interest bearing security investments (French et al., 1987).

Few related papers in a Sri Lankan context, focuses on examining impacts of macroeconomic variables on the stock market performance (Samarakoon, 1996; Gunasekarage et al., 2004; Wickramasinghe, 2011). However, these studies do not specifically focus on exploring the dynamic relationships between macroeconomic variables and sector indices performance in CSE.
Therefore, this study aims to explore the dynamic relationship between sector-wise indices returns as a measure of performance of the industrial sector listed in CSE in Sri Lanka and macroeconomic variables.

The theoretical motivation for undertaking the study on the effect of macroeconomic variables on stock prices returns and industrial index performance can be discussed as follows. The relations between exchange rate movements and share prices are based on the rise in the domestic interest rate. Upward movement in interest rates leads to capital inflows and therefore it makes the appreciation of exchange rate. This suggests that export dominant industries have a negative effect of reduction in exports and stock prices in such industries do not perform well. In contrast, currency appreciation boosts the share market for import dominant industries due to increase in imports. Also, whenever the interest rate on treasury securities increases, investors tend to sell stocks, causing stock prices to fall.

The effects of inflation on the financial assets returns have been an important theoretical issue for many years. The basic theoretical concept in this area is commonly endorsed to Irving Fisher (1930) who stated that the nominal interest rate fully reflects the available information concerning the possible future values of the inflation rate. This hypothesis widely accepted among economists and has played an important role in the monetary economic theory, finance theory and macroeconomics. All the above considerations motivated to conduct the study in the Sri Lankan context for different industrial index performance.

In finance, Arbitrage pricing theory (APT) is a general theory of asset pricing that holds the expected return of a financial asset can be modeled as a linear function of various macro-economic factors or theoretical market indices. Macro-economic factors and market indices are sensitive towards changes in pricing of the asset. Therefore, The APT essentially seeks to measure the risk premium attached to various factors that influence the returns on assets. Accordingly, Chen, Roll and Ross (1986), illustrated that economic forces effect on discount rates for the pricing of assets, also the ability of firms to generate cash flows, and future dividend payouts. This sense provided the basis for the belief that a long-term equilibrium existed between macroeconomic variables and share prices in CSE.

1.1.1 Colombo Stock Exchange

The CSE has two main price indices called All Share Price Index (ASPI) and Standard and Poor Index (S&P). Index values are calculated an on-going basis during the trading session, with the closing values published at the end of each session. The CSE has 295 companies representing 20 business sectors as at 30th March 2016, with a Market Capitalization of Rs. 2,785 Billion in 2016 (Colombo Stock Exchange, 2016).

Public Companies incorporated under the Companies Act No.7 of 2007 or any other statutory corporation, incorporated or established under the laws of Sri Lanka or established under the laws of any other state (subject to Exchange Control approval) are eligible to seek a listing on the CSE to raise Debt or Equity from public. In order to secure a listing of the company’s securities, they will be required to comply with the relevant provisions of the above act, the Securities and Exchange Commission Act No.36 of 1987 (as amended) and the Listing Rules of the Exchange (Security Exchange Commission, 2016).

1.2 Statement of Problem

The financial markets are influential in the advancement of macroeconomic development and macroeconomic variables behaviour of an economy change the direction of financial market development. This is evident that well-developed financial markets encourage investors and corporations to increase saving and allocate capital to productive investments efficiently, which leads to an increase in the rate of economic growth. Therefore, stock market performance and macroeconomic variables behavior has been a popular topic for policy holders, corporations and investors where they need to find out whether there is a relationship among macroeconomic variables and stock exchange. It was concluded that macro economy and share market performance were the two most appropriate concepts for this study. Accordingly, the broad question for the study were:

What is the relationship between macroeconomic variables and ASPI return in post war economy in Sri Lankan Context?

1.3 Objectives

On view of the above discussions, the main objectives of the study are:

- To investigate causal relationship between macroeconomic variables and ASPI return in post war economy in Sri Lanka
- To identify the long term relationship between macroeconomic variables and ASPI in post war economy in Sri Lanka
- To identify the behavioural change in stock market in pre and post war economy context

1.4. Significance of the Study
Sri Lanka is quickly emerging as a prominent contender within the region. There is an evolving interest among the new generation of investors in the Sri Lankan stock exchange Market. This study will enhance potential investors to make investment decisions in Sri Lankan capital market and will certainly help in fast tracking such investments to Sri Lankan capital market with the dynamic change in macroeconomic factors. The literatures which examine the relation of macroeconomic variables on individual stock market indices are very limited. It is important to test how each and every twenty sector index perform in relation to the macroeconomic variable changes. The proposed study serves the investors as their reference or guide in selecting best industry to invest when macroeconomic environment changes. Also, it supports government to make macroeconomic policies and see the effect of those policy actions on stock exchange as well as the industry performance. The findings of the study hold practical implications for various parties. Therefore, a study of this nature is timely and essential.

Policy makers should plan for national macroeconomic policies without the fear of influencing behaviour of capital flow and the stock trade process. Moreover, economic and finance theory suggests that stock prices should reflect expectations about potential corporate performance generally reflect the level of economic activities. The stock prices should be employed as leading indicators of future economic activities if stock prices accurately reflect the underlying fundamentals. Therefore, the causal relations and dynamic interactions among macroeconomic variables and ASPI are important in the formulation of the nation’s macroeconomic policy.

1.5. Literature Review

Maysami and Sims (2002, 2001) examine the relationship between macroeconomic variables and stock returns in Hong Kong and Singapore. The scholar used the Error-Correction Modelling technique to investigate such relationship among macroeconomic variables and stock returns. Also Mukherjee and Naka (1995) applied Johansen’s Vector error correction model (VECM) to analyze the relationship between the Japanese Stock Market and macroeconomic variables. This study uses exchange rate, inflation, money supply, real economic activity, long-term government bond rate, and call money rate as macroeconomic variables. They concluded that a co-integrating relation existed and that stock prices contributed to this relation.

Islam (2003) simulated the many studies to examine the short-run dynamic adjustment and the long-run equilibrium relationships between four macroeconomic variables namely interest rate, inflation rate, exchange rate, and the industrial productivity with the Kuala Lumpur Stock Exchange (KLSE) composite index. His conclusions were that there is a statistically significant short-run (dynamic) and long-run (equilibrium) relationships among the macroeconomic variables and the KLSE stock returns.

Ibrahim (1999) used macroeconomic variables of industrial production index, money supply M1 and M2, consumer price index, foreign reserves, credit aggregates and exchange rate and found the dynamic relationships between the KLSE Composite Index, and seven macroeconomic variables. He concluded that Malaysian stock market was informationally inefficient by observing that macroeconomic variables behavior and Malaysian stock indices behavior.

High correlation among six Singapore sector indices in the period 1975 to 1984 and the overall stock exchange of Singapore (SES)market return is observed by Ta and Teo (1985). The scholar used the variables of All-S Equities Industrial and Commercial Index, SES All-S Equities Finance Index, SES All-S Equities Property Index, SES All-S Hotel Index, SES All-S Plantation Index and SES All-S Mining Index. They had concluded that sector returns were highly correlated to each other, although such correlations did not remain stable by using daily data.

Karam Pal and Ruhee Mittal (2008) used the Indian capital markets indices and key macroeconomic variables such as interest rates, inflation rate, exchange rates and gross domestic savings (GDS). He found that there is a co-integration between macroeconomic variables and Indian stock indices which is indicative of a long-run relationship. The Error Correction Model shows that the rate of inflation has a significant impact on the Bombay stock exchange (BSE) Sensex, the S&P CNX and Nifty. Interest rates on the other hand, have a significant impact on S&P, CNX, and Nifty only.
II. DATA COLLECTION AND METHODOLOGY

2.1. Procurement of Data

The study uses stock prices which were collected from the CSE and macroeconomic variables collected from Central Bank of Sri Lanka. The sample period spans from June 2009 to December 2016 and the study was carried out by using 91 monthly observations. After more than 25 years of violence the brutal civil war ended in May 2009. Following data was collected from various issues of “Economic and social statistics of Sri Lanka” published monthly by the Central Bank of Sri Lanka.

- Monthly Average Weighted Prime Lending Rate (AWPR)
- Monthly Average Weighted Deposit Rate (AWDR)
- Monthly y Inflation Rate \( y \)
- Monthly money supply
- Monthly exchange rate of SDR
- Monthly exchange rate of USD
- Monthly exchange rate of GBP
- Monthly exchange rate of INR
- Monthly exchange rate of JPY

2.2. Preliminary Analysis Techniques

This section identifies the techniques used to get a basic understanding of the time series variables used in this study. Plotting the data may suggest that it is sensible to consider transforming them by taking logarithms or square roots. The three main reasons for making a transformation are as follows.

a) To Stabilize the Variance

If there is a trend in the series and the variance appears to increase with the mean, then it may be advisable to transform the data. In particular, if the standard deviation is directly proportional to mean, a logarithmic transformation is most suitable.

b) To Make Seasonal Effect Additive

If there is a trend in the series and the size of the seasonal effect appears to increase with the mean, then it may be advisable to transform the data in order to make the seasonal effect constant from year to year. In particular, if the size of the seasonal effect is directly proportional to the mean, then the seasonal effect is to be multiplicative and a logarithm transformation is most suitable.

c) To make data normally distributed

Model building and forecasting are usually carried out on the assumption that the errors are normally distributed. Therefore, an appropriate transformation can be applied to make the errors normally distributed.

2.3 Test for Stationary

In order to avoid the possibility of biased results stemming from a likely existence of unit roots in the variables under study, the researcher is planning to test stationary of data using the Augmented Dickey Fuller test (ADF) procedure and Phillip Perron Test (PP). The ADF approach controls for higher-order correlation by adding lagged difference terms of the dependent variable to the right-hand side of the regression. The ADF test is specified here as follows (1):

\[ \Delta Y_t = \alpha + \theta Y_{t-1} + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-2} + \ldots \ldots + \beta_p \Delta Y_{t-p} + \epsilon_t \]  

Where,
- \( Y_t \) = time series to be tested for stationary
- \( \alpha \) = the intercept term,
- \( \theta \) = the coefficient of interest in the unit root test,
- \( \epsilon_t \) = the white noise error term.

Once a unit root has been confirmed for a data series as stationary, there arises a question whether there is any possibility for the existence of a long-run equilibrium relationship among a given set of variables. In order to test for the co-integrating relationship between the variables under study, the general to specific approach was taken to search for a suitable optimal lag length. Johansen’s co-integration tests are very sensitive to the choice of optimal lag length. Therefore, Johansen-Juselius test procedure was used to test for the possibility of a long-run equilibrium relationship between macroeconomic variables, sector wise price indices and ASPI. This way, the researcher was able to analyze whether the time series under study share a common stochastic drift or not.

2.4. Co-integration Test and Vector Error Correction Model
The Hannan-Quinn information criterion (HQ) and the Schwartz information criteria (SIC) are used to select the number of lags required in the co-integration test. VECM is including the error correction term used to investigate the dynamic behaviour of the model. Since the variables included in the VAR model are found to be co-integrated and all series are stationary in the same order, the study specified and estimates a VECM. Moreover, the size of the error correction term indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium state. (Engle, 1987)

III. RESEARCH FINDINGS

EViews software was used for descriptive statistics, Granger Causality analysis in order to examine the influences of variables. The data analysis is divided into the following sections. The first section conducts a Vector Error Correction Model which is marginally superior to an unrestricted VAR and much better in predicting the short-run as well as the long-run dynamics between stock market performance and macroeconomic variables. The next section explains the effect of post war condition on macro economy and all share price index in Colombo Stock Exchange.

The simplest method for determining the time series is stationary or not with the use of graphical representation which observes the evidence of mean, variance, autocorrelation and seasonality. Figure 1 highlights the graphical representation of ASPI from 1994-2016 due to economic and market changes.

Tests for Stationary was performed at first difference and second difference to run VECM to check long run relationship among variables in post war economy. The test for stationary found that all series are stationary at its 2nd difference based on ADF test and Phillips Perron test. Since the all variables are integrated of the order 2, Long-run equilibrium relationship between these series is analyzed.

Selection of optimal lag length for VAR, VECM model based on Schwarz Information Criterion and Hannan-Quinn Criterion is analysed at second difference and found that the minimum values of SIC and HQ statistic were obtained at lag 1. Therefore, it can be concluded that the optimal lag length of this model is one. Thus VECM test was carried out for ASPI and other variables for lag 1. The Co-integration relationship between all share price index (ASPI) & other macroeconomic variables is tested using Johansen approach at the predetermined lag 1. Results in Table 01, indicate that there is one integrating equation, with normalized cointegrating coefficient. Hence, an error correction model should be applied.
The ASPI and macroeconomic variables have the expected signs and are statistically significant according to the t values shown. The study can interpret the coefficients as follows under postwar condition:

- A 1% increase in AWDR leads to a 4.92 per cent decrease in LNASPI in the long run
- A 1% increase in GBP rate leads to a 34.33 per cent decrease in LNASPI in the long run
- A 1% increase in INF leads to a 1.63 per cent increase in LNASPI in the long run
- A 1% increase in INR leads to a 5.11 per cent increase in LNASPI in the long run
- A 1% increase in JPY leads to a 2.87 per cent decrease in LNASPI in the long run
- A 1% increase in SDR leads to a 62.29 per cent increase in LNASPI in the long run
- A 1% increase in USD leads to a 5.37 per cent decrease in LNASPI in the long run

In contrast to the sample results, the AWPR, money supply of M2 and M2b are not statistically significant according to the t values shown. The ECM for All share price index was fitted to determine the short run relationship between macroeconomic variables and ASI results are shown below in Table 2.

### Table 2. Adjustment coefficients (standard error in parentheses)

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</tr>
</thead>
<tbody>
<tr>
<td>Coefficient Value</td>
<td>-0.12</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.01</td>
<td>0.33</td>
<td>-0.02</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.04</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.01</td>
<td>-0.14</td>
<td>-0.02</td>
<td>-0.02</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.01</td>
<td>-0.01</td>
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</table>

According to the above table, 12% of disequilibrium “corrected” each month by changes in ASPI, and about 1% of disequilibrium “corrected” each month by changes in GBP, money supply of M2 and M2b. Thereafter, independent sample t test was carried out to check the effect of macroeconomic variables and share price index of Colombo Stock Exchange in post war economy in Sri Lanka.
### Table 03. Independent Samples Test of Variables

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>ASPI1</td>
<td></td>
<td></td>
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<tr>
<td>Equal variances assumed</td>
<td>15.756</td>
<td>0.00</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-178.33</td>
<td>122.316</td>
</tr>
<tr>
<td>Inflation Rate (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>27.478</td>
<td>0.00</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>8.51</td>
<td>209.673</td>
</tr>
<tr>
<td>M2b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>73.748</td>
<td>0.00</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-817.23</td>
<td>113.333</td>
</tr>
<tr>
<td>Broad Money</td>
<td></td>
<td></td>
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<tr>
<td>Equal variances assumed</td>
<td>256.141</td>
<td>0.00</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-359.19</td>
<td>97.403</td>
</tr>
<tr>
<td>M2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>12.089</td>
<td>001.0</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>13.547</td>
<td>237.348</td>
</tr>
<tr>
<td>AWPR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>20.195</td>
<td>0.00</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>6.815</td>
<td>255.173</td>
</tr>
<tr>
<td>AWDR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>15.756</td>
<td>0.00</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>-178.33</td>
<td>122.316</td>
</tr>
</tbody>
</table>
According to results in Table 3, all the variables show a statistically significant change in two periods at 5% significance level. Specially, ASPI and money supply show a growth compared to war situation while AWDR, AWPR, and inflation rate have decline. It is noted that exchange rate of SDR, USD, GBP and JPY has depreciated more in post war economy.

IV CONCLUSION

This study has some practical implications for policy makers, managers and academics in the field of study. Investors of the major industries would be able to make future finance and investment decisions by sighted at the causality and VECM among macroeconomic behaviour in post war economy. Policy makers may make their macroeconomic policy decisions in favour to the stock exchange investments and industrial developments. The mangers can predict the share market performance with the change of monetary policy instruments and exchange rates.

The findings of this study indicate support for the model development for ASPI behaviour in Sri Lankan context. In this context, monetary policy variables, price level and exchange rate policies significantly affect the ASPI behaviour in addition macroeconomic variables of inflation rate and money supply. The variation in the past ten years shows that ASPI represent highest volatility more than 50 percent of coefficient of variation and JPY and SDR in post war economy. However, policy makers of the country should establish proper policies to control depreciation of the currency against USD, GBP, JPY and SDR in post war economy.

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Anti Money Laundering - Strategy and Way Forward

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Abstract- Money Laundering is an International issue since from the beginning of its evolution. This is a threat to the world economy, because of the fact that the black money is being used for the Terrorist financing and several other illegal activities by various sources of money laundering activities. Such activities are not only impairing the world financial health, but also a threat to the human kind. In order to curb the money laundering the steps taken by India and the principles adopted by United States; should be acknowledged by the world to combat money laundering and terrorist financing.

Index Terms- Financial intelligence & regulation, Money Laundering, Terrorist Financing

I. KEY FINDINGS

The world now acknowledged that the organized crime groups extended their umbrella of anti-social activities by expanding their portfolio through the help of drug cartels, human trafficking, counterfeit goods, supplying armed weapons, illegal migration and so on.

It is estimated that the transnational organized crime groups in the world, contributed the illicit proceeds around 0.2% and 0.33% of profits from the drug trafficking.

Money Laundering is done in several varieties of transactions that are almost become impossible identify and track down the illegitimate transactions, compared to the legitimate one.

1. **Step One: Placement** — getting the cash into the Physical system.
2. **Step Two: Layering** — Spin the money around the world, in and out of fake companies that can never be traced back to the originality. This step is followed by sending phony invoices between those companies where all kinds of goods and services that never existed. Their banks pay those invoices wiring money back and forth across the borders. It's although often impossible to follow the money trail due to digitalization of the global markets. It is easier to Layer with the countries that are disconnected from the rest of the world in the banking services.
Step Three: Integration — bringing the illicit money into the real estate, investments, buying luxury assets etc. are done in the final stage of Integration. It is highly impossible to determine the difference between legal and illegal assets due to the fact that the money once invested in these activities, transfers the hands, banks and finally into the financial systems across the globe.

How big is the problem:-

The world of transnational crime - The first official estimate was in 1998 by the International Monitory Fund, which estimate about 2% to 5% of global GDP, or $900 billion US dollars of black money is flowing across the world economy. The latest report that was updating it was the United Nations Office on Drugs and Crime Report in 2011, which is consistent with the IMF numbers. 3.6% of the global GDP is illicit proceeds.

The ratios of socio economic costs to the economy from $1 of illicit drug proceeds, it’s a 2 to 1 ratio globally and the United States is 3 to 1. That means for every $1 of illicit drug money costs $3 for the society to address all the issues associated with it.

Demonetization in India- A lesson for the rest of the world

On November 8, 2016; India announced the demonetization of Rs 500 and Rs 1000 currency notes and introduced new Rs 500 and Rs 2000 currency notes to curb the contraband currency notes. The impact of demonetization automatically helps in eradicating terrorism financing, funding to infrastructure projects through illegal money, financing to antisocial elements to create political unrest. Demonetization helped India at large with the immediate effect by making billions of contraband currency into just a piece of paper, which stopped funding to the antisocial elements that used to create political unrest in some of the world renowned tourist parts of the country like Jammu and Kashmir. However the immediate effect of demonetization to the general public was felt heavily during the first two months of the implementation and banks, ATM’s ran out of the currency notes, creating panic among general public. In support to the anxiety of the general public, media played a key role in relatively negative propaganda on the demonetization, supporting the opposition political parties. The negative publicity slowly vanished and a confidence was developed in the public due to the RBI interference during the end of 2016 and introduced the new Rs 500 and Rs 2000 currency notes in the early 2017 helped the banks and post offices gain the public trust about the timely support of central govt. Public slowly understood the importance of demonetization through the banks, post offices and subsequently media’s support to the government’s move is a big plus point.

The impact of demonetization is seen on several sectors of the economy. The major impacted sector is the financial sector, which is highlighted below.

(a) Retail Sector: The retail sector has seen a major decline in the growth due to lack of availability of currency notes in the general market, which set the general public to limit their spending on retail sector.

(b) Increase in retail savings: The impact of demonetization helped the banks in getting more retail savings, thus increased the balance sheet of the banks.

(c) Increase in the bank accounts: Demonetization helped generating five crore new bank accounts under various government schemes within 1 year from the date of implementation.
(d) An eye on unusual financial transactions: An amount of < Rs Two trillion is estimated of depositing into the various savings and govt scheme accounts into the banks by various fraudulent modes of financial disposition.

(e) Decrease in lending rates: The increase in savings and current account balances with the deposits of general public, banks received costless monies into their books, which helped in reducing the lending rates.

(f) Increase in investments: A great amount of household savings are diluted towards mutual funds and Insurance sector due to the demonetization

(g) More retail digital payments: Demonetization helped the economy in alternate payments mechanism. General public started using various means of card payment services and thus increase digital payments.

(h) Increase in contraband currency circulation: Antisocial activists started circulating/ disposing off the contraband currency into the general public to get rid of the currency before Dec 31, 2016.

Before the implementation of demonetization on Nov 8th, 2016; Indian Govt has introduced a new act to curb black money “THE BLACK MONEY (UNDISCLOSED FOREIGN INCOME AND ASSETS) AND IMPOSITION OF TAX ACT, 2015” and reviewed the Older “Benami Transactions (Prohibition) Act, 1988” and made various changes to it, keeping in mind the upcoming demonetization and released it as “Benami Transactions Act, 2016”.

The govt has given an opportunity to the general public to disclose the undisclosed income, voluntarily through “Income Declaration Scheme (IDS) between June 2016 to Sep 2016; without exempting the tax deduction. Govt started tracking on all large scale investments on various precious metal purchases and made it compulsory to provide Permanent Account Number (PAN) for all money dealings in excess of Rs 200,000.

The plan for demonetization on November 8th, 2016 is a perfect step with a lot of back ground work done by the Govt of India to curb the illegal and illicit money in the country.

The after effects of Demonetization:

Within the 12 months from the date of demonetization, nearly 99% of the demonetized currency was back into the banks through various sources of currency exchange options provided by Govt of India. With that said, the value of notes in circulation was reduced by 20.2% and the volume of currency in circulation has increased by 11.1%.

It is also visible that the digital transactions increased with the decrease of money in circulation.

<table>
<thead>
<tr>
<th>Monthly digital transactions (Rs in Million)</th>
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<tbody>
<tr>
<td>October, 2016</td>
</tr>
<tr>
<td>November, 16</td>
</tr>
<tr>
<td>December, 16</td>
</tr>
<tr>
<td>January, 2017</td>
</tr>
<tr>
<td>February, 17</td>
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<tr>
<td>March, 17</td>
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<tr>
<td>April, 17</td>
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<td>May, 17</td>
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<tr>
<td>June, 17</td>
</tr>
<tr>
<td>July, 17</td>
</tr>
<tr>
<td>August, 17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

With the increase in digital transactions, it is also observed that an increase in the electronic frauds during the same period of demonetization in India.

Cyber Frauds:

There were 13,083 cases of electronic wallets and electronic payment reported for the FY 14-15 and the cases increased to 16,468 for the FY 15-16. In order to curb the electronic crimes, Govt of India is also created cyber forensic labs.

The issue so far:

By the end of Nov 2017, approximately ≤ 85% of the debarred money has been deposited into the banks and started re-circulation into the market. That means the general public re-invented a safe mechanism to deal with the cash even though the limit for cash transactions are Rs 200,000 only.

Drawbacks:

It was understood that the demonetization was announced without printing the sufficient new currency. The banks, ATM’s were empty within a period of 2 weeks from the date of demonetization due in sufficient supply of smaller denominations in the place of Rs 500 and Rs 1000 notes.
Prior issuance of ATM cards to all the customers of the banks would have helped in reducing the chaos of cash withdrawals inside the bank premises. It was also noted that there were enormous amount of que’s outside the banks for the withdrawal and deposit of currencies causing several incidents of death to general public.

General public started approaching money launderers to get their existing Rs 500 and Rs 1000 notes exchanged, in lieu of the abnormal Que outside the banks for the exchange of demonetized currency. Money launderers started using the fictitious accounts to deposit the illicit money they collected through the chain and started exchanging the currency by bribing the bank officials. It was also noted that Gold and other related investments are increased right after the demonetization, due to the fact that Gold merchants started accepting illicit money in exchange of gold and bringing back the debared money into the system for recirculation through illegal processes.

**Result of demonetization in India:**
- Banks kept on monitoring on all the bank accounts and was observed that ≤ 0.2 million illegal bank accounts are frozen during the period of demonetization. There are also 0.30 million directors are barred from the companies for having financial maneuvers.
- The IT department of India served warning letters and investigated on the persons who exceeded in depositing the demonetized currencies into their bank accounts.
- It is also observed that demonetization has halted the political unrest and militancy in Jammu & Kashmir, due to the fact that there is no enough currency in circulation to be supplied to the political miscreants in the area. However this is a temporary phenomenon in the area of Kashmir.
- Demonetization helped the Govt to identify those individuals with a huge amount of debared cash in their personal lockers and not able to get away with their illegal money.
- It is also noted that debarring Rs 500 and Rs 1000 notes helped the country fight against the terrorist activities within the country and also temporarily halted the activities from the neighboring countries who supply counterfeit currency into India.
- Businessmen started paying advance income tax and declare the demonetized currency by surrendering the excess money and converting it to white money.
- There will be only positive outcomes over a period of 3-4 years from the date of demonetization and the result will be much a welcome approach for the Govt of India.

**United States:**
As of Nov 2017, currency in circulation—that is, U.S. coins and paper currency in the hands of the public—totaled about $1.6 trillion dollars. The amount of cash in circulation has risen rapidly in recent decades and much of the increase has been caused by demand from abroad. The Federal Reserve estimates that the majority of the cash in circulation today is outside the United States. The below chart depicts the actual Billions of Dollars in circulation from 04/01/1984 to 22/11/2017.

(Source: [https://fred.stlouisfed.org/series/WCURCIR#0](https://fred.stlouisfed.org/series/WCURCIR#0))

This includes both notes and coins held in the hands of the public and in the safe rooms of the depository institutions. About 0.33% of the unfit for circulation currency notes are destroyed by Fed every year. For example, a $1 bill is the most circulated currency, stays in the market for a period of approx. 5.9 yrs ; $ 100 note for approx. 15 years.
### Denomination of Bill

<table>
<thead>
<tr>
<th>Denomination</th>
<th>Life Expectancy (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1</td>
<td>5.9</td>
</tr>
<tr>
<td>$5</td>
<td>4.9</td>
</tr>
<tr>
<td>$10</td>
<td>4.2</td>
</tr>
<tr>
<td>$20</td>
<td>7.7</td>
</tr>
<tr>
<td>$50</td>
<td>3.7</td>
</tr>
<tr>
<td>$100</td>
<td>15</td>
</tr>
</tbody>
</table>

(Source: https://www.newyorkfed.org)

The Fed requests for new currency from the (BEP) Bureau of Engraving and Printing, which manufactures the required currency and sends it directly to the Reserve Banks. Unlike the other countries, United States maintains only 6 small Denomination bills in circulation which helped the country to prevent hoarding of physical cash. However it continuously striving to prevent money laundering.

The United States received failing scores for its efforts to prevent the laundering of criminal proceeds by shell companies, accountants and real estate agents, the Financial Action Task Force (FATF) said in a report (Source: Reuters)

There are many loopholes in the law enforcement; which led the illicit, counterfeit and contraband money flow into US economy. However Financial Action Task Force “FATF’s” relentless efforts in curbing the Anti money laundering, Anti-terrorist financing etc. are highly effective and FATF has implemented innovative tools and techniques to monitor and control the anti-money laundering.

FATF gave non-complaint to Washington due to the lack of monitoring of non-financial institutions involvement in the money laundering activities. Mostly the non-financial institutions are named as realtors and law firms.

In the United States real estate agents are excluded from the scrutiny and disclosure of suspected money laundering activities by their customers into the purchase of properties through illicit money. FATF noticed and brought these activities into limelight, which raised concerns on Washington and its lack of monitoring.

New York states banking regulation body accused Standard Chartered Bank of assisting around $250 bn through money laundering activities between 2001-2007. Regulators charged the bank with numerous counts of charges of knowingly engaging in different fraudulent activities to assist around and into the financial systems with its dollar denomination currencies around the world. This depicts an example of why US banks are more attractive towards money launderers. It is also unclear about how much money went towards financing nuclear program and terrorist financing. The bank altered the reports of the source for wire transfers. The bank used series of codes to wire transfer money into Iran, showing various sources of money.

More recently HSBC, Bank of America and Wachovia are also been investigated and accused of helping Mexican drug traffickers, laundered their illicit funds through the American banking system.

The United States has some of the strictest Anti-money laundering laws in the world plus a regulatory environment capable of investigating the reported cases. However it is very common to have some prominent contacts among the bankers and drug traffickers in money laundering activities by paying huge incentives. US has become a safest path to the money launderers through passing the money through US banking systems and once the money moves out of US, is declared as genuine money in most of the cases.

Regulators are more concerned on the most non regulated financial systems in the world, from where the money laundering is done through a series of transactions showing it as a legitimate transaction. However it is very difficult for the regulators to monitor on each and every financial transaction about their legitimacy. Regulators are dependent on banks to notify on any suspicious activities. It depends on the banks to notify regulators on which is a suspicious transaction or comingle with lawyers in justifying the transactions as legitimate. The process of close monitoring is not eradicating the money laundering, however it is making the money laundering expensive with the involvement of more number of players to it. Tax evasion is added as an offence to the money laundering prosecution in 2012 as a global standard.

With this stated, US is expanding its Real Estate Data targeting Los Angeles, San Diego, SFO, Brexar county-Texas, New York City, Miami. There are triggers which are associated with each of these counties, so that regulators start investigating more into the real estate transactions.

In order to further strengthen the regulatory in the United States, FinCEN (Financial Crimes Enforcement Network) was introduced by order of the Secretary of the Treasury on April 25, 1990 to include regulatory responsibilities. FinCEN's developed an information technology portal called FinCEN Portal and Query System, which migrated with 11 years of data into FinCEN Query. It is a search engine like Google and it is a "one stop shop" accessible via the FinCEN Portal allowing wide range of searches across more fields than before and resulting in more outputs. Since September 2012 FinCEN generates 4 new reports: Suspicious Activity Report (FinCEN SAR), Currency Transaction Report (FinCEN CTR), the Designation of Exempt Person (DOEP) and Registered Money Service Business (RMSB). These reports are used to track, identify and take further actions to curb money laundering and terrorist financing. (Source: https://en.wikipedia.org/wiki/Financial_Crimes_Enforcement_Network)

### IV. CONCLUSION

The threat to the world economy through money laundering is immense and it is 2 to 3 times expensive to prevent the society from the impact of these illicit activities through money laundering. Not only it is expensive, but also it is a major challenge to the regulatory authorities to identify the money laundering agencies and take a criminal action against them due to the political, local and international boundaries and restrictions. Bilateral and Multilateral agreements with the countries which are more active towards the prevention and control of anti-money laundering should come forward and work closely for the global cause. It is also pertinent to state that money laundering is a global threat due to the fact that there are
several countries who mainly survive with the money laundering, drug trafficking etc. The laws in those countries are weak and that attracts the rest of the world to route the illicit money through these countries into rest of the developing and developed countries causing world unrest. A strict legal action towards these countries and standard law will make the money launderers from gaining advantage of using different laws and jurisdictions. The financial institutions, law enforcement agencies, administrators and regulators come close and need to work together as a joint task force to combat the issue of money laundering and terrorist financing, so that there would not be another 09/11 in any other country.

**Strategies that countries and territories can follow to combat money laundering:**

- **Maintain Coins, Small denominations currency bills, adopt proper security measures which reduce printing of duplicate bills, demonetization of older bills in circulation and reissuing new currency bills with the same denomination with more security features.**
- **Vigilant on all the bank accounts with international money transfers on frequent basis and those accounts that pool the money from different sources.**
- **Make a due diligence on the customer, follow KYC norms and raise red alerts when a banker finds any suspicious activity in their customer accounts.**
- **There should be more coordination between the regulatory, FI’s and enforcement dept in addressing the issue of money laundering.**
- **Strict punishment to those individuals or groups who are caught in Money laundering. Instead of 1 yr, 2yr of 5 yrs imprisonment and a small amount of financial penalty would not be sufficient. There should be more than what the culprit’s imagination level.**
- **Create a Financial Intelligence Unit (FIU) in every country and it should contain bankers, investigators, financial crime analysts, who can help and analyze the information from banking portal and red flag the money laundering activities to the regulatory for further investigation or criminalization.**
- **Take strict actions on those countries which encourage money laundering activities and terrorist financing. Monitor the banks and take stringent action against the banks which loosen the wire transfer regulations.**
- **Bank secrecy laws should be reconsidered and any restriction on information sharing between the banks and regulatory should be reconsidered and protection should be provided to the banks / bankers who provide support to the regulatory in providing the appropriate information on criminal activities of their customers.**
- **Keep the records of the customers and their transactions for a period of at least 5 years in case of physical documents and electronic documents should be stored in the data base for at least 10- 20 years. In this process regulatory authorities can go back and reference the physical and electronic documents of those suspected customers over a period of time to identify the criminal activities.**
- **Banks and the staff should be given adequate training on modern techniques on identification of money laundering activities and periodically, the training should become a mandatory tool for all the employees of the bank.**
- **International coordination between countries should be implemented to monitor the agencies which are working closely on money laundering activities and their reach is global.**
- **Countries should implement stringent laws on money launderers and anti-social elements, whose properties should be seized and forfeited into Government books.**

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Removal of Lead (II) Ions From Aqueous Solutions Using a Low Cost Adsorbent Obtained from Centella Asiatica Leaves

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Abstract: This work deals with the study of the removal of lead from aqueous solution using low cost adsorbent obtained from the leaves of centella asiatica. Effect of pH, adsorbent dose, dye concentration, contact time and temperature on the removal of the metal ions was investigated. Equilibrium data were analyzed using Langmuir and Freundlich isotherm models. The maximum removal was obtained for the adsorbent dose of 100mg at 10mg/l metal concentration at pH 5 and agitation speed of 120rpm. The result shows that Centella asiatica leaf could be employed as an effective low cost adsorbent for the removal of Lead.

Index Terms- Lead(II) ions, low cost adsorbent, Centella asiatica leaf, Isotherm models, Thermodynamic parameters.

I.INTRODUCTION

Heavy metals are one of the most predominant hazardous pollutants in the environment. Heavy metal ions are often found in the environment as a result of their wide industrial applications. They are the common contaminants of wastewater and most of them are known to be toxic or carcinogenic. In addition, they are not biodegradable and tend to accumulate in living organisms, causing various diseases and disorders¹. Pollutant toxicity has forced industries and municipal authorities to treat wastewater before discharging to the natural water bodies². In the human body very small amount of Pb(II) over a long period of time can lead to malfunctioning of certain organs and chronic toxicity³. It can damage nearly all tissues, particularly the kidneys as well as the immune and nervous system. The maximum permissible limit of lead in drinking water is upto 0.01mg/L. Heavy metals refers to any element with the atomic weights between 63.5 and 200.6 and specific gravity greater than 5.0⁴. Cadmium, zinc, copper, nickel, lead, mercury and chromium are some examples of heavy metals which originates from activities of metal plating, mining, battery manufacture, petroleum refining smelting, tanneries, pesticides, pigment manufacture, printing, photographic industries and paint manufacturing⁵,6.

There are various methods in practice for the removal of heavy metals such as chemical precipitation⁷, ion exchange⁸,⁹,¹⁰, co-precipitation¹¹, coagulation, reverse osmosis¹²,¹³, adsorption¹⁴,¹⁵ and filtration¹⁶. In recent years adsorption techniques for wastewater treatment have become more popular and efficient due to simplicity and low cost. Previous research shows that there is growing interest of searching for a variety of materials as low cost adsorbents including sawdust¹⁷, cocoa shell¹⁸, rice husk¹⁹, modified sawdust of walnut²⁰, papaya wood²¹, maize leaf²², rice husk ash and neem bark²³, fly ash²⁴, and industry waste²⁵.

II. EXPERIMENTAL

Preparation of adsorbate

A stock solution containing 1000mg/l of Lead ions was prepared by dissolving an appropriate quantity of lead nitrate in double distilled water. The working solutions were prepared by diluting the stock solution. The concentration of the lead (II) ions in the solution was determined spectrophotometrically.

Preparation of adsorbent material

Centella Asiatic leaves were collected and washed with tap water several times to remove soil dust and finally washed with DD water. It is dried in sun shade. The dried leaves were powdered and soaked in con.H₂SO₄(1:1, w/w), for a day, then filtered and dried. The charred mass was kept in a muffle furnace at 400°C,for 1 hour, it was taken out, ground nearly to fine powder and stored in vacuum desiccators. The Characteristics of the adsorbent is presented in the table-I

<table>
<thead>
<tr>
<th>pH</th>
<th>6.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Content, %</td>
<td>13.5</td>
</tr>
<tr>
<td>Ash Content, %</td>
<td>10.2</td>
</tr>
<tr>
<td>Volatile Matter, %</td>
<td>21.3</td>
</tr>
<tr>
<td>Water Soluble matter, %</td>
<td>0.45</td>
</tr>
<tr>
<td>Acid Soluble Matter, %</td>
<td>0.89</td>
</tr>
<tr>
<td>Porosity, %</td>
<td>48.1</td>
</tr>
<tr>
<td>Micropore volume cm²/g</td>
<td>0.194194</td>
</tr>
<tr>
<td>Average pore width Å</td>
<td>28.2065</td>
</tr>
<tr>
<td>BET Surface Area, m²/g</td>
<td>604.27</td>
</tr>
</tbody>
</table>

Table-I Characteristics of the adsorbent
III. RESULTS AND DISCUSSION

Effect of pH

The pH is one of the important parameters influencing the adsorption process. The pH of feed solution was examined from solution a different pH levels, covering a range of 1.0-7.0. In the case of Pb(II) the maximum adsorption was obtained at pH 5.0 for both 10 and 50 mg/L. The pH of the working solution was controlled by adding 1NHCl or 1NNaOH solution. The uptake of the lead (II) ions at pH-5 was maximum (fig.1) at lower pH values, the H+ ions compete with the metal cation for the adsorption sites. The heavy metal cations are completely released under extreme acidic conditions. With the increase in pH the adsorption also increases and reaches the maximum at pH 5. Hence the pH of the medium was maintained at 5 for further studies.

Effect of Adsorbent dose

The effect of adsorbent dosage was studied by varying the dosage from 25mg to 150mg keeping the other parameters constant. The result is shown in fig.2. The adsorption percentage increased as the adsorbent dosage increased. The adsorption percentage increases and reaches the maximum at 100mg of adsorbent dosage thereafter, there was no appreciable increase in the percentage of lead (II) ions removal. This is due to greater availability of the sites for adsorption on the adsorbent surface. Therefore the adsorbent dosage was maintained at 100mg for further studies.

Effect of metal ion concentration

The experiment was carried out with 10mg/l to 50mg/l solutions with adsorbent dosage 100mg, for a contact time of 90min at pH-5, and the result is shown in fig.3. From the figure it can be seen that the percentage of adsorption decreases with increase in the lead (II) ions concentration. This is due to less availability of sites on the adsorbent surface.

Effect of contact time

The effect of contact time on adsorption of lead (II) ions removal is shown in fig.4. 100mg of adsorbent was used for this experiment with a contact time of 10 to 120minutes. It is observed that the percentage removal of metal increases with time and reaches the maximum at 90min, thereafter, there was no appreciable increase in the percentage of lead (II) ions removal. This is because at the initial stage, the rate of removal of lead (II) ions was higher due to availability of more number of active sites on the surface of the adsorbent and become slower after 90 minutes, due to availability of lesser number of active sites. Hence all the experiments were conducted for a period of 90 minutes.
Fig: 4 Effect of contact time on the adsorption of Lead (II) ions on to the adsorbent

Effect of Temperature

Effect of temperature on the adsorption of lead is shown in fig. 5. As the temperature was increased from 30°C to 60°C, the percentage of adsorption also increased. The increase in temperature may be accompanied with an increase in the porosity and in the total pore volume of the adsorbent. This may also be attributed an increase in the mobility of the metal ion with the increase of temperature.

IV. ADSORPTION ISOTHERMS

Langmuir Adsorption Isotherm

The equilibrium adsorption isotherms help to understand the mechanism of the adsorption. The Langmuir and Freundlich isotherms have been tested in this study.

The Langmuir isotherm was based on the assumption that maximum adsorption corresponds to a saturated monolayer of adsorbate molecules on the adsorbent surface, the energy of adsorption was constant and there was no transmigration of adsorbate in the surface.

The linear form of Langmuir equation is expressed as follows

\[
\frac{Ce}{Qe} = \frac{Ce}{Q_0} + \frac{1}{Q_0b}
\]

The values of \( Q_0 \) and \( b \) were calculated from the slope and intercept respectively, of the linear plots of \( C_e/Q_e \) verses \( C_e \). Langmuir adsorption isotherm is presented in fig. 6. Higher value of correlation co-efficient (\( R^2 = 0.999 \)) indicates that the experimental data fits well with the Langmuir equation. The values of \( Q_0 \) and \( b \) are given in Table-2.

Fig: 6 Langmuir isotherm for the adsorption of Lead (II) ions on to the adsorbent

<table>
<thead>
<tr>
<th>( Q_0 ) (mg/g)</th>
<th>( b )</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.2307</td>
<td>0.1850</td>
<td>0.999</td>
</tr>
</tbody>
</table>

Table-2. Langmuir constants

The essential characteristics of the Langmuir adsorption isotherm are expressed by a dimensionless constant called separation factor. This value indicates whether the adsorption is favorable or not. \( R_L \) is defined by the following equation

\[
R_L = \frac{1}{(1+bC_i)}
\]

Where, \( R_L \) _ dimensionless separation factor, \( C_i \) – initial concentration, \( b \) – Langmuir constant (Lmg⁻¹). The parameter \( R_L \) indicates the type of the isotherm.

<table>
<thead>
<tr>
<th>Values of ( R_L )</th>
<th>Types of isotherms</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R_L &gt; 1 )</td>
<td>Unfavourable</td>
</tr>
<tr>
<td>( R_L = 1 )</td>
<td>Linear</td>
</tr>
<tr>
<td>( 0 &lt; R_L &lt; 1 )</td>
<td>Favourable</td>
</tr>
<tr>
<td>( R_L = 0 )</td>
<td>Irreversible</td>
</tr>
</tbody>
</table>

The \( R_L \) value obtained using the above equation for 10mg/l Lead (II) ions concentration is 0.3508. This \( R_L \) value lies between 0 and 1 indicating the favorability of the adsorption.

Freundlich Adsorption Isotherm

The Freundlich model can be applied for non-ideal sorption onto heterogeneous surfaces involving multilayer sorption.

The linear form of the Freundlich equation is as follows

\[
\log Q_e = \log K_f + \frac{1}{n} \log C_e
\]

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Where $Q_e$, amount of metal ion adsorbed (mg/g), $K_f$, adsorption capacity, $n$, adsorption intensity. By plotting $\log Q_e$ vs $\log C_e$, the values of $n$ and $K_f$ were calculated from slope and intercept respectively (fig. 7). The values of $K_f$ and $n$ are given in table 3. The value of linear regression co-efficient ($R^2$) was found to be 0.974. This indicates that the adsorption process follows Langmuir adsorption isotherm more than Freundlich adsorption isotherm.

![Fig:7 Freundlich isotherm for the adsorption of Lead (II) ions on to the adsorbent](image)

The value of $n$ in the range 2-10 represents favourable adsorption.

### V. THERMODYNAMIC PARAMETERS

Thermodynamic studies related to the adsorption process is essential to conclude whether a process will occur spontaneously or not. The fundamental criteria for spontaneity is the standard Gibbs free energy change $\Delta G^o$. if the $\Delta G^o$ value is negative, the reaction will occur spontaneously. The thermodynamic parameters, standard free energy ($\Delta G^0$), change in standard enthalpy change ($\Delta H^0$) and change in standard entropy($\Delta S^0$) for the adsorption of lead (II) ions onto the adsorbent were calculated using the following equations.

$$K_0 = \frac{C_{\text{solid}}}{C_{\text{liquid}}}$$

$$\Delta G^0 = -RT \ln K_0$$

$$\log K_0 = \frac{\Delta S}{2.303R} - \frac{\Delta H}{2.303RT}$$

Where $C_i$ is the concentration of the metal ion at equilibrium and $C_e$ is the amount of metal ion adsorbed on the adsorbent.

The values of $\Delta G^0$ (KJ/mol), $\Delta H^0$(KJ/mol¹) and $\Delta S^0$ (J/K/mol) can be obtained from the slope and intercept of a linear plot of $\log K_o$ verses $1/T$ and are presented in table 4.

<table>
<thead>
<tr>
<th>Conc. of Pb (mg/l)</th>
<th>$-\Delta G^0$</th>
<th>$\Delta H^0$</th>
<th>$\Delta S^0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°C</td>
<td>10</td>
<td>4.3732</td>
<td>4.8867</td>
</tr>
<tr>
<td>40°C</td>
<td>20</td>
<td>3.4937</td>
<td>4.0027</td>
</tr>
<tr>
<td>50°C</td>
<td>30</td>
<td>2.6681</td>
<td>3.0468</td>
</tr>
<tr>
<td>60°C</td>
<td>40</td>
<td>1.8820</td>
<td>2.2054</td>
</tr>
<tr>
<td>70°C</td>
<td>50</td>
<td>1.0210</td>
<td>1.1081</td>
</tr>
</tbody>
</table>

![Table 4. Thermodynamic parameters for the adsorption of Lead (II) ions on to the adsorbent](image)

The negative values of $\Delta G^0$ indicates that the adsorption process is spontaneous and highly favorable. The positive values of $\Delta S^0$ indicates the increased randomness at the solid solution interface. The values of $\Delta H^0$ indicates that the adsorption process is endothermic and physical in nature.

### VI. CONCLUSION

The adsorption behavior of Lead (II) ions on the adsorbent obtained from the *Centella asiatica* leaves was investigated in batch equilibrium method. The adsorption was found to be highly dependent on various parameters like contact time, pH, initial concentrations, adsorbent dose and temperature. The optimum pH for Lead (II) ions adsorption was found to be 5. The experimental data were correlated well by the Langmuir adsorption isotherm. The result of this study indicates that this adsorbent can be successfully utilized for the removal of Lead (II) ions from aqueous solution.

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Effect of Classical and Pop Music on Mood and Performance

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I. INTRODUCTION

It is an experimental study to measure the effects of classical and pop music on mood and performance.

1.1 Music

Music varies form culture to culture, it is manifestation of soul, it conveys our emotions, feelings and the distinction between noise and music is culturally bound. It works like a stimulant which transforms psychological and psychic phenomena like “hypnosis ball”. It is manifestation of grief, happiness, and affection. “It is gratuitous play of a child. It is mystical asceticism. Consequently expression of sadness, joy, love, and dramatic situations are only very limited particular instances” (Xenakis, 1971). Confucius define music as heavenly accord, beat and tune replicate the idea it is idea itself, complete in itself. Other form of arts articulate imitations but it is powerful, infallible, and pierce and it is connected to human feelings which “restore to us all the emotions of our inmost nature, but entirely without reality and far removed from their pain.”(Encyclopedia Britannica, 1978).

1.1.2 Music in Pakistan

There is diversity in music of Pakistan. It include Ghazal, Qawalli, Religious (Hammad, Naat) classical and regional music (Bloche, Sindhi, Panjabi Pashto, Kashmiri, Gilgit). Different musical instruments are used in different region of Pakistan which depicts the specialty of different regions according to their cultural values. Some of musical instruments are Borrindo, dilo, andghager, yakhtar, Dando, and Chaparoon, kani, naghara, chung, taloyon, dholak, sharnai, surando, murl, bainsuri, damboor, chimta, zargbagali, Sarangi, daf.(Baloch,1998).

1.1.4 Effects of music


Music has ability to relax, calm and stimulate mood. Different type of music induces different moods. Major mode produced excitement with loud volume, medium pitch, fast tempo, high pitch with major mode induce happiness. similarly minor mode with slow tempo induce sadness. (Bruner, 1990).Fast tempo decrease in heart variability rate, and minor mode increase arousal level, uplifting music manipulate the helping behavior and people become more supportive, while listening annoying music people become short temper and less supportive.(North, Tarrent & Hargeaves. 2004).Music effect mood, tension and mental functioning, it increased positive feelings and enhance productivity (McCraty, 2005). ‘Grunge music’ reduces motivation (McCraty, 2002).Music can be used to elevate depression as it has effect on dopamine level of brain (Robertson, 1998).

Music relaxes our body, muscles, reduce blood pressure, anxiety, stress(Nilsson, 2005) reduce negative emotion and improve the sleep quality in older adults useful cure for insomnia(Lai & Good, 2005)Music influence the behavior of students about social issues. They were more interested in social messages when message was presented with music. (Galizo & Hesdrick, 1972).

Several studies shows that music effect the purchasing and affiliating behavior (Arein & Kim,1993, Alpert, Alert,1990, Mehrabian & Russell,1974) shopping behavior can be influence by playing different types of music. Customers buy more expensive wine while classical music. (Arein & Kim, 1993).

Music affects our brain; it can enhance our performance level. In research basic emotions (“happiness, anger, disguise, surprise, sadness, & fear”) was checked. Results show that good and bad moods were easier to recognize. (Mohn, Arstatter & Fredrich, 2010).Music improve the quality of life. (lesiuk2005).Music affects our perceptual abilities (lesiuk (2010) &Stratton (1992) found that listening to music participants who were waiting: underestimate the time duration. It is belief that music influence response to waiting time. people are less stressful while waiting listen to music then those group with no music(Stratton, 1992).Customer spend more time in shopping store with background music was played(Yalch & Span Genbery,1990).Tempo, volume, rhythm also influence the perceptual abilities. Girls reported more time when music was loud. (Kellaris & Alscern, 1992).

Music has effect on criminal behavior. Classical music reduces the crime rate, and reduce desire to commit crime (Caper,2009).Music has healing power. (Siedliecki & Good, 2006). It can also be used for therapeutic purposes and reduces medication during child birth and relax body. Bernard, Porta &
Sleight (2006) found that music reduces blood pressure and lively music lead to faster beating heart rate. Classical music is helpful for insomniacs (Harmat, Tacka, & Bodiz, 2006) and mostly prescribed for blues (Maratos, Gold, Wang, & Crawford, 2008).

1.3 Mood

Mood is originated from word “Mod” It is enduring condition. Moods are actively working behind the scene and play an important role in our daily functioning. They directly affect our survival. The term mood and emotions are interchangeably used. As it is consider being an emotional state as vocabulary used to define mood is of used for emotions. Moods are classified with names “good or bad, black or blue”. The major confusion is to differentiate mood and emotions, as emotional term used are words who define feelings like “happy, sad, envy, guilty and angry” etc (Dingman. 2008). Excitation irritability, interests, depression, and elation were terms used for possible moods by Wessmen and Ricks. The difference between mood and emotions is that, emotions are vague, less severe, and are less likely to prompt by any particular activating event. Mood is the product of energy and tension (Thayer.2001). People experiences both positive and negative feelings. They feel best when they are in serenity, relaxed energy mood then in anxious state. Food is frequently used to regulate it. Researches shows interaction between mood and culture, moods are culturally bound, two individual from different culture can’t transmit same feelings. (Dingman, 2008) mood affects individual religious and spiritual feelings. William James find out feelings associate with religion, some emotional and some enduring moods that lasts with ones life.

According to Thayer food is fundamentally connected to mood and used to ‘regulate mood’. (Thayer.2001).Larsen and Ketler (1989) suggested that ‘extroversion and neuroticism’ are linked to positive and negative moods. Extroverts react emotionally on positive effects and ‘Neurotics’ have higher reactivity on negative moods.

‘Emotion regulation’ is all about how one manages emotional experiences, and it is important factor in social relations and ones competency. Many factors are involved in emotional regulation; childhood experiences, parent-child relationship, early development, understanding of emotions and social influences (Thomson, Meyer & Jochem, 2008).

Mood effect the person perception and memory. In happy and sad mood people recalling and judgmental ability is affected. Happy mood have more effect on judgments then sad mood (Forgas & Bower, 1987).Miranda, Persons & Byers (1990) suggested that positive and negative mood effect the patient’s dysfunction beliefs. In good mood they are less likely to report dysfunctional attitude while dysfunctional thoughts increase in bad mood. Positive and negative moods also influence the job satisfaction level (Houston & Lorian,2002).Positive mood induce more inclination toward support (Petty, Schuman, Richman, & Strathman,1993),effect stereotypical attitudes(Park & Banaji, 2000)

1.2.1 Music and Mood

Bouhuys, Bloem and Groothuis (1994) conducted studies to measure the influence of music on perception. After listening to depressing music subject report more sorrow in ambiguous faces and less cheerfulness was reported for clear faces. Results indicate that after listening to depressive music subjects’ perception was altered. Judy I & Mark I (2006) studied the effect of mood on consumer behavior, and how music affects consumer response. Result determines that music influence the mood and shopping behavior of customers. Magee & Davidson determines that music altered the mood of patients and music therapy is successful to deal with pessimistic condition in population of ‘neuro-rehabilitation’. It decreases the anxiety and depression in patients (Cassileth, Magill, & Vickers, 2003).

1.2.2 Music and Performance

Music plays profound role in cognitive functioning. It boosts performance and language acquisition improves reading and literary skills (Medina, 1993). Vendor (2003) determines that it is useful for dyslexics to improve their writing skills. Music positively influences the reasoning ability, recalling ability (Mammarella, Fairfield, & Cornoid, 2007) mathematical abilities, and helpful for ADHD children, for movement disorder (Bernatzy, Hess, & Staffen, 2004) .Music training is more influential then music listening. Children with music training have better memory then children with no music training (Patson, Hogg & Tippet, 2007)

It increases concentration and attention and improve performance (Yim Chi et al, 2003). Music education have positive effect on memory and learning, the people who have education of music are high on performance test and have more GPA then people with no music equivalent (O,Dennell,2005). According to Watkins (1995) “It’s not neutral, it have either positive or negative effects on body and brain”.

1.3 Literature review

Different type of music affect differently. It heals and reduces depression in patients (Zahra, 1997). An upbeat melody makes us happy, and slow music makes us sad; can alter our mood or entertain us. Musical mode affects the emotions; the major mode elicits positive emotions while minor mode elicits negative responses. (Diagiancomo, Anthony, Kibby, & Branda, 2006) Music language also shows profound effects. In one study the participants who listened to uplifting music offered more help than those who listen to annoying music. North, Tarrent & Hageaves, 2001).Researchers found that music affects our brain and improve our performance level. It influenced perception and quality of work. (Lesiu, 2010) Stratton (1992) founded that music affects our perception of time. While listening to music participants who ware waiting; underestimate the time duration.

Music therapy influenced mood and self esteem. In a study one group was given music therapy with pre and post tests of mood and emotions. The other group was not given music therapy. Results showed significant difference between both groups self esteem and mood (Henderson, 1983).

McCratty,Choplain,Atkinson and Tomisino (1988) studied the effect of different genre of music on emotions, anxiety and cognitive clarity. Their was increased rate of tiredness, stress and unhappiness in group who listen grunge music and decreased in enthusiasm while designers music induce happiness, vivacity,
cognitive clarity and decrease in unhappiness, tiredness and stress.

Saarikallio and Erkkila (2007) conducted a qualitative study on eight young adults to measure the influence of music to direct mood. Interviews were taken from individual and results were examined through “grounded method”. Result indicates that music is helpful in mood regulation.

Music affects our learning ability (Nelson, 1989). Music does not have negative effect on ‘language acquisition’. (Medina, 1993). “Man expresses themselves in rhymes and beats. It is not necessary for life but it is hard to imagine life without music” (Dallin, 1959). It affects our daily life by influencing emotional experience, our cognition and social relations (North, Hagreaves, 1994). Music therapy reduces the nervousness, distress, restlessness and the use of anesthesia, tranquilizers during surgery (Ovayolu, Ucan, & Pehlivan, 2006). Music is linked to reasoning process, as ‘areas of cortical are involved in higher brain functioning’, music affect these area and enhance reasoning process (Leng, Shaw, & Wright, 1993). Performance of children increase after listening to relaxing music (Hallen, Price, & Katsarou, 2010).Researcher found that mood of ‘stroke recovery patients’ change after listening to music, they were less depressed then those patient who didn’t listen music (Sarkamo, Tervaniemi, Laitinen, Forsbolm, & Pretez, 2008). Classical music successfully reduced DAT (dementia) in the females (Casby, Julie, Holm, & Morgo, 1994). Researcher conducted an experiment to measure the influence of music on the reasoning ability of adults and children. Adult performance was high on upbeat music then downbeat. Similarly children drawings were reported as more innovative, vivacious, and more technical after listening to music (Schellenberg, Nakata, Hunter, Tamoto, 2005) and it is a mood regulator for adults (Saarikallio & Erkkila, 2007). Reading Music listening on daily bases have positive influence on women with physical ill, it help them to cope with their problem. Nicol conducted qualitative research on women who were physically ill, who report music as good friend to manage unexpected onset of disease. Freeburne, Fleischer, & Murry (1992) studied the influence of music on reading and intellectual capacity. Results determine that reading speed was fast while listening to “jazz music and classical, semi classical” have no significance influence on reading and intellectual capacity.

The sad and happy classical music trigger different areas of brain which are involves in emotional experience, attention, and judgment. Fast beat cause excitement, increase in blood pressure and heart beat, downbeat generate calmness (Bernardi, Ports, & Sleight, 2005). It is less expensive cure to decreases nervousness in patients who wait and go through the inquiry for surgery (Cooke, Chaboyer, & Hiratos, 2005). It has ability to induce change in moral reasoning, upbeat music decrease consciousness. Popular music improves performance on tests then Mozart music (Susan & Schellenberg, 2006) and improves logical thinking (Schellenberg, 2005).

Palheiros and Hargreaves (2001) found that listening to music and its education has positive influence on adolescent. Music education increases their devotion to knowledge, and at home music listening serves as entertainer for relaxation and improves their social dealings.

1.4 Rationale

Music is the area of interest for researcher. Many researches were conduct to measure the effect of music on ones life. How it influence mood, emotions, learning, memory, perception, social behavior etc. And this study is conducted to investigate the effect of music on mood and performance of young adults. Many researches have been done for this purpose and my study is aim to see whether these findings are applicable in our culture.

1.5 Objective

To investigates the effect of Pop music on mood and performance.

To investigates the effect of Classical music on mood and performance.

To investigate whether there is any difference between the effect of pop and classical music on mood and performance.

1.6 Hypotheses

Classical music would affect mood and performance.

Pop music would affect mood and performance.

Both kind of music (pop and classical) would affect the mood and performance differently.

II. METHOD

2.1 Participants

Sample comprised 50 students 25 girls and 25 boys age range 18-25 from GCU Lahore. It was based on convenience sampling.

2.2 Instruments

In experiment following instrument were used.

2.2.1 Music tracks

Two music tracks were used one in classical music and other in pop music. Classical track was Raag Mesh by Nusrat Fateh Ali khan and pop track was Music of Life. Both track was presented for 4 minutes and were without lyrics to avoid the effect of lyrics on individual as lyrics tend to be perceived differently by very individual.

2.2.2 Oxford Happiness Questionnaire

It was used to measure the current mood of individuals. It is originated from general happiness inventory(GHI) develop by Argyl, Martin & Crossland (1989) which is comprise of 29 items,21 reverse item of BDI and add 11 more item to measure well being With four options scale. Oxford general happiness questionnaire also include 29 items, with six option likert scale. The OHQ is easy to administer. Both GHI and OHQ show values α (167) =0.92 and α (168) =0.91 respectively. The inter-item correlations for the OHI ranged from −0.03 to 0.58, mean 0.28, and the corresponding values for the OHQ were −0.04 to 0.65, mean 0.28.

2.2.3 WAIS Coding Scale

It is develop by David Wechsler in 1855. Forth edition was published in 2008 by Pearson. It is primarily used to assess the intelligence of adults. It includes both verbal and non verbal
tasks (performance tests). It is used to measure the intelligence of people age 16 or above, it is determine that it appropriate measure for over 74. For performance IQ reliability is .93 across all groups, verbal IQ .97 and r = .97 for full test. .95 is Split half reliability which is very strong. It is valid test and highly correlated with other IQ tests.

2.2.3 Procedure
Experiment was conducted in seminar room of psychology department GCU. Participants were randomly assigned to all conditions. In first group 25 participants were taken. Brief instructions were given about experiment. They were given OHQ before music. Then pop music (music for life) was presented for 5 minutes. After pop music they were given OHQ, and after completion of questionnaire they were given WAIS coding task to fill it in 2 minutes. Then they were presented classical music (rag mesh by Nusrat Fateh Ali khan) for 4 minutes. And OHQ was again given after classical music and after completing questionnaire WAIS coding task was given for 2 minutes. Then on second Day, 2nd group were given similar conditions but in different order. They were presented classical music first and then pop music to reduce the order effect.

III. RESULTS

Data was analyzed through Two Way ANOVAs.

Table 3.1
Mean and standard deviation of pop, classical and no music.

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Music</td>
<td>4.10</td>
<td>0.57</td>
</tr>
<tr>
<td>Pop Music</td>
<td>4.22</td>
<td>0.73</td>
</tr>
<tr>
<td>Classical Music</td>
<td>4.00</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Table 3.2
Two way ANOVA comparing gender and music on mood (N = 50)

<table>
<thead>
<tr>
<th>Sources of Variance</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1</td>
<td>1282.7</td>
<td>2.4096</td>
<td>0.12</td>
</tr>
<tr>
<td>Error</td>
<td>43</td>
<td>532.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music</td>
<td>1</td>
<td>514.6</td>
<td>4.6455</td>
<td>0.04*</td>
</tr>
<tr>
<td>Music x Gender</td>
<td>1</td>
<td>35.8</td>
<td>0.3233</td>
<td>0.57</td>
</tr>
<tr>
<td>Error</td>
<td>43</td>
<td>110.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis of data revealed that significant main effect of music $F(1, 43) = 4.65, p<0.05$ on mood. A post hoc analysis indicated that pop music ($M = 4.23, SD = 0.73$) has significant effect on mood as compared to classical music ($M = 4.04, SD = 0.76$) and no music ($M = 4.1, SD = 0.57$). No interaction was found between music and gender.

Table 3.3
Mean and standard deviation of pop and classical music on performance

<table>
<thead>
<tr>
<th>variables</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pop Music</td>
<td>51</td>
<td>19.4</td>
</tr>
<tr>
<td>Classical Music</td>
<td>46</td>
<td>16.7</td>
</tr>
</tbody>
</table>
Table 3.4
Analysis of variance comparing gender and music on Performance (N = 50)

<table>
<thead>
<tr>
<th>Sources of Variance</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1</td>
<td>4.76</td>
<td>4.13</td>
<td>0.04*</td>
</tr>
<tr>
<td>Error</td>
<td>43</td>
<td>1.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music</td>
<td>2</td>
<td>0.405</td>
<td>4.263</td>
<td>0.01*</td>
</tr>
<tr>
<td>Music x Gender</td>
<td>2</td>
<td>0.175</td>
<td>1.843</td>
<td>0.16</td>
</tr>
<tr>
<td>Error</td>
<td>86</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis of data shows that music has significant $F(1, 43) = 4.13, p < 0.05$ effect on performance. WAIS Coding scale suggests that men ($M = 45.2, SD = 17.64$) has significant low performance as compared to women ($M = 52.8, SD = 18.14$). Performance is significantly high on pop music ($M = 51, SD = 19.4$) as compared to classical music ($M = 46, SD = 16.7$).

IV. DISCUSSION

Music is pure form of art, complete in itself. Although every culture has its own musical style but language of music is universal, even if one cultures’ music is unknown to other still it conveys meaning and influences others. It can be possible that it’s helpful to bring people together from different culture.

Music has been an area of interest for researchers for a long time and still researchers are conducting studies on music and its effect on human beings. It has healing power; influence our social behavior, interaction, cognition, learning abilities, judgment, perception, criminal behavior and emotions. It has strong influence on ones life it can be either positive or negative (country music induce suicidal tendencies and increase the suicide rate but not neutral. Music can alter our behavior, and can mold it in specific ways. It has power to reduce pain, anxiety, reduce sleep disturbance, depression and used for therapeutic purpose. As various studies have been done on “consumer behaviors”, how specific type of music alter the customer shopping behavior. It can manipulate our perception and judgment. Even different genre of music elicits different responses. Music is effective tool to induce change in ones life, if he has proper knowledge of music and how it affects human beings.

This study was conducted to measure the influence of classical and pop music on mood and performance of university students. Our study has also support that music has influence on our mood and performance. Every genre of music have different influence, as in our study Pop music enhances positive mood and level of happiness. While classical music decrease the level of happiness and mood become low.

Similarly there was significance effect of music (pop and classical music) on performance of WAIS coding scale. The performance was high on pop music as compared to classical music. Performance on classical music was higher then no music. Our study claims that there is effect of music on mood, level of happiness and performance. Gender difference was also founded in performance. Although it was not included in our hypothesis but we want to see either gender affect the performance level or not, for this purpose post hoc were used. Results indicate that Women score higher then men. The findings of Lesiuk (2005) study also suggested that music improves the quality of work and alter mood and perception about work environment.

As in this study specific type of music was taken from pop music, which was energetic, upbeat, and cheerful may be if any other music is taken from this genre effect would be different. And the music taken from classical genre was “raga mesh” by Nusrat Fateh Ali khan, and if any other rags or song was used it could have different impact. Many other factors could be involved in these findings. As study of Cassidy & McDonald shows that there is different effect of music on extroverts and introvert. The performance of introverts was more affected when “high arousal” music was present. So it could be possible that these differences were due to personality types. The findings of Larsen and Ketler (1989) also suggested that ‘neurotic’ and extroverts react emotionally different.

4.1 Conclusion

Our study claims that pop and classical music effect performance and mood of individuals. The performance was high with music as compared to no music. Similarly pop music enhances mood and level of happiness as compared to classical and no music.

4.2 limitations

Sample size was small and was taken from one university. Large sample size may have different results.

The music was presented for 4 to 5 minutes, if more time was given, it could have more effect on mood and performance.
Participants’ music preferences could affect findings, if their liking and disliking is considered; it may have given better results.

4.3 Implications

As studies indicate that there is significant impact of music on individual mood and performance level. So it is applicable in schools and universities to enhance memory and performance of students. Music education would also lead to better academic performance. It can be used for therapeutic purpose to regulate emotions and mood. Every genre of music has different impact on mood so different forms of music can be used to manipulate mood.

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Preparation and Evaluation of Floating Drug Delivery System for Gastric Retention


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** Pharmacy, Mallareddy institute of pharmaceutical sciences

Abstract- The recent developments of Floating drug delivery system which includes the gastric physiology and different variables in formulation affects gastric retention in turn improves the bioavailability of drugs especially which have a narrow absorption window. The aim of the work was to develop and evaluate gastro retentive floating drug delivery of Metformin hydrochloride as a model drug to increase the gastric residence time. The tablets of Metformin hydrochloride were prepared with hydrophilic and hydrophobic polymers like HPMC K-15, Ethylcellulose with and without disintegrant carboxy methyl cellulose. Developed formulations were evaluated for the pre compression parameters, post compression parameters, FLT, and in vitro dissolution study. From the results it was concluded the formulation F6 showed comparatively good release which complies with the dissolution requirements.

Index Terms- Metformin Hydrochloride, Floating drug delivery, HPMC k-15, Ethylcellulose

INTRODUCTION
Drug release from a controlled release drug delivery systems is at a predetermined, predictable and controlled rate. Most drug delivery systems available in market are oral dosage forms because of the low cost and ease of administration. Gastro retentive systems prolong the gastric residence time of drugs by remaining in the gastric region for several hours this reduces drug waste, improves solubility, bioavailability for drugs. Floating drug delivery systems modulate the gastro intestine transit time of a drug for the maximum gastro intestinal absorption of drugs and site specific delivery.

Modified release systems, on the other hand, have been developed to improve the pharmacokinetic profiles of active pharmaceutical ingredients (APIs) and patient compliance, as well as reducing side effects. Oral extended release dosage forms offer the opportunity to provide constant or nearly constant drug plasma levels over an extended period of time following administration. Extended release DDS include single-unit, such as tablets or capsules, and multiple-unit dosage forms, such as minitablets, pellets, beads or granules, either as coated (reservoir) or matrix devices.

Metformin is an anti hyperglycemic agent with type 2 diabetes, lowering postprandial plasma glucose. Metformin decreases intestinal absorption and increases insulin production. Metformin does not produce hypoglycemia in either patients with type 2 diabetes or normal subjects and does not cause hyperinsulinemia.

METHODOLOGY
Preparation of Metformin Hydrochloride floating tablets
Metformin Hydrochloride floating tablets were developed by wet granulation techniques using different concentrations of various polymers. All the ingredients except talc and magnesium stearate were shifted through sieve no 40 then blend. After sufficient mixing, the blend was wetted by adding sufficient quantity of isopropyl alcohol as a granulating agent. Prepared wet mass was granulated by passing through sieve no 18. Prepared granules were dried at 50°C – 60°C for 20 min in hot air oven. After drying, dried granules were lubricated by adding sufficient quantity of magnesium stearate and talc for 5min. 10 mm punches were used to compress the tablets. The tablets weight was kept constant for tablets of all formulations, which was 800 mg.
Table 1: Formulation of Metformin hydrochloride floating tablets

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
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<tbody>
<tr>
<td>Metformin HCl</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
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<td>135</td>
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<tr>
<td>Ethyl cellulose</td>
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<td>40</td>
<td>60</td>
<td>50</td>
<td>40</td>
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<tr>
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<tr>
<td>Lactose</td>
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<td>30</td>
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</tr>
<tr>
<td>Talc</td>
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<td>10</td>
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<tr>
<td>Magnesium stearate</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>PVP</td>
<td>20</td>
<td>20</td>
<td>25</td>
<td>25</td>
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<td>Carboxy methyl cellulose</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
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<td>5</td>
</tr>
<tr>
<td>Total</td>
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</tbody>
</table>

PRE-FORMULATION STUDIES

**Bulk density (BD)**

The bulk density was found by using the formula,

\[ \text{Bulk density (BD)} = \frac{M}{V_b} \]

**Tapped Density (TD)**

The tapped density was found by using the formula,

\[ \text{Tapped density (TD)} = \frac{M}{V_t} \]

**Compressibility Index (CI)**

Compressibility index is calculated from BD and TD using the formula,

\[ CI = \frac{TD - BD}{TD} \times 100 \]

**Hausner Ratio (HR)**

Hausner Ratio is calculated from BD and TD using the formula,

\[ \text{Hausner ratio} = \frac{TD}{BD} \]

**Angle of Repose (AR)**

The angle of repose for the granules of each formulation was determined by the funnel method. The granule mass was allowed to flow out of the funnel orifice on a plane paper kept on the horizontal surface. The radius (r) and height (h) determined from the pile formed on the paper. The results were sown in table no.2.

\[ \text{Angle of repose (} \Theta) = \tan^{-1} \left( \frac{h}{r} \right) \]

EVALUATION OF TABLETS

**Weight variation (WV)**

Twenty tablets from each formulation were taken and individually weighed in milligrams. The average weight and standard deviation of 20 tablets was calculated. The results were sown in table no.3.

**Hardness (H)**

Twenty tablets from each formulation were taken and measured in kg/cm² using Monsanto type hardness tester. The standard deviation was calculated form average hardness. The results were sown in table no.3.
**Friability (F)**

Twenty tablets were weighed from each formulation and after weighing accurately placed in the friabilator. The rotation speed of the friabilator was kept at 20 rpm for 5 minutes. After 5 minutes, the tablets were dusted and weighed again. The percentage friability was calculated. The results were shown in table no. 3.

**In vitro buoyancy Test**

Buoyancy test was performed by placing them in a beaker containing 500 ml of 0.1 N HCL (pH 1.2, temp. 37±0.5°C). The time between its initial and its buoyancy in the medium was calculated for the determination of lag time and total buoyancy time by visual observation. The time taken for dosage form to move to the surface of medium called floating lag time (FLT) or buoyancy lag time (BLT). The results were shown in table no. 3 and fig no. 1.

**In vitro dissolution study**

The dissolution study was carried out using USPII (paddle method) apparatus in 900 ml of 0.1 N HCL (pH 1.2) for 480 mins. The temperature of the dissolution medium was kept at 37±0.5°C and the paddle was set at 100 rpm. 10 ml of sample solution was withdrawn at specified interval of time and filtered through what man filter paper and the same amount of fresh 0.1N HCL was replaced in dissolution medium. The sample was diluted to a suitable concentration with 0.1N HCL. The absorbance was measured at $\lambda_{max}$ 233 nm using a UV-spectrophotometer. The results were shown in fig. no. 2.

**Kinetic analysis of In Vitro drug release**

From the result of In Vitro release profile obtained the optimized formulations were plotted in models of data the results were shown in table 4.

**RESULTS**

**Table2: Pre-compression evaluation parameters**

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>TESTS</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bulk density (g/ml)</td>
<td>0.36</td>
<td>0.34</td>
<td>0.33</td>
<td>0.35</td>
<td>0.34</td>
<td>0.32</td>
</tr>
<tr>
<td>2</td>
<td>Tapped density (g/ml)</td>
<td>0.44</td>
<td>0.43</td>
<td>0.42</td>
<td>0.46</td>
<td>0.44</td>
<td>0.45</td>
</tr>
<tr>
<td>3</td>
<td>Hausner Ratio</td>
<td>1.22</td>
<td>1.25</td>
<td>1.23</td>
<td>1.24</td>
<td>1.26</td>
<td>1.22</td>
</tr>
<tr>
<td>4</td>
<td>Angle of repose (°)</td>
<td>25.74</td>
<td>25.55</td>
<td>26.58</td>
<td>25.68</td>
<td>25.70</td>
<td>25.62</td>
</tr>
<tr>
<td>5</td>
<td>Compressibility</td>
<td>18.29</td>
<td>19.25</td>
<td>19.07</td>
<td>19.03</td>
<td>18.90</td>
<td>19.01</td>
</tr>
</tbody>
</table>

**Table3: Evaluation of tablets**

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>TESTS</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Appearance</td>
<td>Round and white</td>
<td>Round and white</td>
<td>Round and white</td>
<td>Round and white</td>
<td>Round and white</td>
<td>Round and white</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thickness (cm)</td>
<td></td>
<td>Hardness (Kg/cm)</td>
<td></td>
<td>Weight variation (%)</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>----------------</td>
<td>---</td>
<td>------------------</td>
<td>---</td>
<td>---------------------</td>
<td>---</td>
</tr>
<tr>
<td>2</td>
<td>3.35±0.13</td>
<td>3.32±0.04</td>
<td>3.32±0.01</td>
<td>3.33±0.16</td>
<td>3.35±0.01</td>
<td>3.34±0.17</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>2.2</td>
<td>3.2</td>
<td>2.3</td>
<td>2.6</td>
<td>3.1</td>
<td>2.8</td>
<td>0.61%</td>
</tr>
<tr>
<td>7</td>
<td>100</td>
<td>100</td>
<td>99.1</td>
<td>99.7</td>
<td>99.2</td>
<td>99.5</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 1: Photographs of prepared floating tablet

Figure 2: *In vitro* dissolution graph of prepared formulations
Table 4: Kinetic analysis for optimized formulation (F6).

<table>
<thead>
<tr>
<th></th>
<th>Zero Order</th>
<th>First Order</th>
<th>Higuchi Kinetics</th>
<th>Peppa’s model</th>
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<tbody>
<tr>
<td>$R^2$</td>
<td>0.981</td>
<td>0.938</td>
<td>0.955</td>
<td>0.714</td>
</tr>
<tr>
<td>$R^2$</td>
<td></td>
<td></td>
<td></td>
<td>0.981</td>
</tr>
</tbody>
</table>

**Discussion**

The angle of repose for the formulated blend was found to be in the range of 25.5° to 26.58°. Hence the entire formulations blend was found to be good, passable flow property. Compressibility index was carried out and it was found between 18.29% to 19.25% indicating the powder blend has the required flow property for compression. Hausner’s ratio was calculated for the blend, it found between 1.22-1.26 indicating powder blend has the required flow property for compression. The results were shown in table no.2.

The measured hardness of tablets of each batch ranged between 3.0 to 4.0 kg/cm². This ensures good handling characteristics of all batches. The percentage friability was less than 1% in all the formulations ensuring that the tablets were mechanically stable. All the formulations (F1 to F6) passed weight variation test as the percentage weight variation was within the pharmacopoeial limits of 5% of the weight. The measured thickness of tablets of each batch ranged between 3.32 to 3.35 for uncoated tablets. The percentage of drug content for F1 to F6 was found to be 99.1% to 100% of it complies with official specifications. The results were shown in table no.3.

All the formulations were subjected to in vitro release studies. Dissolution profiles of all formulations were compared by cumulative percentage drug release versus time. The percentage release at the end of 480 min. for formulations F1, F2, F3, F4, F5 and F6 was found to be 42.24±0.26%, 45.84±0.44%, 50.24±0.62%, 60.62±0.24%, 64.26±0.42% and 75.46±0.26%. From dissolution result it was confirmed that formulation F6 was showing good dissolution profile in comparison to other batches. From the in vitro dissolution data, zero order, first order and Higuchi type release kinetics of drug release were calculated. Korsemeyer-Peppas semi-empirical models were also employed to find out mechanism of release. Zero order seemed to be the most appropriate model describing kinetics for the optimized formulations (correlation coefficient 0.981). On the other hand n values (0.5 ≤ n ≤ 1.0) for optimized formulations indicated the order of drug release by anomalous diffusion (non-Fickian) type. So, the drug release is the combined actions of both diffusion and erosion.

**References**

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Voices of six mothers of children with Developmental Disabilities: experiences with health care workers in Gaborone, Botswana

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Joseph Habulezi

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Abstract- The purpose of the study was to explore the experiences of mothers of children who live with developmental disabilities with reference to medical health care practitioners. Qualitative research approaches were used to explore the experiences of three mothers of children with Cerebral Palsy and three mothers of children with Autism Spectrum Disorder. Convenience sampling was used to select the study participants. A thematic approach was used to analyse the stories. The women’s stories revealed that there is inadequate understanding of Cerebral Palsy and Autism by both the general public and health care workers. The lack of understanding of developmental disabilities impacts on the health and development of these children and over-burdens the mothers/caregivers. The mothers of children with developmental disabilities find themselves confronted by a condition they have to learn about while dealing with it and with very limited resources. In addition, the study revealed endurance and agency of these mothers as they continuously polish the gem they see in their children despite their status and stigma of living with disabilities. In conclusion, understanding of developmental disabilities in general by the general public and health practitioners would lead to improvement in the lives of those who live with such disabilities.

Keywords- Developmental disabilities, mothers, experiences, agency.

Definition of developmental disability/intellectual disability

Developmental Disability is an umbrella term that includes intellectual disability but also includes other disabilities that are apparent during childhood. The words; intellectual disabilities and developmental disabilities are used interchangeably in this study. Developmental disabilities are severe chronic infirmities that can be cognitive, physical or both. The disabilities appear before the age of twenty-two and are likely to be lifelong. Some developmental disabilities are largely physical issues, such as cerebral palsy or epilepsy. Some individuals may have a condition that includes a physical and intellectual disability, for example Down syndrome or foetal alcohol syndrome and other developmental disabilities often co-occur, intellectual disability professionals often work with people who have both types of disabilities. Adapted from, https://aaidd.org/intellectual-disability/definition/faqs-on-intellectual-disability#.WhvsaFWWa71

Introduction

The following quote by the former U.S. Secretary of Health and Human services in closing the Gap summed up the situation of persons with developmental disabilities in some parts of the world; Compared with other populations, adults, adolescents and children with intellectual disabilities experience poorer health and more difficulty in finding, getting to, and paying for appropriate health care... many health care providers and institutional sources of care avoid patients with this condition. Without direct clinical experience, health care providers may feel incapable of providing adequate care. They may not value people with intellectual disabilities.... (Kuntz, Garcin, Lewis, Mines, Martins & Holden, 2005 p. 58).

Health care systems play a critical role in ensuring quality health care services to the general population. To a large extent, mothers depend on the
advice and education on child care they receive during prenatal and postnatal lessons from the health care workers. One of the main goals of these sessions is to ensure the wellbeing of both mothers and babies; thus enabling them to fulfil their mothering role. The ideal postnatal care training should include: emergency preparedness and complication readiness for the mother and baby. Based on this, accessing the health care systems is associated with hope for solutions of wellness. However, observation is that no one prepares mothers and families to care for children with disabilities in Botswana. The mothers face a double challenge of learning of the situation they are confronted by and at the same time being primary caregivers. This situation is often worse where resources are limited. Observation is that not much is known about developmental disabilities by both the general public and the health care workers. As such mothers of children with developmental disabilities and their children are bound to experience insufficient assistance characterized by discriminatory attitudes. As reflected in the former U.S secretary of Health and Human services’ words, persons with disabilities at some point in their lives, face prejudice and negligence. This discrimination against children with disabilities perpetuates the struggles of this marginalized population and continuously widens the gap between them and their non-disabled peers.

This study therefore, aims to explore the experiences of six mothers of children with developmental disabilities in regard to treatment they receive from health care workers in Gaborone and Bokaal in Botswana. In addition, the study establishes the mothers coping strategies.

Prevalence of disability in Botswana

About 15% of the world population is people living with disabilities, and 80% of this group lives in Sub Saharan Africa. The results from the 2011 Population and Housing Census show that, of the total Botswana population of about 2 million people, 59,103 (2.92%) were reported to be people with disabilities (Central statistics, 2011). This is almost equal to the 2001 prevalence rate of 2.99%. Based on the analysis of the 2011 Population and Housing Census data, the findings revealed that there has not been significant change in the national prevalence rate of disability between 2001 and 2011 census, as the prevalence is still around 3.0% for both males and females. The most common type of disability reported was visual impairment (49%) followed by hearing impairment (20%). Disability is more prevalent in rural areas than in urban areas. This is consistent with pervious censuses and world trends (Mmatli, Kebotsamang & Lesetedi, 2011). The data further showed that people with disabilities were more likely to have never been to school. Not much was found on access to health care systems, hence the study’s main objective to find out what the experiences of mothers/caregivers of children with developmental disabilities are with specific reference to medical health practitioners.

Literature

There is evidence of prevalence of disparities and inequities that characterize the health outcomes of people living with disabilities in general. For example, literature, (Groce, 2014; World Health Organization, 2007) shows that interrelated factors that include socio-cultural, attitudinal and economic factors contribute to the marginalization of children with developmental disabilities in society. In addition, Krahn, Walker and Correa-De-Araujo, (2015) argue that the existing health disparities among people living with disabilities and their “non-disabled” peers are avoidable. For example, it has been noted that in certain cultures babies born with disabilities were not valued, and were often hidden to avoid the shame they would bring to their parents, while in other cultures they are considered to be a curse or a sign of the wrath of God to the family. These discriminatory cultural attitudes are also transmitted to society in general through folklore, books, films or television programmes (Innocenti research Digest, 2007). In modern times, the existence of deep-seated negative attitudes has been observed to play a major role in perpetuating the marginalization of children living with developmental/intellectual disabilities and disability in general.

Different models of approach aimed at improving people with disabilities’ lives have evolved from the medical model where for a long time; children with disabilities were treated as objects of charity and passive recipients of welfare (Groce &
Kett, 2013). Often, conditions at the institutions (that prevailed with the medical model) were disheartening. This charity-based legacy persisted in many countries and to some extent it still affects the perception and treatment received by children with disabilities. Along with the Convention on the Rights of Children (CRC), the Convention on the Rights of Persons with Disabilities (CRPD), adopted by the United Nations General Assembly in December 2006, brought a new agenda of hope that aims to promote the human rights of all children with disabilities. Leeder and Dominello, (2005) noted that though a lot has been achieved in health at a global level, there is still persistence of inequalities especially with regard to the health and welfare of persons with intellectual disabilities.

Studies show that people with intellectual disability generally experience poor health than the general population (World Health Organization, 2011 Report; Beagne & Durvasula, 1999). People living with intellectual disability are often associated with lower life expectancy and less morbidity because not much is known about them. This same population is mostly at risk of obesity and respiratory related complications (Beagne, 1996). In addition dental disease has been found to be rife among people with intellectual disabilities and other conditions which are dealt with accordingly on persons with no disabilities (Beagne, Lennox & Parmeter, 1999 in Leeder & Dominello, 2005).

Findings from Krahn, Hammond and Turner’s (2006) study revealed a cascade of health disparities experienced by this particular group. These include higher prevalence of adverse conditions, inadequate access to quality health services, inadequate attention to care needs as well as inadequate focus on health promotion in all societies and these compromise the enjoyment of their rights (World Health Organisation, 2011). The fact that they are already not counted for in most programmes, they are often left out on health campaigns such as breast cancer screening, cervical cancer and others. Beange and Durvasula (2001) add that breast cancer deaths occur three times more commonly among women with cerebral palsy than any other.

Another observation is that people living with intellectual disability are often left out even in campaigns against any global epidemic of whatever nature especially in health. In another study Beange, Lennox and Parmeter (1999) state that what is apparent with ‘non-disabled’ children often goes unnoticed with persons with intellectual disabilities. For example, even though children with intellectual disabilities are more vulnerable to HIV and AIDS infections, rape and unplanned pregnancies, they are often left out on campaigns on issues pertaining to sexualities. Groce (2013) made an observation that there are various myths and stereotypes about people with disabilities, several myths related to disability include the assumption that people with disability are asexual, and do not need sex education. Such assumptions influence the lack of services and programmes on HIV for people with disabilities. Groce (2013) argued that the stigma associated with disability has led to people avoiding the issue of HIV and AIDS because it creates double stigmatization due to both disability and HIV and AIDS.

In another study, Leeder and Dominello (2005) pointed that despite the large general gains in global health, the gains have not been spread evenly. This unevenness is underpinned by inequalities in the society. It has been observed that one of the greatest impediments in the general health and well-being of persons with intellectual disabilities is the long standing stigma, societal discrimination and negative attitudes that arise from misconceptions, stereotypes and attitudes that link disability with punishment for past sins, misfortune and witchcraft. Arguably, this has even permeated the health practice institutions. Given that health care workers are to a large extent expected or hoped to provide solutions to ‘all health problems’, it is disheartening to experience this perpetual health disparities and inequities in relation to people with intellectual disabilities.

Moyle, Iacono and Liddel (2010) carried out a study on knowledge and perceptions of graduate medical practitioners in Malaysia of their role in medical care of people with developmental disabilities. Their study indicated deficit and consistencies in both content and experience. The study concluded that there is need for increased content, training and exposure in relation to
developmental disabilities in all settings of undergraduate medical training.

Summing up, the literature reviewed revealed that the problems associated with poor health outcomes of people with developmental disabilities are at most linked to lack of knowledge and understanding of developmental disabilities and discriminatory attitudes by health care practitioners. Krahn, Hammond and Turner’s (2005) study revealed this dearth of information as a global phenomenon. For example, Moyle, Iacono & Liddell (2010) linked the poor health outcomes of people with intellectual disabilities/developmental disabilities to lack of knowledge and experience with this population by medical practitioners.

Theoretical frameworks
The theory of intersectionality is based on the concept that oppressive institutions within a society, such as racism, ageism, ableism, sexism and homophobia do not act independently, but are instead interrelated and continuously shaped by one another (Joseph, 2015). Intersectionality framework was coined by the feminist scholar Crenshaw and its proponents argue that it can be used to understand systemic injustices and social inequalities. On women, it stipulates that women suffer from diverse discriminations due to several factors such as gender, age, class, disability and others.

Intersectionality is a tool that can guide researchers, policy makers and practitioners to learn about and respond to the diverse experiences of mothers of children living with disabilities and the social structures and systems that often exclude and silence them. Persons with disabilities (and their caregivers) are often viewed as the recipients of support and the beneficiaries of social programs rather than recognized as experts essential to the development of inclusive programs and policies. Even when consultation with experts occurs, the implementation of programs and policy may misrepresent them. The authentic representation of complex experience, the influence of intersecting social factors like gender, age, sexuality, culture and the true extent of the inaccessibility of resources and opportunities are most often still missing (Kudsen, 2006). Using intersectionality can result in practices and processes that are progressive, more socially just, and consistent with the needs of those living with disabilities (Knudsen, 2006).

Purpose
The purpose of the study was to explore experiences of children with Developmental disabilities (CP & autism) in the hands of medical practitioners through the voices of their mothers. The aim of the study is to give a voice to this marginalised population and create a platform for their stories to be heard.

Research Questions
The study answered the following questions:
1. What are the experiences of children with Intellectual Disabilities (cerebral palsy & autistic disorder) in the hands of medical practitioners in Botswana?
2. How do the mothers of these children mould the gem they see in their children despite their experiences and challenges?

Research Methodology
This qualitative study is phenomenological in nature because it is based on real life experiences; it depicts typical situations, daily experiences or occurrences and encounters of the participants with medical practitioners (McMilan & Schumacher, 2014; Giorgi & Giorgi, 2003).

Study participants
Six mothers were sampled using convenience sampling; three were mothers of children with Cerebral palsy and three were mothers of Autistic children. Four of the participants live in Gaborone while two lived in Bokaa village in Kgatleng District

Instruments
Focus group discussions, autobiographies and one-on- one in-depth interviews were used to collect the mother’s stories. One- on-one interviews lasted for approximately 45 minutes each depending on the willingness of the participant to talk.

Ethical Considerations
Relevant steps that have to do with research with human subjects were taken. The purpose of the study was explained to the participants and issues of confidentiality were observed. Pseudonyms are used to protect the participants in the study. Participants
were asked to be free to ask for clarification of anything they would want to know or understand about the study. They were also made aware that they can withdraw from the study at any point if ever they felt like withdrawing. As a way of further protecting participants, the author used anonymity even in acknowledging the participants. Prior to the start of the data collection, two meetings were held to explain the purpose of research and consent forms were filled by the participants.

Data analysis
After every interview session, data was transcribed verbatim. We repeatedly listened to the audio tapes and read the transcriptions to familiarize with the women’s narratives (Creswell, 2007). Data was analysed according to themes as they emerged from the data collected.

Results
From the autobiographies, group discussions and in-depth interviews conducted with participants, it was apparent that people living with developmental disabilities face challenges in accessing medical health care due to various reasons. Below are the themes that emerged from the mothers’ narratives: late diagnosis, lack of understanding of the disability, attitude to disabilities, being insensitive and lack of counselling. The mothers’ stories also revealed resilience, agency and strength in each other’s support.

Late diagnosis
Generally participants indicated late diagnosis of their children’s conditions by the medical practitioners. From the participants’ stories, it is clear that the conditions of cerebral palsy and autism are not well known or researched even by medical practitioners such that mothers get frustrated at first by the problems they see their children displaying especially that they fail to get professional help quickly. This is what Mma K echoed about her son with cerebral palsy:

I was a young mother when I gave birth to my two boys. One of the twins, seemed weak. He made sounds when breathing such that you could hear him if you were standing just by the door where he was. Each time he cried with a very loud voice as if he was in excruciating pain. Several times I took him to the hospital, the health practitioners would just tell me that I should be patient with him he would outgrow the crying, but could not explain the breathing. At six months I was told that the boy is just growing slowly and might be having problems with his bones. That is when I was referred to a hospital in the city where he was diagnosed. The boy is twenty years old now but just lies down.

Mma Prince: Prince is ten years old; he was diagnosed with cerebral palsy at eighteen months. Prince cried a lot as a baby. Although I was a new and young mother, I felt that my child was not developing well. This is because he was not mastering milestones accordingly, the doctor told me that I should let my child develop as he does, there was no problem with the boy, and he would grow. One day Prince’s eyes seemed to be ‘crossed’ I went to the pediatricians, who somehow that day decided to do a CT scan. It seemed the doctor was discouraged and disappointed at the results. He felt sorry that he could not realize that there was a problem early. However, he recommended therapy and referred us to the occupational therapist and physiotherapist.

Well, the doctor showed remorse and continued to monitor the child’s development.

Mma T.
I only learnt that my son, Tiro, was autistic when he was four years old. This was after several years of struggling with medical practitioners in Botswana. After being referred from one doctor to another, Tiro was only diagnosed in Johannesburg where it was confirmed that the boy was autistic.

Mma 2
I started noticing that Shima was different when I called his name and he wouldn’t look at me at all. I went from one doctor to another, but there was no help, one of them even said it could be just a character if not spiritual matters. However, after a discussion with a colleague who suggested that it could be autism, and recommended that I take the child to ..., from then the child was diagnosed with autism after a year. Hospital medical practitioners did not have much to offer except discouraging statements that seemed to be aimed at making me give up on my child.
**Disheartening revelations by medicals**

Some participants felt that the health practitioners were insensitive when giving them details of their diagnosis. This is what Mma Motho said:

The doctor asked me if the baby cried at birth, and when I responded that the child did not cry the doctor just said; ...Mental Retardation! (sounding like a judge passing judgement at a court of law). There is not much to be done to help this boy, he will grow into just a cabbage; ..... by this I mean he is not a normal baby and might not live longer than five years at most. The doctor was so hard I thought, he continued to tell us that ...in fact in other countries, if it is diagnosed early this child could have been aborted, there is just no help for him. I later learnt that my son’s condition is cerebral palsy after seeking for help from other private medical practitioners. My son is now 18 years old and has never walked nor talked.

Mma Rosa: My eight years old daughter Rose has cerebral palsy. When she was born, the medical practitioners told me she was not going to live longer because she is abnormal. I was told that due to my thin frame, my daughter’s core muscles and bones are damaged. I was told that the child will be nothing but a vegetable. The term of vegetative babies was familiar therefore I cried bitterly. The medical practitioner further told me that it was going to be a struggle to raise her because she was not going to grow like a normal child and there is no cure for her condition.

**Discriminatory tendencies**

Mothers’ narratives revealed discriminatory tendencies by health care workers in some instances. This is what some of them said:

Mma Prince

Prince had a descendental testicle at one point which was only discovered at seven years. He was referred to a surgeon and this is what the surgeon said; He is not going to marry, he is not going to give you grandchildren...why make him go through this unnecessary pain... is he your only child? If so where is your husband, why don’t you talk to him so that you make another baby who can give you grandchildren?... I will not operate this boy and put his life at risk, ...... yes.

I hear your fear of possibilities of him developing testes cancer, but we can monitor it every year than risk his life. Probability is high that he will not have cancer and might not live longer for the testicle to reach a cancerous stage......

**MmaBino**

I used to put this boy in a wheel burrow to transport him to the hospital for therapy, but nowadays he is too heavy for me because he is growing. I try to tell the nurses but they tell me that they are only nurses but not transport officers... this is what one of them said; mma you need to try your best to bring him for therapy, the hospital does not have enough transport to cater for all patients so you too should try....

**Resilience**

Mothers revealed that they use different strategies to cope with their situations of caring for children with developmental disabilities. Some of them revealed spirituality as a cornerstone of their strengths while others revealed that hearing and reading other people’s stories gave them courage. The mothers also revealed that internet is a very good tool they use for information. This is what some of the mother’s said:

**Mother 1**

I constantly observe him, and seek information online and anywhere else just to understand my child. This has helped a lot. My son is strong, he used to have breathing and constipation, I try my best to manage this through diet and it is like each day I discover new ways on how I can help my child. Although he lives with this disability I thank God that through my mother’s help, his brother and my constant search for information, my son has lived and is still going strong contrary to what the doctor had told us. Mogomotsi’s strength has replaced sadness and sorrow in me/us with courage. I try my best once in a while to reach out with motivation whenever I hear or learn that someone has a child with cerebral palsy. I know hospitals can somehow kill one’s emotions.

While some health workers have shown unkind and discriminatory attitudes, there are those who go an extra mile to support partly because of their
knowledge of the condition or passion for children. One mother revealed that while one surgeon at a local hospital viewed the child as fragile and asexual, other health care professionals at a hospital outside the country found it necessary for the child's undescended testicle to be corrected. She further confirmed that the boy's operation was successful and other surgeries will be done to help improve his gait.

Seeing a gem in my child kept me going

Research Question 2: How do the mothers of these children mould the gem they see in their children despite their experiences and challenges? The mothers’ stories revealed that despite the challenges and discouraging statements they receive about the conditions of their children with cerebral palsy and autism the mothers do not give up but rather continuously find ways on how to assist their children grow. This is what the mothers said:

Mother 2 Autism

Gladys said she started seeing different people and did her own research on ways in which she could control autism.

"I realised that it is a normal condition, and children with autism and neuro-developmental disorders need special care facilities that can help them develop at their own pace," she said.

Another mother said

Since I took my child to a private centre for rehabilitation here in Gaborone, my child has improved, she has now mastered toilet training and enjoys swimming.

.............proper facilities will help many parents with children with the same needs as it is not every day care centre that can help provide for these children.

Another mother said: contrary to the ‘cabbage picture’ I was given at the hospital few years ago, my child’s condition has improved a lot as he now responds more to questions and can play with other children. There are still some challenges though.

The same was echoed by the mother of another eight years old girl as she shared how they, as a family, continue to see improvement and great developments in their daughter’s life.

Our commitment to finding out as much as we can about Chendzi’s condition has helped us see her progress into a beautiful girl who is now improved a lot in social skills. From a vegetable we were told our daughter was going to be, we have a lovely girl, who enjoys singing, colouring and trying house activities. Chendzi enjoys some computer games... and we look at her and appreciate God.

Indeed it is a lot of work to raise a child with autism, but it is a lot of work to raise any other child if one is to appreciate the differences our children are born with. To us, Chendzi is such a joy to have, we chose not to be disgruntled by the medical practitioners’ stories but to continuously educate ourselves. We are now able to share and encourage other parents who find themselves having to raise a child of whatsoever condition.

Learning from others

One day a colleague told me about sports as therapeutic to children with cerebral palsy. I shared with other mothers and we invited the colleague to give us a presentation. His presentation was lively during one of our tea meetings, we saw children like ours in other countries such as Brazil and United States of America swimming and playing other sports activities. We did not waste time but agreed with the centre where our children go for stimulation to engage a swimming teacher. Since then children swim, Prince loves water and is now able to swim. He has now been nicknamed the big fish both at home and school referring to the skill he portrays in the water.

After swimming Prince enjoys a peaceful sleep which is sometimes difficult for him. Prince wakes up a more calm and rested boy after the sleep.

I always look forward to his swimming session...

From ‘abnormal and not worth spending on’ to a football star.
My son is going to be a great footballer. Autism does not always follow him wherever he is, it’s not even a death sentence like the picture the medics gave. After sharing with other parents from our group, reading online stories with the help of occupational therapist routine activities have been drawn and this has made Nyaladzo stable. When it’s his time to play football, you just cannot put him off it. I have made a mini field with goal posts for him in the yard, he enjoys kicking the ball and making sure he has scored. Whenever he scores it is victory we all have to celebrate.

To every mother the life brought to earth is such a precious stone that needs to be dusted, refined and continuously shined to achieve its uttermost beauty.

Discussion

The findings of this study have revealed that mothers of children with disabilities face challenges that partly emanate from the marginalized position of persons living with disabilities in general. The revelations confirm Groce’s, (2013) and World Health Organization, (2007) studies which were not specifically based on Botswana but yielded similar results. In addition, late diagnoses and lack of understanding of developmental disabilities have also been observed as a problem in other studies done in and outside Africa (Krahn, Hammond & Turner, 2005). Studies that focused on Cerebral Palsy in Africa also revealed that there is inadequate knowledge of the disability and lack of appropriate resources that could improve the lives of the children and their caregivers.

This study also found that mothers are sometimes met by harsh words and insensitivity from health care workers that most likely emanates from negative attitudes towards disabilities. For example, the statement by the surgeon that a child with Developmental disability does not need corrective surgery for undescended testes clearly indicates discrimination and devaluing of persons with disabilities. Moreover, these findings revealed the often held assumptions that persons with disabilities are asexual and fragile, hence in most cases they are even left out in most of the health campaigns. Furthermore mothers of children with developmental disabilities are challenged by their marginalized position of women in the society and the fact that they have children with disabilities. This puts them in a precarious position where they are not able to assist their children adequately because of lack of support and discouragements by health workers.

Although mothers and their children face challenges, the study also revealed that these mothers actively try their best to help their children with disabilities. Through learning from each other and using internet and searching for information, mothers to a certain extent, play a critical role in helping improve the lives of their children.

Therefore, persons with disabilities especially intellectual disability are deemed fragile and asexual. Krahn, Hammond and Turner, (2005), documented health disparities between general population and people with disabilities. People with ID have been considered useless, unworthy of finding solutions for, because sometimes they are believed to be never going to heal but going to die quickly. The analysis also reveals that often times, people with disability are considered to be too fragile. This particular group is also side-lined or is hardly considered in health campaigns that include cancer screening and other health campaigns. In another study, Groce, (2013) argued that people with disabilities are rarely mentioned in HIV/AIDS campaigns and other related issues, and this is because they are considered to be asexual. This poses a health risk for this already marginalized people because studies show that they are not immune to HIV/AIDS, cancer and other diseases. This is because despite their condition of disability, they are normal and function like their non-disabled peers. The environment therefore creates problems for them and structures in place which are created by the so called normal.

However, in this case, the perseverance of the mothers to achieve the shine they desired from the forgotten gems, show resilience and agency. Despite that sometimes mothers of children with developmental disabilities encounter inadequate assistance and negativity by health care workers, mothers of children with disabilities in this study showed resilience. They stood up for their children by finding more information, in whatever possible way they could to educate themselves. The mothers’ resilience is revealed as a strength that leads to improved health outcomes and longer lifetimes of their children.
Conclusion and recommendations

Generally the mothers’ stories have revealed late diagnoses and inadequate knowledge of Developmental disabilities by the health workers. In addition, discriminatory tendencies were also revealed which also show ignorance and/or cultural and negative assumptions about disabilities by health workers. In order to improve the services for children with intellectual disabilities, mothers’ experiences should be heard and taken into consideration as the mouthpiece for their children who in most cases cannot communicate their experiences. Therefore, it is imperative that studies be conducted on the experiences of the information and solution seeking mothers of children with developmental disabilities with reference to health care. There is also need for public education on developmental disabilities. The study also revealed that where health care workers are supportive and understand developmental disabilities, mothers were able to access the limited resources that they were advised to use and they found that revealing.
ACKNOWLEDGMENT

We would like to thank the mothers who volunteered to share their stories and gave us permission to publish them.

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